Setting priorities for publicly funded research

Volume II: Evidence

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## Oral Evidence

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Written evidence from the Department for Business, Innovation and Skills  
Oral evidence (28 October 2009)  
Supplementary written evidence from the Department for Business, Innovation and Skills  

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Oral evidence (28 October 2009)  
Supplementary written evidence from Lord Sainsbury of Turville  

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Written evidence from the Ministry of Defence  
Written evidence from the Department for Environment, Food and Rural Affairs  
Oral evidence (5 November 2009)  
Supplementary written evidence from the Ministry of Defence  
Supplementary written evidence from the Department for Environment, Food and Rural Affairs  
Further supplementary written evidence from the Department for Environment, Food and Rural Affairs  

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Written evidence from the Department of Health  
Written evidence for the Department for International Development  
Oral evidence (5 November 2009)  
Supplementary written evidence from the Department of Health  
Supplementary written evidence from the Department for International Development  

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Written evidence from the Environment Agency  
Written evidence from the Joint Nature Conservation Committee  
Written evidence from the Food Standards Agency  
Oral evidence (11 November 2009)  
Supplementary written evidence from the Environment Agency  
Supplementary written evidence from the Joint Nature Conservation Committee
Dr Brian Bowsher, National Physical Laboratory, Professor Chris Thorns, Veterinary Laboratories Agency, and Mr Derrick Ryall, Met Office
Written evidence from the National Physical Laboratory 118
Written evidence from the Veterinary Laboratories Agency 119
Written evidence from the Met Office 121
Oral evidence (11 November 2009) 122
Supplementary written evidence from the Met Office 131

Mr David Sweeney, Higher Education Funding Council for England
Written evidence from the Higher Education Funding Council for England 132
Oral evidence (2 December 2009) 135

Mr David Sweeney, Higher Education Funding Council for England, Professor Alan Thorpe, Natural Environment Research Council, Professor David Delpy, Engineering and Physical Sciences Research Council, Dr Steven Hill, Research Councils UK, and Sir Leszek Borysiewicz, Medical Research Council
Written evidence from Research Councils UK 140
Written evidence from the Medical Research Council 154
Oral evidence (2 December 2009) 158
Supplementary written evidence from the Higher Education Funding Council for England 172
Supplementary written evidence from Research Councils UK 172

Professor Sandy Thomas, Foresight, Department for Business, Innovation and Skills, and Professor Chris Gaskell, Science Advisory Council, Department for Environment, Food and Rural Affairs
Oral evidence (9 December 2009) 184

Mr Nick Dusic, Campaign for Science and Engineering, Professor Geoffrey Boulton, Royal Society of Edinburgh, and Professor Roger Kain, British Academy
Written evidence from the Campaign for Science and Engineering 193
Written evidence from the Royal Society of Edinburgh 196
Written evidence from the British Academy 202
Oral evidence (9 December 2009) 205

Mr Colin Smith, Rolls Royce, Mr Simon Denegri, Association of Medical Research Charities, and Ms Anne Glover, Amadeus Capital Partners
Written evidence from the Association of Medical Research Charities 213
Oral evidence (15 December 2009) 217
Supplementary written evidence from Rolls Royce 227

Mr Iain Gray, Technology Strategy Board, Dr Graham Hillier, Centre for Process Innovation, and Dr David Clarke, Energy Technologies Institute
Written evidence from the Technology Strategy Board 230
Written evidence from the Centre for Process Innovation 232
Written evidence from the Energy Technologies Institute 236
Oral evidence (15 December 2009) 238
Supplementary written evidence from the Technology Strategy Board 248
Supplementary written evidence from the Centre for Process Innovation 249
Department of Communities and Local Government 379
Department of Energy and Climate Change 381
Dr Martin Dominik 385
Energy Research Partnership 386
Foreign and Commonwealth Office 388
Forensic Science Service Ltd 388
GeneWatch UK 389
Professor Luke Georghiou 395
Government Chemist 399
Government’s Chief Social Scientist 401
Mr Chris Harries 403
Health and Safety Executive 403
HM Revenue and Customs 406
HM Treasury 407
Home Office 412
Imperial College London 416
Institution of Chemical Engineers 419
Institute of Physics 423
James Lind Alliance 430
John Innes Centre 433
Professor Michael J Kelly 437
Linnean Society of London 442
Ministry of Justice 445
Office of the Vice Provost for Research, University College London 447
Dr James Ren 453
Resource Efficiency Knowledge Transfer Network 454
Roche 462
Roslin Institute 465
Royal Academy of Engineering, Institution of Chemical Engineers, Institution of Civil Engineers, Institution of Engineering and Technology, Engineering Council UK and Engineering and Technology Board 468
Royal Astronomical Society 472
Royal College of Paediatrics and Child Health 475
Royal College of Physicians 477
Royal National Institute for Deaf People 479
Royal Society of Chemistry 482
Russell Group of Universities 485
Sustainable Development Group of the Institute of Materials, Minerals and Mining 492
Syngenta 493
UK Computing Research Committee 496
UK Deans of Science 498
UK Government’s Spongiform Encephalopathy Advisory Committees 502
Professor Christos Vassilicos 504
Wellcome Trust 505

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Minutes of Evidence

TAKEN BEFORE THE SELECT COMMITTEE ON SCIENCE AND TECHNOLOGY

WEDNESDAY 28 OCTOBER 2009

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   Colwyn, L.
   Cunningham of Felling, L.
   Haskel, L.

May of Oxford, L.
   Methuen, L.
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   Oxburgh, L.
   Sutherland of Houndwood, L. (Chairman)

Memorandum by the Department for Business, Innovation and Skills

1. Introductory Remarks

This memorandum covers total BIS spend in science and research, which is relevant to the policy objectives of most if not all Government Departments. BIS funding includes:

   — The Science and Research Budget, including funding for the Research Councils and National Academies
   — HEFCE funding for research in Higher Education Institutions (HEIs) in England
   — Technology Strategy Board funding
   — A small amount of policy-directed research.

Altogether this comprises over half of all Government funding for research.

2. Objectives of Publicly-Funded Research

Research enables us to deepen our understanding of our world and of our universe, and this knowledge underpins a wide variety of economic outcomes. These include drivers of productivity and competitiveness including innovation and skills creation. This justifies government intervention to ensure that enough investment is undertaken to guarantee the maximum benefit for society and the economy. The research funded by BIS, and its economic impact, is key to the success of Government policy in economic development, health, education, defence, the environment and many other areas.

Although private firms do undertake investments in Research and Development, they normally only consider the effects of these expenditure on their own profits, ignoring the wider benefits on other firms and society at large. Given that the social benefits of investment in Science and Research exceed those accruing to the firms themselves the private investment will fall short of the socially desirable amount. Therefore Government must provide public funds to fill the gaps left by the private activity.

Public intervention in this area is to fill this gap in two ways. On the one hand to fund directly the kind of research that because of its uncertain and long term nature would not find space in the private initiative, so called basic research. On the other hand to provide indirect incentives for the private initiative to invest more by providing tax credits and subsidies and through joint ventures.

Government also has a lead role in influencing or supporting the environment for innovation. Through the funding and activities of the Technology Strategy Board, BIS looks to stimulate business innovation in those areas which offer the greatest scope for boosting UK growth and productivity. This supplements the contribution of the research base to innovation and economic exploitation. The Government laid out in detail its approach to making targeted interventions to help the economy of the future in the policy statement Building Britain’s Future—New Industry, New Jobs, published on 20 April 2009.

Public funding for research is governed by the principle of excellence. This means that the quality of the research, as judged by the research community, is the prime criterion for the allocation of funding. Experience shows that this approach consistently produces the highest quality research base and generates the greatest impact.
3. ALLOCATION OF RESEARCH FUNDING

The mechanisms for allocating research funding are intentionally different for each funding stream, reflecting the different aims and purposes of each stream. In particular, the Haldane principle (that researchers are best placed to make detailed funding decisions and that Government should set the over-arching strategic direction) applies to research that is, as Haldane put it, “for general use”. Haldane was also clear that “many Departments must retain under their own control a distinctive organisation for the prosecution of specific forms of research.” Government is clear that this type of policy-directed research should not be covered by the Haldane principle.

Funding is supplied to HEIs, and also to a number of Research Council Institutes, which provide facilities and carry out research of a type or scale that would not be possible for HEIs.

3.1 Science and Research Budget

As has already been noted, the Science and Research Budget funds research “for general use”, and as such is rightly governed by the Haldane Principle.

This budget is the subject of a separate Request for Resource from Parliament, and is ringfenced by HM Treasury. The Government remains committed to the Science and Research ringfence, as was made clear by the Prime Minister on 27 February this year:

“We will maintain the ringfence we have placed around science funding—protecting money for science from competing demands in the short-term and providing the sustained support the research community needs to deliver world-class results in the medium and long term.”

Before allocating the Science and Research Budget following the Comprehensive Spending Review 2007, the then Department for Innovation, Universities and Skills collected evidence on the activities and performance of all funding from this Budget. All the Research Councils and the national Academies provided detailed delivery plans, which set out what future spending would deliver against the overarching objectives.

The following factors were taken into account in determining the Science Budget Allocations to individual Research Councils and Academies:

— a thorough assessment of draft Research Council and Academy Delivery Plans for CSR07;
— the strength of the case for increasing the investment in any particular area of research in CSR07, which takes account of the quality of the research base in particular fields; and
— a full evaluation of the performance of each of the Research Councils and Academies through the SR04 period.

Once each Research Council and Academy receives its allocated funding, it makes the detailed decisions on allocation, in accordance with the Delivery Plan agreed with Government for the Spending Review period, and with the Haldane Principle.

The Government has already committed to improving this process by consulting more extensively in the run up to the next Science and Research Budget allocation. However, the Government sees no case for fundamental change to this system.

Because of the strategic nature of its funding, the Large Capital Facilities Fund (LFCF, part of the Science and Research Budget) is not allocated to any one Research Council. For the same reason, it is one of the few cases in which Ministerial involvement is required. To determine which projects should be earmarked for funding from the LFCF a project selection and prioritisation exercise, led by RCUK (Research Councils UK) takes place every two years or so. LFCF projects are prioritised by RCUK according to published criteria. The most recent version of the resulting RCUK Large Facilities Roadmap was published in 2008. A consultation with the scientific community has just been launched by RCUK on its revision.

Once a prioritised list of projects has been agreed by the Research Councils, it is submitted to the Director General Science and Research, (DGSR), for consideration by Ministers against the available LFCF budget.

3.2 The Dual Support System

Government funding for research in HEIs in England is channelled through the Dual Support System: Research Council funding supports specific projects and postgraduate training and the HEFCE Quality-related research (QR) block grant provides strategic underpinning support.
The Dual Support System balances:

— A stable (but not static) financial foundation with competitive funding for specific projects;
— The need for funders to promote specific priorities with the freedom of universities to set their own agenda;
— The rewards for discovering new knowledge with those for working with users; and
— Rewards for future potential with those for established performance.

In the devolved nations a similar system operates, although block grant funding supplied to HEIs by HE Funding Councils is a matter for the Devolved Administrations.

3.3 HEFCE funding for research in HEIs in England

The large majority of HEFCE QR block grant funding—known as “mainstream QR”—is allocated to institutions based on the volume of excellent research within them. In the past, the Research Assessment Exercise (RAE) periodically assessed the quality of research, and the results were used by HEFCE to inform the funding allocation. HEFCE are currently developing the Research Excellence Framework (REF) to replace the RAE. The REF will for the first time explicitly take account of the impact research makes on the economy and society.

This funding is consistent with the Haldane principle, in that funding is allocated on a block grant basis to institutions, which are then free to choose how this money should best be spent.

3.4 Research Capital Investment Fund (RCIF)

RCIF is funded partly from the Science and Research Budget, and partly by HEFCE. The Science and Research Budget element is distributed to HEIs in proportion to their research income from Research Councils. The HEFCE element is distributed to HEIs in proportion to the sum of HEFCE quality-related research funding and research income from

— UK-based charities;
— UK central government bodies/local authorities, health and hospital authorities;
— UK industry, commerce and public corporations; and
— EU sources (both EU government bodies and other EU sources).

Again, the choice of how to invest the capital funding allocated is for the institution’s senior management to make.

3.5 Technology Strategy Board

Following each spending review a Framework Letter accompanies the statement of the Technology Strategy Board’s settlement and provides an opportunity for the Department to give the Board an indication of the Government’s policies and overall strategic objectives for technology and innovation over the spending review period.

The Technology Strategy Board in turn submits Strategic and Delivery Plans, for approval by the Secretary of State, outlining the approach and activities it will undertake to support the achievement of the Department’s Public Service Agreement target(s), the Secretary of State’s policies and strategic objectives, and any other requirements set out in the Framework Letter.

Though the Secretary of State sets the overall strategic priorities, day-to-day decisions on the merits of different programmes and projects are taken by the Technology Strategy Board without Government involvement. Within the day to day decision-making there will often be opportunities for collaboration with the RDAs and DAs—this occurs at the programme and project level. This collaboration links national activities with the RDA and DA activities that invest in the capabilities of business and the knowledge base to promote regional economic development and growth.
4. COORDINATION OF RESEARCH PRIORITIES AND ALLOCATION OF FUNDING FOR POLICY-DIRECTED RESEARCH

This section deals only with BIS Departmental policy-directed research; the Science and Research Budget is addressed elsewhere in the Memorandum.

4.1 Policy-directed research in BIS

BIS commissions a limited amount of research from external organisations to strengthen its understanding of the context in which it operates, to inform the appraisal of policy options and to evaluate the impact of interventions already in place.

As a new Department, BIS is currently establishing a new and coherent approach to the process of commissioning external research. Hence the retrospective sections of this response draw upon practice in the former BERR and the former DIUS.

Neither former Department had a single dedicated budget for research. Research is funded from a number of budgets managed at the Group or Directorate level. This arrangement ensures close alignment between decisions about allocation of research funding and the decision-making processes governing the policies that the research is addressing.

The majority of the research commissioned by former BERR and former DIUS was economics or social science based. Typical projects might include literature reviews, qualitative research, modelling and surveys of businesses or individuals. Many projects and initiatives are commissioned in collaboration with—and often co-funded with—external partners such as other Government Departments or Research Councils. Significant examples of such collaboration include:

- The longstanding series of Workplace Employment Relations Surveys (in collaboration with ESRC and ACAS)
- Spatial Economics Research Centre (in collaboration with ESRC and Department for Communities and Local Government)
- Innovation Research Centre initiative (in collaboration with ESRC, Technology Strategy Board, NESTA)

The former BERR published an Economics Research Strategy in 2009 identifying key policy themes and the research projects underway or planned to meet them. BIS intends to publish an updated strategy later this year.

Within BIS, the Departmental Chief Scientific Adviser, Professor Brian Collins, is located organisationally alongside the Department’s Chief Economic Adviser and Director General of Economics, Vicky Pryce. This arrangement enables them to provide advice to the Management Departmental Board on the quality and relevance of the evidence base supporting Departmental policies and expenditure.

4.2 Technology Strategy Board

The Technology Strategy Board plays a cross-Government leadership role in delivering a national technology strategy and advising on policies which relate to technology innovation and knowledge transfer.

Working with the Regional Development Agencies and the Research Councils, the Technology Strategy Board will invest with these partners over £1 billion between 2008–09 and 2010–11, and in doing so, create critical mass and coherence so that UK business has greater clarity and is better able to access the most relevant support available.

Furthermore, it also works with Government Departments to ensure policies including public procurement and regulations can be used to best effect to stimulate innovation. A prime example of such coordination is Low Carbon Vehicle Innovation Platforms, worth over £140 million, which brings together activities and funding from the Technology Strategy Board, Department for Transport, Advantage West Midlands, One North East and the EPSRC, with a view to accelerate the market introduction of low carbon road transport vehicles and maximise the benefit to UK business.

5. BALANCE OF FUNDING (TARGETED VS. RESPONSIVE MODE)

The Quality-related Research block grant allocated by HEFCE is in effect a form of responsive funding, as HEIs are free to spend it in response to their own needs. This is part of the balance provided by the Dual Support System, as it complements the project-based funded provided by Research Councils.

On the issue of protection, both the Science and Research Budget and the HEFCE Research block grant funding are ringfenced.
5.1 Research Council Funding

Research Councils have strong networks with their research communities and have governance structures (from their Councils downwards) which promote engagement with those research communities. For example, the various professional institutions form an important stakeholder group with whom the Research Councils regularly work. When Research Councils take strategic decisions, including those about the balance between directed and responsive mode funding, many complex factors and stakeholder needs have to be balanced and Councils’ advisory groups are key in assessing those balances with the Council itself taking the final strategic decisions.

It is important not to place undue emphasis on the distinction between directed and responsive mode. In practice, directed programmes fund a wide variety of research, including significant amounts of basic research into fundamental questions. Statistics that attempt to catalogue in detail the type of research being carried out based on the balance of directed and responsive mode funding can therefore be misleading.

6. Coordination of Publicly and Non-Publicly Funded Research

In keeping with the Haldane principal, BIS does not take a direct role in deciding what research is funded by the Research Councils. Decisions of this nature are taken by the Research Councils who have long-established and embedded processes in place to ensure that research is aligned and co-ordinated. All Research Councils consult widely, and engage with key stakeholders (including charitable organisations, the National Academies and other public bodies), when they establish their research strategies. Continuing mechanisms are in place to enable engagement, and where appropriate coordination, across the Research Councils, RDAs, Local Authorities, and the Technology Strategy Board.

Examples of where research is aligned and co-ordinated across public sector, industry and the third sector include:

1. The Energy Technologies Institute (ETI), a private sector organisation, established as a unique private-public partnership, funded equally by member companies (BP, Caterpillar, EDF Energy, E.ON, Rolls-Royce and Shell) and the Government (including Research Councils and the Technology Strategy Board). ETI’s target is to secure up to 10 private sector investors, each contributing up to £5 million per year for 10 years, with the UK Government matching these investments to create a potential £1 billion investment fund for new energy technologies. By bringing together the efforts and investments of both private and public sectors, and by focusing on key energy challenges with a new level of scale and ambition, the Energy Technologies Institute has the potential to achieve step change advances in the demonstration of low carbon technologies.

2. The Office for Strategic Coordination of Health Research (OSCHR) was set up in 2007, with the task of forging agreement between the major public funders of health research (known as the OSCHR Partners) on a shared vision for UK Health Research, and of monitoring their delivery of the Vision. The OSCHR E-Health Records Research Board (EHRRB) has established a Strategic Coordination Group to develop a coordinated strategy in this area. This Group includes representatives from all the OSCHR Partners as well as from third sector funding organisations such as the Wellcome Trust and Cancer Research UK and industry. E-health records research is an area where the UK is well positioned to become a world leader.

3. The Living With Environmental Change programme is a ten year £1 billion initiative. The partnership brings together 20 government departments, research bodies and others which fund, undertake and use environmental research to find ways for society and individual people to adapt to current and future environmental changes. It will connect world-leading natural, engineering, economic, social, medical, cultural, arts, and humanities researchers with policy makers, business, the public, and other key stakeholders. It aims to provide governments, industry and other sectors with the best information to effectively manage and protect vital ecosystem services on the time and space scales on which the economy is managed.

Considering the other half of the dual support system, within England, the HEFCE QR block grant also provides incentives for HEIs to undertake research collaborations with research charities and business.

In addition to the largest “mainstream QR” component, the QR calculation also includes a Charity Support and Business Research element to provide extra support for institutions conducting research with charities and business. The new Research Excellence Framework will better recognise research departments that generate impacts from their research—for example through collaborations with business.

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1 The OSCHR Partners are the National Institute for Health Research, the Medical Research Council, the Chief Scientist Office, Scotland, the Wales Office for Research and Development, and the Health and Social Care Research and Development Office, Northern Ireland.
6.1 How can industry be encouraged to participate in research efforts seeking to answer societal needs?

Research Councils work in collaboration with partners across the public sector, the third sector, and industry. The Research Councils work with around 3,000 businesses and have built long-term strategic partnerships with business. In many cases, businesses are participating in research efforts seeking to answer societal needs.

Many Public Sector Research Establishments (PSREs) are engaged in collaborative research with business. The latest survey of knowledge transfer activities in PSREs (which covers 2006-07) indicated that they had generated £43 million income from business consultancy and are engaged in nearly 3,500 revenue generating agreements with businesses.

The Research Councils have a number of Cross-Council Research Programmes addressing key challenges:

- Living with Environmental Change;
- Energy;
- Global threats to security;
- Ageing: Life long Health and Wellbeing;
- Digital Economy; and
- NanoScience.

All address societal challenges and all programmes involve industrial collaborators.

The Research Councils have been working hard for a number of years to improve the way that they demonstrate the impact that the research they fund has. For instance research funded under the Analytical Biotechnology LINK programme (BBSRC) has contributed to the development of a new holographic sensor technology, with applications in drug discovery, minimally invasive diagnostics and the detection of bioterrorist agents. Led by the Institute of Biotechnology at University of Cambridge, the research is being commercialised by Smart Holograms Ltd and has wider benefits to society in the form of better healthcare and national security.

As the Research Councils become more successful at communicating to a wider industrial audience the benefits of engagement in this type of research effort then more industry participation is likely to be forthcoming. In many cases, in finding solutions to the challenges currently facing society new opportunities for business arise and new markets develop.

The ETI aims to bridge the gulf between laboratory proven technologies and full scale commercially tested systems. The broad concept is to take the most challenging large-scale energy projects to full system demonstration, so “de-risking” their future development. This has made investment in the organisation attractive to business. The ETI aims to overcome major barriers to the deployment of low-carbon energy by developing a focused portfolio of projects in areas such as Wind, Marine, Distributed Energy, and Transport. While identifying solutions to societal challenges the potential benefits to business are clear.

The Technology Strategy Board has been established to operate across all areas of the economy to stimulate business innovation in those areas which offer the greatest scope for boosting UK growth and productivity. As highlighted in its strategy “Connect and Catalyse”, “Challenge-led innovation” is a key strand in its work that will account for approximately 50 per cent of the Technology Strategy Board’s overall budget. Under this theme, the Technology Strategy Board will look to stimulate business research and innovation focused on addressing key societal challenges and maintaining a world leading position in industries where the UK has strength and can take a future leading position.

The approaches include Innovation Platforms, which bring together key partners (Government and business) to address a major societal challenge and to open up market opportunities to increase business investment in R&D and innovation. Drawing on Technology Strategy Board and other funding mechanisms, Innovation Platforms involve the integration of a range of technologies, combined with better co-ordination of policy and regulation, linked through to public procurement opportunities. For example the Technology Strategy Board has brought together business and universities with local and regional authorities to develop electric vehicles and the infrastructure they need.
7. **Focus on Areas of Potential Economic Importance**

At the outset, it must be recognised that long term economic benefits may come from research of any or all types. There is therefore a need to maintain a balance in publically funded research, in the breadth of disciplines funded and in the balance between “blue skies” research and user led research.

Furthermore, the Government seeks to maximise the economic impact of excellent research of all types. As already mentioned, the Research Excellence Framework will for the first time explicitly take account of the impact research makes on the economy and society. All Research Council grant applications must now demonstrate how they seek to maximize the economic impact of the proposed research. The strong ongoing collaborations between Research Councils, the Technology Strategy Board, businesses, the public sector and other users of research all facilitate the harvesting of economic impact from excellent research.

Government should, and does, set the over-arching strategic priorities for research funding. However, Government does not set priorities in isolation: there is continuing dialogue between Government, Research Councils, learned societies, research users, and the research community about the strategic priorities for research funding. This consultation takes account of changing circumstances. Such discussions have in the past informed cross-council programmes such as those set up following the Comprehensive Spending Review. The Government has already committed to consult more extensively in the run up to the next Science and Research Budget allocation. This consultation will include the Royal Society, the Royal Academy of Engineering, the British Academy, the Council for Science and Technology, the Confederation of British Industry, and the Chief Scientific Adviser’s Committee.

Earlier this year, Lord Drayson launched a debate about whether research funding could or should be more focussed on areas with strong economic potential. This was set clearly in the context of the ongoing consultation process. It was timely in light of the turbulent economic climate, for at least two reasons: science and research will have a key role driving the economy through and out of recession, and it is more important than ever that every pound of taxpayer’s money is used as effectively as possible.

Lord Drayson wrote to Research Councils, Higher Education Funding Councils and National Academies, seeking their input on identifying strategic research priorities for the UK. Input was received from all these bodies and a number of others.

The Research Councils, Technology Strategy Board and HEFCE held a conference on 6 April 2009, where they discussed priorities with the community. RCUK, with the support of that conference, proposed priority areas:

- green economy;
- life science sector (including health and food);
- digital economy;
- high value manufacturing systems and services; and
- cultural and creative industries.

Many of these fit well with existing cross-Council programmes and priorities, and they will all support key areas of economic potential. This debate also demonstrates the responsiveness of the research base during a spending review period.

In a similar way, the recently published strategic policy statement, “Building Britain’s Future: New Industry, New Jobs”, outlined that Government can and must be intelligent about ensuring its actions deliver a high value, high skilled economy able to respond to long-term opportunity. It highlighted the need for concerted action to back businesses in markets and sectors where Britain has strength and noted that Government can make a difference by clearing obstacles or correcting market failure.

A number of approaches can be adopted to identify economic opportunities including through the work of Industrial Growth Teams or through ongoing discussions with industry and the research community facilitated by Knowledge Transfer Networks. For example, in the area of plastic electronics, BIS officials, the Technology Strategy Board, Research Councils and the KTN will work alongside key players from within the UK’s plastic electronics sector to develop a UK strategy for plastic electronics that will identify the UK’s main strengths and how businesses throughout the supply chain can best take advantage of future commercial opportunities. Due for publication in the autumn of 2009, the strategy will also define the role for Government in unlocking competitive potential of this emerging industry.
8. International Comparisons

On both research and innovation, in international terms the UK is highly competitive. Evidence on research output\(^2\) shows that the UK is ranked second, behind only the US, on the majority of measures. Furthermore, the UK has been consistently the most productive country for research in the G8, with the highest number of papers and citations amongst G8 countries per unit of GDP and per unit of public research funding, and the UK is ranked ahead of the USA for citation impact in health, biology and environment sciences. A particular strength of the UK is the breadth of its research excellence. Counting frequency of presence in the top three by citation volume in the main subject areas, the UK is in the top three in seven out of nine areas. The UK has four of the top seven universities in the latest THE-QS Rankings. Recent international analyses of innovation performance\(^3\) locate the UK within the “innovation leaders” in Europe.

The UK takes a broadly similar approach to many of its competitors to research funding mechanisms. Like the UK, the majority of G8 countries provide funding via a dual system that combines responsive mode and block grant funding. Thematic priorities that are publicly announced drive funding strategy in most countries, including the UK. There is also a great deal of consensus on priority areas: energy, climate change, the environment, and information technologies figure in investment plans across all countries that publish priorities.

The UK measured level of gross R&D expenditure is strongly influenced by the sectoral mix of the business sector. Business R&D investment has been rising in real terms but not as a proportion of GDP, but less R&D intensive industries (for instance financial services) account for a larger share of UK output than most other nations.

At the same time, need to recognise that R&D is only a partial indicator of innovation activity, though an important one. NESTA is leading work on a new Innovation Index which will aim to provide a fuller picture of UK innovation performance to inform future policy.

Data on public expenditure on R&D from the OECD show that the UK’s expenditure, as a percentage of GDP, has in recent years been lower than France, Germany, Japan and the United States and higher than Italy and China. In 2007 the UK’s expenditure accounted for 0.61 per cent of GDP compared with 0.74 per cent for France, 0.76 per cent for Germany, 0.70 per cent in Japan, 0.65 per cent in USA, 0.54 per cent in Italy (2006) and 0.42 per cent in China.\(^4\)

The fact that UK achieves world class research performance at a lower public cost than many of its competitors is testament to the efficiency and productivity of the UK research funding system, and to the quality of our researchers and research institutions.

September 2009

\(^3\) The European Innovation Scoreboard provides a comparative assessment of the innovation performance of EU27 member states using a wide range of indicators including human resources, firm activities and measurable outputs and economic effects. http://www.proinno-europe.eu/EIS2008/website/docs/EIS_2008_Final_report.pdf
\(^4\) All data is from OECD Main Science and Technology Indicators (MSTI)
Examination of Witnesses

Witnesses: Mr Jeremy Clayton, Deputy Head of the Government Office for Science, and Dr Graeme Reid, Deputy Director, Economic Impact, Science and Research Group, Department for Business, Innovation and Skills, examined.

Q1 Chairman: May I say welcome to our two witnesses, Dr Reid and Mr Clayton. It is welcome back, in fact. Thank you for your written evidence and also for your contributions to our seminar that we had two or three weeks ago. Can I remind you that everything that is said is recorded and a transcript will be made available to you. I wonder if the best way to start is to ask each of you by way of introduction to say something about the responsibilities that you and your team have in these areas.

Mr Clayton: Thank you very much, Chairman. My name is Jeremy Clayton. I am the Deputy Head of the Government Office for Science and my job is to manage and lead that office under Professor Beddington, who is the head of that office as well as the Government Chief Scientific Adviser. The Government Office for Science is responsible for the management and use of science and engineering in government, for leading the science and engineering professions across government. It also provides advice to ministers directly on some particular science and engineering issues. Its services the Council for Science and Technology and has within it the Government's Foresight Programme and Horizon Scanning Centre. Its reporting lines are to the Prime Minister and Cabinet at ministerial level and to the head of the Home Civil Service within the Civil Service. Our key relationships are particularly with the Science and Research Group within the Department for Business, Innovation and Skills and with BIS ministers, Lord Mandelson and Lord Drayson, who have responsibility at ministerial level within the Cabinet for science matters; also with the Science and Research Group within the Cabinet Committee on Science and Innovation, chaired by Lord Drayson, who have responsibility at ministerial level within the Cabinet for science matters; also with the Cabinet Committee on Science and Innovation, EDSI, chaired by Lord Drayson, and we have close relationships as well with Number 10 and the centre of government.

Dr Reid: Chairman, members of the Committee, my name is Graeme Reid. I come from the Science and Research Group within the Department for Business, Innovation and Skills reporting to the Director General, Adrian Smith. The Science and Research Group is responsible for the science and research budget that funds research councils and other parts of the research base, and we are responsible for oversight of the research councils as part of that role. For about the last 12 months we have also been responsible for the research funding that goes through the Higher Education Funding Council for England and for knowledge transfer funding that goes through HEFCE. We have close relationships reciprocally with the Government Office for Science and also with the Technology Strategy Board, for which we are not responsible but with which we have a great deal of collaboration.

Q2 Chairman: Thank you very much. The way departments seem to move around these days it is very useful to have your take on just where responsibilities do lie and I am sure we will come back to that in a little bit of detail. I wonder if I can begin the more formal questioning by picking up a point from your departmental submission. This is the one where you expressed. I took it, a bit of concern about the language in which the debate is often conducted, and in particular the distinction between “directed” and “responsive” mode funding. You thought this maybe was not fit for purpose and you would rather have an alternative version. Would you like to elaborate on that?

Dr Reid: We did indeed express concern about that language and that is only part of the lexicon. There are terms such as “pure” and “applied” research, “blue skies research” and any number of other terms of art. Conceptually these can be quite useful in trying to describe the nature of research but, coming down to project level, these distinctions often are less useful. Looking at an individual piece of research and trying to decide where it is pure and where it is applied can be pretty hard work. If these terms are given too much weight in the formulation of policy it is easy to lose sight of the fact that they work more at a conceptual level than they do at a practical level. It was that that I meant in the note. You will be seeing witnesses from research councils and funding councils later in this inquiry and they may be able to elaborate on that point. I think you will find that they share a similar view.

Q3 Chairman: One of the points I wanted to pick up, and I think Lord May wants to come in on this one, is the sorts of terms you put into your submission which you thought we might use. The first refers to those areas of research where there is a degree of uncertainty about outcomes because it is very much long term research and so on, and it remains to be seen what particular results there will be. I found this a bit inadequate, to be blunt, because I think there are at least two different areas covered by that. One is where you do have research and the research councils, for example, fund through creating five-year grants for centres, where clearly there is a long way for a project and a type of inquiry to run, and these certainly are long term. There are longitudinal studies which can be very long-term if they are to be effective, but, if you are talking also about uncertainty and long-term in the sense of it being a long term financial
commitment in major research facilities such as CERN or radio telescopes or what-have-you, but I think there is a real teasing out to be done in what you seem to list as one item, uncertain and long-term research. Would you like to react to that?

Dr Reid: I think you have just described one of the key dilemmas faced by those of us that allocate funding within research. A research funding allocation is often a judgment of how to balance the tensions such as those you have described, and I am sure there are others as well, and, in doing that, recognising that research is not some orderly process in which you can put research projects into neat categories which might be attractive to tidy-minded bureaucrats but do not actually relate to the real world.

Q4 Chairman: I am not accusing you of being tidy-minded or a bureaucrat, but if the cap fits—There is the dilemma. What practically then can you do about that?

Dr Reid: Resources are allocated partly so that groups of people can manage them and partly to reflect the strategic priorities that the Government sets at one level and that research councils or funding councils might set at another level. When you ask what can we do about it, one of the main things is a recognition at the different layers in the allocations process and of the limitations of these categories and not to let the bureaucracy drive the research beyond the healthy limits of what it can do; allow the researchers flexibility to pursue their curiosity.

Q5 Lord May of Oxford: I completely agree with you that you cannot put things in tidy boxes but, frankly, there are two kinds of extremes that I think can usefully be distinguished, and the word “research” in some of these contexts to my mind is used too loosely, because I think you can draw distinctions along the continuum from research to development. It is summarised very well by a very influential American Chief Scientist, Bruce Branscome, who said, “the Government invests in tomorrow; business invests in today”, and that is a rough mapping from research, knowledge base, necessarily public money, as you say, through to development, although, of course, there are lots of things we need to be doing, and very sensibly you are doing, to try and improve the connections between them. Having said all that, I found it a bit disconcerting that, of the three kinds of purpose that you distinguished for the word “research”, only one of them was what I would call research and the other two are both development. I found it even more disconcerting that your CV says you are responsible for “the economic impact of the research base”, which is great, and it goes on to say, “and its delivery through the research councils”. I wonder if you can expand on exactly what you mean by that, particularly in the context of the meaningful distinction between “directed” and “responsive” mode research.

Dr Reid: If I may I will take that in two parts, what do I mean by delivery through the research councils and then I will come to “directed” and “responsive” mode. The research councils are accountable to the Government through us for their stewardship of public funds and we have a very clear distinction between the role of the research councils and the role of the Government in that. One of the things that is set out in the royal charter for each research council and is also in the delivery plans of research councils put forward to us is that they will deliver excellent research and try to increase the impact of that research on the economy and society, and we can unpick that later if you wish. It is my responsibility to monitor research councils’ delivery of that agenda as they said to us they would, and, indeed, when we make the case to the Treasury for this public funding it is on the basis that the research councils will be pursuing that high level strategic agenda. My responsibility for delivery through research councils is of that nature, so it is ensuring that it is happening at a strategic level and that the research councils are able to describe to us the results of that delivery. I have an analogous but in many ways quite different responsibility in relation to funding that goes through HEFCE. In terms of responsive and directed research, research councils will decide on the balance of funding between those two types. “Responsive mode” is a term of art that is used to describe proposals that are put forward by the researchers in areas of a researcher’s choosing. “Directed mode” is a term of art that is used to describe programmes that have a theme that is determined by the research council and the research council invites funding proposals within that theme. The research councils themselves say that in fact they sometimes find those terms rather difficult to work with because, as I said earlier, when you look at an individual research proposal, whether it is submitted under responsive or directed mode, the reality is that it is probably a bit of both.

Lord May of Oxford: But, insofar as you can distinguish them, I think you can because “directed” are things that come into specific programmes that have called for proposals in that programme. For one of the research councils, when it came under my aegis, it was a general rule, and Cadogan then was the person, that roughly half the money should be responsive. I know that one of the research councils that was roughly half is now about a quarter, and I wonder about that. You will be aware of the rumours that something like £80 million was transferred across the ring-fence not that long ago, and I am sure
that is a question of definition, but could you give a little more of chapter and verse to the remaining sanctity of the ring-fence between the research council budgets, separately negotiated as they were when I was familiar with them not by the Permanent Secretary at DTI but by the Director General meeting separately with the Prime Minister. I ask it against my background that, during the five years I was in DTI, there were various attempts to breach the ring-fence that had to be fought off and I have lost track of what happened since.

**Chairman:** So, how many holes in the ring fence?

**Q6 Lord May of Oxford:** If any, and I discount Gordon Brown’s letter that says everything is hunky-dory.

*Dr Reid:* Would that letter be the introduction to the document published this morning?

*Lord May of Oxford:* I do not know but it is in the papers.

**Q7 Chairman:** We have received that document but, to be honest, we have not read it. We got it ten minutes ago.

*Dr Reid:* It was Jeremy who was responsible for the preparation of the document rather than me but I took a strong interest in it because Gordon Brown writes an introduction to the document in which he voices his “continuing commitment to the science and research budget ring-fence”. That is of this morning. The ring-fence is the subject of a great deal of discussion and debate. It has been over the years that I have spent in and out of this field and I am sure it will continue to be. The commitment to the ring-fence is something that has been voiced repeatedly by ministers and Lord Drayson in particular, Science and Innovation Minister, loses no opportunity to voice his commitment to it. The value of the ring-fence I think is very considerable in providing stability and certainty of funding within the spending review period. With only one exception that I am aware of, the one to which Lord May refers, that has protected the ring-fence against short-term pressures which all areas of public spending come under. I see the ring-fence, in summary, as having two roles: first of all to hold onto the money, but, perhaps equally important, to provide that level of confidence and certainty in the scientific community, and indeed in the businesses that work with the scientific community.

**Q8 Lord Oxburgh:** Pursuing a similar point but from a different aspect, does it mean very much to talk about economic impact of the research base without specifying a timescale?

*Dr Reid:* I think it means a great deal, actually.

**Q9 Lord Oxburgh:** Could you give us that, please?

*Dr Reid:* Indeed. Particularly at times like these but actually at any time I think it is important for funding bodies and the research community to be able to explain in reasonably clear language what they give back for the money that the taxpayer provides, and the term “economic impact” has been used as the headline for that description. One of the reasons for introducing that term was to try to get beyond a debate that was couched entirely in terms of pure and applied research and a debate that was couched in terms of how many patents had been filed by university departments, which we thought were particularly poor indicators of value to the taxpayer. Instead, therefore, on advice from an independent review, we opened up the description of the impact of the research base and I like to think of five different routes through which the research base contributes but I recognise that these are five of many. In no particular order, the research base first of all develops highly qualified people who move into many areas of employment throughout the economy and society; the research base creates new businesses and improves the performance of existing ones; the research base makes enormous contributions to public policy and public services in areas such as health and environment but many more; and, finally, I think perhaps the untold story in this is the way that the excellence of the research base attracts businesses from around the world to do research and development in this country. You will notice in that description that I have made no reference to pure and applied or directed and responsive or any of these other terms because the primary driver, as best we can tell, is the excellence of the research base.

**Q10 Lord Oxburgh:** But, given the reassuring explanation that you have just offered, do you not feel that you need to indicate in some way that it is not really just the short-term results that you are concerned with, the short-term impact?

*Dr Reid:* First of all, I agree entirely that this is not a short-term issue, and in fact our move to that language was an attempt to get away from short-term thinking. I would take every opportunity to reassure this Committee and others that this is a long-term issue. Indeed, I would say that this is about harvesting now the results of research that has been funded over many decades, and indeed the research councils only quite recently have published some timelines that illustrate the benefits that are being reaped now from research that goes back in some cases to the 1930s.\(^5\)

*Lord Methuen:* You are familiar, no doubt, with the comment of the late Lord Porter that there are only two sorts of research: applied research and not yet applied research.

\(^5\) See: http://framework.rcuk.ac.uk/timelines.htm
Lord Broers: I would debate that, actually. I think it is not quite true.

Chairman: One is here and one is there.

Q11 Lord Broers: I want to ask a directly related question to this impact. How parochial are we in evaluating our impact? I continually receive literature about things like Plastic Logic and, to declare my interest, I chaired it for a while, now funded by American money in Germany, the Silent Aircraft project that came out of the Cambridge/MIT thing, now being followed up by NASA and not by us. Do we take that into account or do we just regard ourselves as the internationally excellent place and we are serving the world and it does not matter?

Dr Reid: There are two parts to the answer. First of all, I hope we would recognise that science and research are global activities, and certainly we think scientists tend to operate in global networks and collaborations, so the notion that generally it is UK science that can be used in the UK does not stand much scrutiny. Clearly we are interested in converting taxpayers’ money into benefit for taxpayers in the UK but that is not going to be done entirely within these shores. Lord Broers, you have given a couple of examples, and I know that you will be aware of many more, where the path between the search and the value to the taxpayer is a long and complicated one and not all of it, maybe not even most of it, happens within one country. What is more, this country has now built up an enviable track record of attracting global businesses to do R&D in the UK and the path that the knowledge takes within these global businesses will be complicated. The first part of my answer is that, while my primary concern is that the taxpayer in the UK should recognise the value they get from taxpayers’ money that goes into research, that interest will not be served by being parochial. The second part of my answer is that this is a relatively young agenda and in some areas the management information we have and the survey data we have to try to capture something as complicated as economic impact is rather more parochial than our ultimate goals. Certainly a lot of the survey data and management information was gathered only from within these shores but I would not want to imply that the limitations of evaluation data mean that we are only thinking about the United Kingdom in a bubble because we simply are not.

Chairman: I think we should move on. We will keep coming back. These are amongst the very largest issues.

Q12 Lord Haskel: I wonder if we could go back to the matter of allocation. In your submission you identified several areas of allocation—funding directly, providing investment incentives, managing the innovation environment, supporting the research. How do you decide what proportion of your effort and funding you should put into these areas? How do you allocate your involvement in each of these areas?

Dr Reid: I would draw a distinction between the factors we take into account in making an allocation and the allocation of resources. We are not allocating the resources under the headings directly that you have given but these are factors that we take into account when making the allocation. How do we make the allocation? First of all, this is and always will be a judgment, not a calculation, and I make no apology for that. Secondly, in making the allocation in 2007, when the last allocation was made, one of the things that we set out to encourage was cross-fertilisation of activity between the research councils, so in allocating money to a research council we were not saying, “You can take that away. It is yours and you can do with it entirely as you wish only within your community”. We invited proposals for how councils would work together, and indeed they came forward with, I think, very exciting and innovative proposals for cross-council themes in areas like the environment and ageing and energy, in which, managing their own agenda, they also worked together on something like Living with Environmental Change. I hope I am being helpful in drawing a distinction between the factors we take into account and the nature of the allocation we make. In terms of making the allocation, we operate to some high level criteria which are published in the allocations document which take account of the quality of the proposals that are made to the research council and the capability of the research council in our judgment to deliver on its own proposals. What I could not give you, I am afraid, is a formulaic mechanism by which we get from a science research budget to an allocation.

Q13 Lord Haskel: What is the level of involvement that you give it?

Dr Reid: The level of involvement in making the allocation is at a strategic level, not an operational one. That is the first point. We invite the research councils to put forward plans for how they would use the money that is provided and, as I said, how they would work together. Those plans, together with a rolling dialogue with the research councils and with parts of the community, provide us with the information on which to take a judgment. In reality, because of the long-term nature of research, because of the research institutes that Lord Sutherland has mentioned, we do not start with a blank sheet of paper; we start with considerable spending pressures and a budget, as you will be very well aware. There are many pressures, some of which are pressures to leave everything just as it is and some of which are pressures to change things, and in reaching a
There are, of course, a lot of direct relationships that will reflect the needs of government departments. Review that advice will be formally sought and that councils, so for the first time in the next spending research budget and the allocations made to research there is a formal input from the Chief Scientific Adviser which has been set up within the last year is that sector. These are two of the mechanisms by which we work.

Q14 Lord Crickhowell: Dr Reid, can you fill in a gap in my understanding at the moment? I came into this room and saw this rather nice chart, Science in Government, setting out the organisation. You have the Government Chief Scientific Adviser and so on in a nice block and connecting somewhere else at the top with your department, the Department for Business, Innovation and Skills, but not obviously connecting down at the bottom. You have been talking about getting value for money, asking the research councils to do this and that, and you kept saying, "We do this" and "We do that". I am left with a gap at the moment as to how you in the department, asking these things, deciding these things, allocating these monies, are liaising with the Government’s Chief Scientific Adviser and Science in Government and all those other neat little boxes set out in this chart. This is the first bit of questioning about the structure of government and how it works through government that I am asking outside your department.

Dr Reid: I will say a few words and then I would like to hand over to Jeremy Clayton who will be able to describe in rather more detail how the Government Office for Science liaises with us and with other parts of government. First of all, we have frequent dialogue with the Government Office for Science at all levels of the system, so the Director General for Science and Research and the Chief Scientific Adviser stay in close contact, as do the management layers that are shown on that chart. As well as that there are several formal processes to ensure co-ordination. I will mention two of them and then hand over. The research council chief executives and the Government chief scientific advisers meet regularly under the chairmanship of John Beddington to ensure that their ambitions and challenges are known and understood. Under the chairmanship of Adrian Smith, the Director General for Science and Research, a group called the Funders Forum meets, and that Funders Forum includes GO Science representation research councils and Higher Education Funding Councils as well as major research funders from business and the charities sector. These are two of the mechanisms by which we work.

Mr Clayton: It is a very complicated landscape. There are important formal mechanisms and one of the new ones which has been set up within the last year is that there is a formal input from the Chief Scientific Advisers Committee to decisions on the science and research budget and the allocations made to research councils, so for the first time in the next spending review that advice will be formally sought and that will reflect the needs of government departments. There are, of course, a lot of direct relationships between government departments and research councils, a very large number of memoranda of understanding, so that they talk to each other frequently and know each what the other is doing and can liaise. There are a number of cross-departmental bodies which involve research councils and departments, for example, the research council programme Living With Environmental Change which involves a number of departments and research councils amongst others, so in specific areas there is very close liaison. There are a number of other areas such as Foresight or areas where there are formal bodies like the Energy Technologies Institute which bring these bodies together, so there is a large range of different bodies, but at the end of the day it depends mostly on sensible people working together effectively with a lot of good conversations, which I think does happen increasingly.

Q15 Lord May of Oxford: I have a little funny question. When I was Chief Scientist my first observation of this strange tribe was that they were a very games playing tribe and I was a games player, so I took a lot of interest in these little diagrams, and I noticed there has been a radical change in the organisational diagrams since I was familiar with it when I was in Trade and Industry. When I was there the Director General of the Research Councils, who would be Adrian Smith, would have been in the green box, oddly enough, not reporting to me but reporting directly to the minister, not reporting to me so that I did not hold any budget, and certainly the Director General did not report to the Permanent Secretary in DTI. I see him now reporting, yes, directly to Lord Drayson but also to the Permanent Secretary, unless that line is a misprint, but he is in a different coloured set of boxes from where he used to be. I wonder if you could tell me the operational significance of that.

Mr Clayton: This is a diagram which was produced, I think, very recently to be helpful.

Q16 Lord May of Oxford: These diagrams, as you know better than I do, have tremendous resonance within the Civil Service and do not pretend otherwise.

Mr Clayton: All I am saying is that this is not a diagram which is sitting on a website or whatever. It is something which has been produced on that basis.

Lord May of Oxford: Do the proper one and send it to us so that we can look at it and pursue this.

Q17 Chairman: Make your comments and then, if you need to change the diagram, we would like to see the new one.

Mr Clayton: I think this is largely right. The difference I think you were referring to, Lord May, was that in 2007 the Office of Science and Innovation,
within which both the Chief Scientific Adviser and the Director General of Research Councils sat, was discontinued as an organisation and the Government Office for Science was set up as a separate body, and that is the green part of this diagram. I think the practical arrangements are in very substantial part unaltered. I think what this does do is perhaps more clearly than previously separate out the Government Office for Science from the department within which it sits so that there is no ambiguity: it does not report to Lord Mandelson and Lord Drayson; it reports to the Prime Minister and Cabinet and that is very clear from this diagram. I believe it is the case, subject to correction, that in your day the accounting officer for the science budget was the Permanent Secretary in DTI, so to that extent there was inevitably—

Q18 Lord May of Oxford: No. I asked a question earlier and it comes up in this context. The budget for the research councils was negotiated as a separate unit and did not involve the Permanent Secretary in DTI.

Mr Clayton: It was on a separate vote, as I remember. In 1995 when OST joined DTI I was in the finance division so I was quite heavily involved in that at that time, but if the accounting officer had to appear before Parliament and defend that vote it was the Permanent Secretary to the DTI who would probably do that with the Director General sitting alongside him.

Q19 Lord May of Oxford: We can check that.

Mr Clayton: I believe I am right in saying that there was that formal relationship, and that remains the case now. I do not think substantively, in terms of budgetary responsibilities, there is any substantial change in those accountability and responsibility arrangements.

Dr Reid: I just want to add one point. I agree with what Jeremy has said. Lord May is right that the science and research budget was negotiated quite separately from the departmental budget, and in the 2007 spending review it was still negotiated as a separate budget, although I think I am right in saying that it was negotiated under this management structure but negotiated as a separate budget line and actually settled by the Treasury at a different time from the rest of the DTI budget.

Chairman: It might be helpful for the Committee to have a note laying out what the changes have been. I go even further back when the OST was in the Cabinet Office and the CST was from there as well.

Q20 Lord Cunningham of Felling: How often does the Government review the mechanisms it employs to establish priorities for research funding?

Dr Reid: The mechanisms evolve continuously and one of the reasons for that is that the research regime evolves continuously. For example, in recent years we have created an Arts and Humanities Research Council and merged two councils to form the Science and Technology Facilities Council. When changes of that significance take place in the landscape it clearly has implications for both the mechanisms but also for the very nature of the evidence that is used. That said, when the science and research budget is being bid for and then subsequently being allocated, we would look afresh each time (and that in recent history has been round about every three years) at ways to improve the allocations process. We announced some months ago that in the next allocation the Director General for Science and Research will consult more widely and more formally bodies in the academic and business and public service communities to be sure that we understand better their views on the allocation before offering advice to ministers.

Q21 Lord Cunningham of Felling: If I were heading a research group which was not regarded as a priority in this funding mechanism how would I go about trying to make a breakthrough to get the priority changed?

Dr Reid: The allocation of funds in research councils is first of all managed by the research councils, not by the Government, and it is done by peer review. The way with research funding is to submit research proposals which win support from peers. One vulnerability in the system which I think is widely recognised is that, if you are in a ground-breaking area of research that does not have a well established peer group, or if you are cross-fertilising research disciplines so that you are bringing together two well established areas into one that is not well established, the peer review process will underrate you. What I would say is that awareness of these problems is so acute, both within the research community and within the funding agencies, that, while I would not claim perfection, I would say that the peer review system is acutely aware of the need to support ground-breaking research that would fall foul of everyone sticking to their subjects.

Q22 Lord Cunningham of Felling: You have just identified one pretty serious weakness. You volunteered that. What are the other weaknesses in the system that you can identify?

Dr Reid: I would say that we have identified several different weaknesses in the past and have taken steps to try to remedy these. The interaction between different research councils in their responses to major challenges, such as the environment and ageing, I think is something that has seen significant progress. A long-standing concern in this country, which I share, was the relationship between the academic...
world and the business world and we have seen significant steps in both the funding bodies and in universities to improve performance there and I think in recent years we have seen something of a transformation in that relationship. I could go on, but if I talk about challenges that remain I think that international collaboration and the challenge of securing funding through agencies in different countries without going through the full bureaucracy of each country remains a challenge, and the research councils indeed have opened offices in China, India and the US partly with that in mind. Another challenge, and this will be my last one, is the relationship between the academic community and some sectors of business that, although they are intellectually intensive, they do not have a great history of working with the academic world and I think there is room to do more there and quite a few people are trying to do it.

Q23 Lord Oxburgh: Can I just make sure I understand your point? If I understand you correctly, in spite of the separation between the blue and the green boxes, and in spite of the solid line between the research councils through Adrian Smith to the Permanent Secretary, because of a separate Treasury allocation it is not possible for BIS to raid the research councils’ budget?
Dr Reid: That is correct.

Q24 Chairman: I do not know if your colleague has any weaknesses that he has spotted that we should know about.
Mr Clayton: My responsibilities, of course, are more in the area of the government departments’ research programmes, but in terms of weaknesses, just to mention a key recent strength before I go on to that is the fact that we do now have these regular discussions between chief scientific advisers and research council chief executives which mean that the identification of priorities and the way they are treated is improving as a result. I think the weaknesses from the government department point of view is that some of these issues run across a large number of departments and that does make them difficult to manage because the budgets sit within departments under individual accounting officers. We have a number of means of trying to address that problem and one of them is the public service agreements in which a number of departments are involved and which try to make sure that delivery of an important government objective is managed effectively across a number of departments, and it should be the case that there is a senior analyst on each of those PSA boards trying to make sure that the evidence and research has been used effectively. Also, John Beddington has a number of ad hoc groups of chief scientific advisers from groups of departments looking at issues like counter-terrorism, food, energy and climate change, which try to bring those departments together so that we get the maximum bang for our buck for research spending. There is a sort of fallback mechanism where things are not working, which is that one of the roles of the Cabinet Committee on Science and Innovation is to try to help deal with issues where things are falling between departmental cracks or where departments are simply not adding up to a coherent whole, and I think Professor Beddington gave some evidence to this Committee earlier on how that process works.

Q25 Lord Cunningham of Felling: What you have just been talking about used to be referred to as joined-up government. I have to say from my experience in the Cabinet Office that it really was joined up in a way that the then Prime Minister was trying to make sure it was. Have things changed?
Mr Clayton: I think things are improving, and certainly, without naming names, sometimes when one talks to countries overseas they admire the degree to which our government departments are joined up on some of these cross-cutting objectives compared to the situation in those countries, but it is a very high priority of ours and John Beddington’s to continue to improve this because it is very difficult and we are not yet perfect.

Q26 Lord Cunningham of Felling: So the silo mentality of mulishly defending departmental responsibilities and budgets has not yet been eliminated?
Mr Clayton: I would not like to adopt your words exactly, Lord Cunningham, but the challenge is identified and it has been identified recently by the Cabinet Secretary who has had for a couple of weeks an on-line discussion forum on whether there should be more cross-cutting budgets and whether the budgetary arrangements within government are best fit for purpose at the moment.

Q27 Baroness Neuberger: It is really more of the same. I was going to ask you to go through what all the various bits do and I gather that we have now got a fairly lengthy explanation of what we were given this morning. You have said that where there are difficulties, and it has really got to be cross-departmental across a variety of disciplines in our wonderful coloured chart, it would go to the Cabinet Committee on Science and Innovation but that is a Cabinet committee and I think one of the questions that we would like the answer to is whether there is a role for a central advisory expert group in setting strategic priorities for research funding, particularly given this business of doing stuff that covers different disciplines and, indeed, different departments.
Mr Clayton: I think the answers may be slightly different there as regards the research council budgets and government departments. Perhaps the first thing to say is that the Prime Minister does have a top level, independent, external science and technology advisory body, which is the Council for Science and Technology.

Q28 Baroness Neuberger: Can I interrupt there and just say that that is advisory; it does not make decisions, so there is a central advisory expert group that advises the government but you have also got a Cabinet committee. I do not see how it all fits together at the moment. Perhaps I am being a bit stupid but that is where, it seems to me, there might be an argument for something else.

Mr Clayton: There are a number of advisory bodies at different levels. In terms of how decisions are taken, there is nothing ultimately different in this area from how government decisions are taken generally. Ultimately they are taken by Cabinet or manifestations of Cabinet, which may be Cabinet committees or individual secretaries of state. In order to help those decisions be made effectively we have a number of supporting mechanisms, which are these advisory committees, on ways in which departments and research councils come together. All the committees and advisory bodies you could want are in the system at the moment. My own view would be that adding another one would not necessarily help very much. What we need to do is make sure that the ones we do have are effective.

Q29 Baroness Neuberger: And feed into each other, presumably?

Mr Clayton: Absolutely, and increasingly that is happening. For example, the Technology Strategy Board attends meetings we have with research councils and chief scientific advisers. The Energy Technologies Institute fits in different bodies. There are lots of different variations on this which we try to adapt to the particular challenge that is being addressed.

Dr Reid: I would say that similar arguments apply within the allocation and prioritisation of the science and research budget. There are many sources of advice and we have announced that we will formalise the acquisition of that advice in preparation for the next spending allocation. I suspect that the creation of a further advisory committee would make it more complicated.

Q30 Lord Methuen: To what extent and how do the Government engage with the devolved assemblies in setting strategic priorities for research funding and co-ordination?

Dr Reid: As part of the answer to that may I just say that there are three different geographies at work here and I have responsibilities that operate within each of these three geographies. First of all we have funding and priorities which apply across the United Kingdom, secondly, funding and priorities that operate within England, and, thirdly, funding that goes across the four countries of the UK. How do we bring together the four countries of the UK? The answer is at least at two different levels. The Director General of the Research Councils chairs the Funders Forum, on which both the devolved governments and the higher education funding bodies are represented, along with research councils, the Technology Strategy Board, business and charities, and that looks at the interaction and overarching priorities across all of the major research funders in the United Kingdom. In recent times devolved issues have featured quite prominently in the work there because there is a strong desire to achieve the right balance between the co-ordination of the four countries of the UK and the distinctiveness that they have under devolved arrangements. At an operational level there are frequent discussions, particularly between the funding agencies in the devolved territories, again, attempting to strike the balance between unity and diversity. The arrangement sounds complicated but in my experience it works quite well.

Chairman: I am not sure that has been the experience of this Committee on specific inquiries, but that is another matter. I think we have time for just one more question because we have a programme running through the morning.

Q31 Lord May of Oxford: I was going to ask how strategic priority decision making processes are co-ordinated across government between government and other organisations and, lest I seem to have been saying that everything used to be better than it is, this is in my opinion something that is a great deal better than it was, with Dave King driving forward the programme, the thing that began as protocol and science advice, and John Beddington’s effective chairing of the thing that brings more people together. I think we have covered this question unless you want to add something to it.

Mr Clayton: I think that is right; I think we have covered that area. The one thing to say is that certainly within government what we need to try and do effectively is make sure that the research and development that is done is linked properly to the department’s top-level objectives, what it is trying to achieve, so that we have a story for ministers which says, “This is why you need to spend this much money in this area”, either within the department or spread out across several departments, and I think that is a main focus, particularly going into the next
spending review, trying to make sure that that story is articulate and compelling across government.

Q32 Lord Broers: I was involved a little in the consideration of manned space flight: should we do it or should we not. How can a decision be made there? Is that Lord Drayson’s decision? Say there was a serious issue: should we spend £50 million more so that we can participate in the manned space programme? How would we make that decision?

Mr Clayton: I do not know, is the answer to the specific question. Generally within government it is a matter for negotiation between ministers at different levels and the centre of government in terms of who needs to be involved in what decision and what level it is taken at. Clearly, there are decisions which are taken by Lord Drayson and, indeed, by officials. Other decisions will need to go to a Cabinet committee.

Dr Reid: I have nothing to add to Jeremy’s description.

Chairman: I am tempted to say we recognise with great interest the first “don’t know” of the season. We do not get many of those in this Committee.

Lord Broers: Could I ask for a bit of information? It would be very valuable to the Committee to have a diagram like this but in a different form, actually showing the flow of money and at which point decisions are made and by whom, and then, as branches on that, the advice coming into it.

Baroness Neuberger: It is where the advice cuts with the money which is what we really need to see, and that is, I think, what I was trying to get at.

Q33 Lord Oxburgh: Do you think you could produce something of that kind?

Mr Clayton: We can certainly have a go at it. It will not be an unambiguous diagram, because a decision which in theory might be taken at one level, if it is in some senses a challenging decision, may move to another level. These things are a bit flexible.

Lord May of Oxford: It could be a sort of hologram thing, so that it will look different!

Lord Broers: This was the clear, defining decision in industry—who signs the cheque. That would always clarify your understanding of an organisation.

Baroness Neuberger: In the funding charities it quite often is too.

Chairman: That would be very helpful. We have given you note of a number of topics, most of which we have made inroads into; but if there are points that you would have wanted to have made today that there has not been time for, it would be very helpful to receive written notes and we may come back to you with very specific written questions. Thank you both very much indeed for taking time and making the preparedness to come here to answer our questions.

Supplementary memorandum by the Department for Business, Innovation and Skills

RESPONSES

— An organogram of the current organisation of BIS and the Government Office for Science which includes lines of accountability and reporting for all senior staff within the organisations, and externally to the Prime Minister, Cabinet Office and HM Treasury.

1. This organogram is at the end of this document

— A diagram showing how public funds are allocated for research and development in government. This should outline at which point in the process decisions are made, by whom, and from whom advice is sought. [This was clarified with the Committee Clerks and a narrative response is given below]

2. Spending Reviews set firm and fixed three-year Departmental Expenditure Limits and, through Public Service Agreements (PSA), define the key improvements that the public can expect from these resources. The 2007 Comprehensive Spending Review set spending plans for 2008–09, 2009–10 and 2010–11. These spending plans reflect each department’s strategic objectives and priorities for investment and reform.

3. Public funds are not generally directly allocated to research and development as part of the spending review process. The major exceptions being the Science and Research Budget and the Department of Health’s ringfenced R&D budget. BIS is the custodian of the Science and Research budget on behalf of Government and works with delivery partners to sustain a world-class research base.

4. The allocation of funds directly to research is a matter for individual departments and is driven by the policy and delivery requirements of those departments. Plans by government departments for policy-directed research are set as part of overall planning for delivery of relevant PSAs, other cross-cutting priorities and departmental strategic objectives.

5. Departments produce research and analysis strategies that are closely linked to Public Service Agreements and to departmental objectives. Plans for research in departments are based on these strategies, as are research budgets where they exist.
6. The key mechanism for setting and monitoring cross-government delivery on its top priorities are the Public Service Agreements (PSA). Each PSA has a Senior Responsible Officer (SRO) and a Delivery Board. PSA Delivery Boards should include a senior professional analyst (who may be a relevant departmental Chief Scientific Adviser (CSA) or other senior analyst) who will take responsibility for the evidence for monitoring the PSA and its delivery.

7. A senior analyst should sit on the Board of each government department so that decisions on strategy and resources are fully evidence-based, and that departmental structures and processes promote good analysis and use of evidence. This may be the CSA, for example, as is the case in Defra, MoD and the Food Standards Agency, among others, or the senior economist, statistician, social researcher or operational researcher, depending on the particular requirements of the department. The Board member should draw upon the other analytical Heads of Profession within their department. Their role is to promote advice to ministers that evidence based and to represent and champion input to policy making from all analytical professions at Board level.

8. Departmental chief analysts and CSAs should be consulted as a matter of course by departmental strategy and finance teams on strategy and budget proposals, so that they are evidence-based and that sufficient resources are dedicated to evidence and research to underpin the achievement of departmental priorities, including the department’s contribution to Public Service Agreements and other cross-cutting priorities.

9. Departmental CSAs should in turn keep the Government Chief Scientific Adviser (GCSA) in close touch with current and planned R&D investment in their departments, and alert him to any significant issues.

10. A number of departments have created overarching independent Science Advisory Councils. The roles of these vary, but typically they provide independent overview and challenge of the management and use of science by the department concerned, including on the strategic direction of, and priorities for science, and on the balance, relevance and adequacy of science activities supporting departmental objectives.

11. How individual departments fund research and development (R&D) varies. For example, in Defra, virtually all of the R&D budget is allocated to Senior Responsible Owners (usually at Director level) for specific policy programmes and ongoing functions. These are structured to focus on delivery of the Department’s Strategic Objectives. Depending on their requirements, other departments may choose to have separate research budgets.

   — A note outlining what changes have been made to the allocation process for the Science and Research budget including the accountability and responsibilities of senior staff over the last 10 years.

   — Please can you clarify within this note the lines of reporting for the DG of Science and Research and the Chief Scientist; how the current Director General for Science and Research negotiates the science and research budget with HM Treasury; who is involved in this process; and the approval process for the science budget before it is submitted to HM Treasury.

12. The Director General responsible for advising the Secretary of State on the allocation of the Science and Research Budget has always reported to the civil service head of the appropriate department (the Permanent Secretary), and advised the appropriate minister(s). All budgets, including the Science and Research Budget, are ultimately agreed between departmental ministers and Treasury ministers.

13. The GCSA has responsibility for providing scientific advice personally to the Prime Minister and members of Cabinet, and reports to the head of the Home Civil Service.

14. A brief history of the responsibilities for advising Ministers on the Science and Research budget is as follows:

   1992—The OST is formed with Government Chief Scientific Advisor (GCSA) as its head, as part of the Cabinet Office.

   1993—The position of DGRC was created

The House of Commons Science and Technology Committee described the change in their sixth report of 2000–01:

6 Taken from the House of Commons’ Science and Technology Committee’s Seventh Report of 2005–06; http://www.publications.parliament.uk/pa/cm200506/cmselect/cmsctech/900/90006.htm, p17.

The 1993 White Paper created the new role of Director General of the Research Councils (DGRC) and the functions of the Advisory Board for the Research Councils were absorbed into the Office for Science and Technology.\textsuperscript{8} The post of DGRC was created to enable the Chief Scientific Adviser to concentrate upon his responsibilities for transdepartmental science and technology issues across Government.\textsuperscript{9} The DGRC is responsible for securing the successful and high-quality operation of the Research Councils and in advising the Departmental Minister (the Chancellor of the Duchy of Lancaster until 1995, and now the Secretary of State for Trade and Industry and the Minister for Science) on the allocation of the funds to the Research Councils, the Royal Society and the Royal Academy of Engineering.\textsuperscript{10} The post was held by Sir John Cadogan until 1998.

\textit{1995—OST became part of DTI}

\textit{January 1999—Sir John Cadogan was succeeded by Sir John Taylor as DGRC}


The allocations document published in 1999 described the allocations process:

The CSR involved analysis and consultation on an unprecedented scale on the Science Budget and its outcomes, both past and potential. The DGRC and his team carried out widespread consultation with Government departments, industry, Foresight panels and learned societies on the strengths, weaknesses, opportunities and threats related to Research Councils’ programmes. Chief Executives, supported by their all-embracing pyramids of scientific advice were fully involved. This work involved extensive benchmarking, notably including the international comparisons published by the Chief Scientific Adviser. The Steering Group for the Science Budget CSR, chaired by the DGRC, had cross-departmental membership, including the Treasury. The Steering Group approved the CSR’s analysis, which was subsequently accepted by Ministers.


The 58 page allocations booklet described in some detail the rationale for the allocations.

\textit{January 2004—Sir Keith O’Nions succeeded Sir John Taylor as DGRC}

\textit{May 2005—Science Budget allocations 2005–06 to 2007–08 published}

This allocations document outlined a new Performance Management System for science spending. In April 2005 responsibility for funding the Arts and Humanities Research Council and the British Academy transferred to DTI from DFES.

\textit{April 2006—OST to OSI, and DGRC to DGSI}

The Commons’ Sixth report of 2006–07\textsuperscript{11} described changes which took place following an internal review within DTI:

a new Office of Science and Innovation [was] created by merging the DTI’s Innovation Group into the Office of Science and Technology. The OSI would have the twin purpose of “investing to develop further the excellence of the UK’s research base; and promoting technological and other business innovation”.

…the role of CSA [for DTI] was added to the portfolio of responsibilities awarded to Professor Sir Keith O’Nions, the former Director General of the Research Councils, now Director General of Science and Innovation, who also took on oversight of the Innovation Group.

\textit{28 June 2007—DIUS created}

John Denham becomes Secretary of State for Innovation, Universities and Skills. The DIUS press release stated:

The Department for Innovation, Universities and Skills (DIUS) will lead the Government’s work to deliver its long-term vision to make Britain one of the best places in the world for science, research and innovation. It will also lead work to ensure that the UK has the skilled workforce it needs to compete in the global economy. The Department will work to:

Sustain and develop a world-class research base.

Maximise the exploitation of the research base to support innovation across all sectors of the economy.

\textsuperscript{8} Evidence given to the above, Cm 2250, paragraph 1.18.

\textsuperscript{9} Evidence given to the above, Cm 2250, paragraph 3.26.

\textsuperscript{10} Evidence given to the above, Cm 2250, paragraphs 3.26, 3.27

\textsuperscript{11} House of Commons’ Science and Technology select committee’s Sixth report of 2006–07: http://www.parliament.the-stationery-office.co.uk/pa/cm200607/cmselect/cmsctech/203/20305.htm

\textsuperscript{12} Letter to Phil Willis MP, Chairman, Science and Technology Committee, from Sir Brian Bender, Permanent Secretary, Department of Trade and Industry, http://www.publications.parliament.uk/pa/cm200607/cmselect/cmsctech/203/203we33.htm
Raise and widen participation in Higher Education.
Raise participation and attainment by young people and adults in post-16 education and learning.
Tackle the skills gap amongst adults, particularly equipping people with basic literacy and numeracy.
Increase the supply of people in science, technology, engineering and mathematics (STEM)\(^\text{13}\)

20 July 2007—Formation of Government Office for Science Announced

From the DIUS press release:\(^\text{14}\)

The GCSA and Head of the Government Office for Science will be responsible for:

- Providing scientific advice personally to the Prime Minister and members of Cabinet (in consultation with Departmental Chief Scientific Advisers when appropriate);
- Advising the Prime Minister and Cabinet on aspects of Government policy on science and technology;
- Ensuring and improving the quality and use of scientific evidence and advice in Government;
- Leading the science and engineering profession within the Civil Service.

The other elements of the former Office of Science and Innovation (OSI) will become part of the DIUS Science and Innovation Group, which will be headed up by Sir Keith O’Nions as Director-General. Science and Innovation Group will continue to be responsible for:

- The science budget including funding for the seven Research Councils, three National Academies, the Higher Education Innovation Fund, Capital Funding for Research Infrastructure, and science and society programmes;
- Policy on innovation including funding for the Technology Strategy Board, the National Measurement System, the National Physical Laboratory, British Standards Institute, the Design Council and government links with NESTA (the National Endowment for Science, Technology and the Arts)
- British National Space Centre
- UK-Intellectual Property Office (UK-IPO)
- National Weights and Measures Laboratory (NWML)


The allocations document\(^\text{15}\) set out the following description of the allocations, building on earlier spending rounds:

The following factors were taken into account in determining the Science Budget Allocations to individual Research Councils and Academies:

- a thorough assessment of draft Research Council and Academy Delivery Plans for CSR07;
- the strength of the case for increasing the investment in any particular area of research in CSR07; and
- a full evaluation of the performance of each of the Research Councils and Academies through the SR04 period (see the annex for more detail on the performance measurement of the Research Councils).

The Science Budget renamed the Science and Research Budget to reflect that it funded research across all academic disciplines. During 2008, a separate Director General was appointed in DIUS with responsibility for Innovation.

\(^{15}\) http://tinyurl.com/sciencebudget07
From the DIUS press release:¹⁶

The Director General of Science and Research is responsible for advising the Permanent Secretary of DIUS and the Secretary of State on science and research spending policy. He is also responsible for enhancing understanding of the role of science in society and improved public engagement on key scientific issues.

June 2009—DIUS merged with BERR to form BIS

1. What is the breakdown of funding for the following activities within Government:
   — Direct funding of research through the Research Councils and HEFCE;
   — Indirect incentives for the private sector to invest more by providing tax incentives and subsidies and through joint ventures;
   — Influencing innovation or supporting the environment for innovation, through the Technology Strategy Board;
   — Research to support policy through Government departments, agencies and institutions; and
   — Any other research activities not covered above.

Direct research funding

15. The ring-fenced Science and Research Budget (£3.97 billion for 09/10) funds Research Councils, Academies, capital and other research related activity, as described in The Allocations of the Science Budget 2008/09—2010/11 published by DIUS in December 2007. A copy of this document can be found at http://tinyurl.com/sciencebudget07. The Science and Research Budget is the subject of a separate Request for Resource which means these resources cannot be used for any other purpose without Treasury and Parliamentary approval. This ring-fence covers all spending, including capital.

16. Funding for Higher Education, including research, is devolved and the appropriate devolved bodies decide the volume and form of funding for research in HEIs outside England.

17. In England, the Higher Education research budget provides block grant funding to HEIs in England, predominantly through Quality Related (QR) research funding. HEFCE also provides money for university research capital. The allocation to HEFCE is set out in an annual letter from the Secretary of State to HEFCE, which is publicly available on the HEFCE website.¹⁷ HEFCE funding for research and research capital for the year 2010–11, announced in the most recent HEFCE grant letter, totals £1,785 million.

18. As well as money from the HE research budget, HEFCE also distributes some of the funding from the Science and Research Budget such as HEIF (Higher Education Investment Fund, designed to encourage knowledge transfer in Higher Education institutions in England) and RCIF (Research Capital Investment Fund, a strategic fund to help universities maintain their research infrastructure).

Indirect incentives and Support for Innovation

19. The primary routes through which the Government supports innovation are:
   — R&D Tax credits
   — The Technology Strategy Board
   — UK Innovation Investment Fund (UKIIF)
   — Small Business Research Initiative (SBRI)
   — And, from April 2013, The Patent Box

20. Innovation is also supported through the work and research performed by departmental institutions and agencies such as the National Measurement Office, Intellectual Property Office, and the UK Accreditation Service, and by Regional Development Agencies, which provide research and innovation services to both Government and businesses.

¹⁶ http://www.dius.gov.uk/news_and_speeches/announcements/dg_science
¹⁷ HEFCE Grant letters can be found at http://www.hefce.ac.uk/finance/fundinghe/grant/
R&D Tax Credits

21. R&D tax credits are one of the Government’s most important policies designed to promote innovation in the UK, playing an effective and increasing role in supporting business investment in scientific and technological R&D. The forecast future costs of claims are: FY 08-09 £820 million; FY09-10 £890 million. Since 2000, almost £3.9 billion of support has been provided to UK companies, through payable credits to SMEs not in profit or as tax relief to both SMEs and large companies.

22. In FY07-08, the last year for which published figures are available, there were 7,670 claims totalling £790 million, based on almost £8.7 billion of business investment. Around 75 per cent of claims are made through the small and medium sized companies scheme, and the other 25 per cent through the large companies scheme. Claims were primarily from companies in Business Services (38 per cent of claims, totalling £340 million) and Manufacturing (33 per cent of claims, totalling £300 million). From 1 August 2008, 175 per cent relief is provided under the SME scheme, available to companies of up to 499 employees. Companies claiming through the SME scheme also have the option of exchanging the enhanced deduction for a payable cash credit from HMRC worth 24.5 per cent of the original qualifying expenditure if they are loss making. From 1 April 2008, 130 per cent relief is provided under the Large Company Scheme. The UK scheme is normally considered to compare well with the schemes of other countries. The government has undertaken a number of measures to enhance and improve the schemes and their accessibility for all companies undertaking qualifying R&D, and is committed to evaluating the effectiveness of the schemes, focusing first on the SME scheme, by the end of 2010.

The Technology Strategy Board

23. The Technology Strategy Board (TSB) is an executive non-departmental public body funded by the BIS innovation budget. For the three-year CSR 07 period, £711 million was allocated to the TSB, which was increased in the 2009 budget by a further £50 million. Its budget for 2010–11 is £288.8 million. This money is part of the innovation ring-fence and is separate from the Science and Research Budget.

24. The TSB plays a cross-Government leadership role in delivering a national technology strategy, and therefore works extensively with other organisations, such as Regional Development Agencies, the Research Councils, other Government Departments and the Devolved Administrations, to create critical mass and coherence so that UK business has greater clarity and is better able to access the most relevant support available. This will result in the TSB and its partners investing well over £1 billion between 2008–09 and 2010–11 with the aim of catalysing business innovation in those areas which offer the greatest scope for boosting UK growth and productivity.

UK Innovation Investment Fund (UKIIF)

25. The UKIIF was established to drive economic growth and create highly skilled jobs by investing in growing small businesses, start-ups and spin-outs, in strategically important UK sectors including digital and life sciences, low carbon and clean technology and advanced manufacturing. It will operate on a Fund of Funds structure which means it will not invest directly in companies, but rather invest in a small number of specialised, private sector technology funds that have the expertise and track record to invest directly in technology businesses. By increasing the supply of venture capital to these funds the UKIIF will drive investment in high-growth businesses, start-ups and spin-outs which are finding it difficult to raise finance in the current economic climate. From early 2010, £325 million of new venture capital is available to invest at first closing, and the Government’s longer term ambition is that the UKIIF will be worth up to £1 billion over its 12–15 year lifespan. In his Pre Budget Report, the Chancellor announced the Government’s intention to appoint, subject to contract, Hermes Private Equity and the European Investment Fund as the Fund of Funds Managers.

SBRI

26. The government also aims to use government procurement to drive innovation, through the Small Business Research Initiative (SBRI). Following the recommendation of the Sainsbury Report and successful piloting, this initiative was thoroughly reformed and relaunched in April 2009. The new SBRI provides business opportunities for innovative companies whilst solving the needs of government departments and other public bodies. Through SBRI, public bodies run open competitions for ideas and new technologies to meet specified needs, leading to the award of fully funded development contracts between the companies and the government body—it is not a government grant programme, but promotes innovation through the commercial procurement of technology development. The scheme is administered by the Technology Strategy
Board, and in the first nine months since launch, 25 competitions generated 962 responses which resulted in the award of over 286 contracts with a total value of £12.05 million. The TSB continues to engage with Departments to extend the use of SBRI.

Patent Box
27. As announced in the Pre-Budget Report, Government will introduce a Patent Box, applying a 10 per cent rate of Corporation Tax to income from April 2013, to strengthen the incentives to invest in innovative industries and ensure the UK remains an attractive location for innovation. The Government will consult with business in time for Finance Bill 2011 on the detailed design of the Patent Box.

The National Measurements Office
28. The National Measurements Office’s (NMO) proposed strategy sets out the priorities for supporting leading edge research to advance the measurement technologies that would underpin the UK’s economic growth. The NMO is funded by the Innovation budget within BIS, and £56.2 million per annum is provided to support National Measurement System programmes.

RESEARCH TO SUPPORT POLICY THROUGH GOVERNMENT DEPARTMENTS, AGENCIES AND INSTITUTIONS
29. As set out in response to the question on how public funds are allocated for research and development in Government (submitted previously), public funds are generally not directly allocated to research and development as part the spending review process. The allocation of funds directly to research is a matter for individual departments and is driven by the policy and delivery requirements of those departments. Depending on requirements, this can be delivered internally, in government agencies or via other institutions.

30. The major exceptions to this are the ring-fenced Science and Research Budget and the Department of Health’s ring-fenced R&D budget. The Department of Health’s ring-fenced research budget is currently just under £1 billion in 2009–10 and will rise to over £1 billion in 2010–11.

31. As funds are generally not directly allocated to research and development as part of the spending review process, the following figures are based on the latest available expenditure data provided to Office for National Statistics by departments for the annual Government Research and Development Survey and reported in the Science, Engineering and Technology (SET) Statistics. These show that total expenditure by departments on research and development in support of policy and delivery was of the order of £3.4 billion in 2007–08 (£1.3 billion spend in relation to civil departments, including the Department of Health’s ring-fenced budget, and £2.1 billion in relation to defence) (Source: SET Statistics, Table 3.1 Net Government expenditure on R&D by departments in cash terms, November 2009 update).

2. How are departmental R&D performances assessed and how does GO-Science work with departments to improve their research and analysis strategies through the science review process or other means?
32. Understanding the performance of science and engineering research activity in Government is one of the core functions of the GCSA and GO-Science. A number of formal and informal mechanisms are in place to do so.

33. The GCSA has routine meetings with the network of departmental Chief Scientific Advisors (CSAs) though the Chief Scientific Advisors Committee (CSAC). This Committee meets quarterly and is a forum for the discussion of issues relating to all aspects of the management and use of science and engineering across government. Specific matters can be raised for peer advice and support.

34. Departments produce research and analysis strategies and routinely share these, at an early stage, with the GCSA. This allows the GCSA and GO-Science to input to the development of these strategies, and to provide external challenge.

35. More generally, the Foresight Programme and the “issues teams” in GO-Science work closely with departments in the development of coherent science and engineering advice on both current issues and future planning assumptions. Through these routine contact channels, GO-Science and the GCSA are fully appraised of the state of departmental R&D performance and issues in relation to key government policy concerns.

36. A more formal performance review process is represented by the Cabinet Office’s Capability Review process, which has reviewed departments’ overall performance on an annual basis. This review process has a workstream dedicated to the assessment of the evidence base (S2 “base choices on evidence”). While this represents only a small part of the overall Capability Review activity (one component of 10 assessed), evidence is taken from the Government Heads of Analysis Group to get a view of the use and management of evidence
from all the analytical professions themselves. GO-Science provides input on matters relating to the management and use of science and engineering as part of this process.

37. GO-Science’s most formal performance assessment mechanism is represented by the current Science and Engineering Assurance (SEA) review process (successor to the former Science Review process that it replaced in 2009). The SEA review process uses a seven point framework to monitor the management and use of science and engineering in government.

38. Reviews are tailored to support the delivery requirements of each department, but the framework is used to guide the coverage of the reviews. The seven criteria that are used are:

   — Strategy, policy making and delivery should be effectively informed by science and engineering.
   — Government as a whole, and individual government departments, should take a strategic approach to the prioritisation, accessing, resourcing and delivery of science and engineering.
   — All science and engineering used by government should be robust, relevant and high quality.
   — Science and engineering evidence should be made publicly available unless there is a clear justification for not doing so.
   — The implications of science and engineering for society should be fully considered, engaging the public whenever appropriate, using good practice.
   — Government should ensure effective knowledge transfer, innovation and pull through of its research to the economic development of new technologies and services.
   — Departments should ensure that they have the science and engineering capacity and capability to manage and deliver the above sustainably and effectively.

39. These criteria were set out in “Science and Engineering in Government: An Overview of the Government’s Approach”, October 2009.

40. The review process is managed by GO-Science but assessments, which are evidence-based, are made by an external panel of eminent scientists and senior industry or government officials, selected according to the requirements of each departmental review, and agreed by the GCSA and Departmental Permanent Secretary. A small number of relatively strategic observations and recommendations are made that aim to help a department improve its performance in key areas. Care is taken to ensure that while requirements are clearly articulated the department itself is free to develop the implementation response itself. Further assistance can be provided where requested, but it is more common to review the impact of changes with the department at a later date.

41. To ensure that this follow-up process works well, GO-Science has developed a more robust follow-up process than was previously in place, requiring departments to indicate what actions they plan to implement and to assign responsibility for delivery to nominated individuals. These plans can then be followed up by the GCSA and Departmental Permanent Secretary and CSA at agreed post-review stages.

42. All main departments that have not yet had a science review are being included in the current SEA programme. Reviews have been scheduled and are being project managed tightly, to ensure that this benchmark review programme is completed by March 2011.

43. Once reviews of main departments have been completed, a process of light touch self-evaluation will be introduced; this will entail external verification and, where relevant, involve the departmental Scientific Advisory Council.

44. The SEA review programme provides the GCSA with the evidence he needs to continue to advise the Prime Minister and cabinet on the quality and management and use of science in government—as well as supporting departments in the delivery of their business objectives and spreading good practice.

3. We have heard evidence that departmental commissioning procedures are not scientifically robust and do not involve peer-review in many cases. What is GO-Science doing to try and address this? Is there considered to be a “best practice” approach to commissioning of research within departments?

45. Government needs to have access to robust, relevant and high quality science and engineering. While this will often involve drawing upon the existing evidence base in universities and elsewhere, it also involves commissioning new research and advice.

46. Each department should have in place robust procedures for directing, approving, monitoring and evaluating its research investment, including establishing quality assurance procedures for evidence. Where a departmental Science Advisory Council exists it should be consulted on these procedures and advised on their outcomes.
47. A key element of the Government Office for Science’s Science and Engineering Assurance Programme is a review of the commissioning process and of how departments ensure that the science and engineering they use is robust, relevant and high quality. The findings of GO-Science’s Science Reviews have indicated that Departments generally have robust procedures in place for the commissioning of science. However, there is always room for improvement, and recommendations on this have been made where appropriate.

48. For example, the Home Office has a Project Quality Approval Board (PQAB) process in place for the appraisal of projects. As a part of this process, project bids are peer reviewed internally by colleagues who are expert but do not have a vested interest in the work and who offer constructive criticism of the proposals. However, one of the recommendations of the recent GO-Science Science Review of the Home Office/Ministry of Justice was support for the Home Office’s intention to make greater use of external expertise as part of their Project Quality Approval Board (PQAB) process, (although the potential difficulties, in terms of avoiding conflicts of interest in a small research community and of security concerns, are acknowledged). The Home Office has accepted this recommendation and has discussed an approach with members of the Home Office Science Advisory Committee to involve the Committee in the quality assurance process and the Committee will review PQAB processes within 12 months.

49. As well as peer review at the commissioning stage, external challenge and peer review takes place at all stages of the identification, commissioning and delivery of science and engineering in government. This ensures that government has access to the best science and engineering to contribute to good policy making and sound government.

50. Every major science-using department now has a Chief Scientific Adviser. This network of departmental CSAs and the CSAC Core Issues Group (CIG), Science Advisory Councils and the Scientific Advisory Committees all provide a means of external challenge and peer review of science and engineering used by government. For example, the CSAC Core Issues Group (CIG) activities have included peer reviews of the Gallagher review of biofuels sustainability, and of the geomorphological and hydraulic response of the Severn Estuary to a tidal power development.

51. In addition, departments may work with national and international external experts, the academic community, research institutes, the business and voluntary sectors, and other interested external parties in the identification of evidence gaps, and, in the development, commissioning and delivery of their research and analysis strategies.

4. You stated that the DG for science and research will consult more widely and formally bodies in the academic and business and public service communities to understand their views on allocation (transcript reference: Question 20). How will you consult with such bodies? Which bodies will you be consulting?

52. This consultation process was described in evidence provided by this Government to the Commons’ Science and Technology Select Committee for their inquiry Putting science and engineering at the heart of government policy. Allocation of the science budget is underpinned by a body of evidence including draft delivery plans from each Research Council.

The DIUS (now BIS) Director General of Science and Research (DGSR) has committed to wider consultation in the run up to the next Spending Review. As a starting point, any consulting will satisfy the following principles:

Consultation will be wide-ranging and visible to ensure it is of high quality and has the confidence of the community.

Consultation will not be at the disciplinary level.

The DGSR has asked the following bodies to provide formal advice:

— The Royal Society
— The Royal Academy of Engineering
— The British Academy
— The Council for Science and Technology
— The Chief Scientific Advisers Committee
— The Confederation for British Industry

The process of consultation would involve the following steps:

Early in the process, the DGSR would attend a Council meeting of each of the above bodies for a discussion around the core issues.

Each of the above bodies would publicly submit advice to the DGSR at two stages in the process:
- Before the departmental submission is sent to Treasury
- After the departmental allocation is received from Treasury but before the allocations to each Research Council are made

At least twice during the process the DGSR will chair a meeting of the Chairs/Presidents of each of the above bodies to discuss the advice given in plenary.

5. How is the performance of each Research Council evaluated and by whom? How are the Research Council and Academy Delivery Plans assessed and by whom? What criteria are used to do this?

RESEARCH COUNCILS

Introduction

53. Research Councils are established by Royal Charter under the 1965 Science and Technology Act.19

54. The Secretary of State for Business, Innovation and Skills is answerable to Parliament for the Councils’ activities, and appoints members of Council to Councils. The Secretary of State also submits to Parliament the annual report and accounts of each Research Council. The formal relationship between each Council and the Department is set out in a Management Statement and Financial Memorandum (available on each Council’s website).

55. The current Performance Management System (PMS) started on 1 April 2005. It is designed to require organisations, including the Research Councils that receive funding from Science and Research Budget, to identify how they are deploying that funding and their delivery of agreed objectives.

Delivery Plans, Scorecards and Economic Impact Research Framework monitoring

56. The performance management system is in three parts:

Each Council sets out in a published Delivery Plan the key deliverables for the next three years at the start of each Spending Review period, following discussions with the Department for Business, Innovation and Skills. Delivery Plans are refreshed every year through the Spending Review. An Annual Delivery Report is produced and published.

Activities from the Delivery Plan are described in more detail in the scorecard, which details the targets and milestones by quarter. Scorecards are refreshed every year.

An annual report on the economic impact of each Council’s activities under the Economic Impact Reporting Framework (EIRF) provides evidence on how Councils spend their allocations and the benefits that accrue to society as a result. This report is submitted to BIS in August and it details Council activities using around 30 quantitative and qualitative metrics. As a complementary document, Councils also produce a narrative summary of their economic impacts known as their Economic Impact Baseline.

Finance monitoring

57. Following each Spending Review the Department sets out funding allocations and summarises the key highlights of the three year delivery plans for each Council. These are published in the Science Budget Allocations booklet: http://tinyurl.com/sciencebudget07

58. The Councils each produce a monthly financial report summarising their expenditure for the year to date and projecting their expected spend for the remainder of the financial year. The finances are reported against agreed budgets. Research Councils provide explanations to BIS of key variances and the actions they are taking to deliver financial outturns within budget.

59. Financial pressures arising during the spending review and other financial issues of common interest to the Councils are discussed and addressed through regular meetings of the Financial Strategy Group (FSG) which is chaired by BIS and comprises the Finance Directors of each Council.

Setting Research and Funding Priorities: Evidence

Reviews

60. Six-month review meetings are held between the Director General Science and Research (DGSR) and the senior executive team of each of the individual Research Councils, as well as with RCUK.

61. At these meetings, there is a review of the progress being made against the Delivery Plan, the detailed scorecard, the high level risk register and the financial position.

62. DGSR reports to Ministers the outcome of these six-monthly reviews.

63. The performance of the Research Councils’ Chief Executives is separately reviewed annually by the DGSR.

64. In addition, a BIS official attends Council meetings on behalf of the Secretary of State and there are regular contacts at working-level on a variety of issues.

Documents

65. Copies of most of the documents are available on the Research Council websites.

Academies

66. The National Academies are fully independent bodies that receive Government funding for specific projects and programmes, principally to allow a cadre of the most capable academics to work full-time on research. Funding from the Science and Research Budget is agreed on a three-year cycle following each Spending Review.

67. Lighter touch performance management arrangements are appropriate for the self-governing Academies than for the Research Councils but, like the Research Councils, the Performance Management System is based on the same three elements. Review meetings are held every six months. A new reporting and evaluation framework, incorporating relevant indicators of impact, is being piloted in 2009–10.

Documents

68. The text referred to from The Allocations of the Science Budget 2008/09—2010/11 (DIUS, December 2007) briefly summarises the allocations process:

Before allocating the budget, DIUS collected evidence on the activities and performance of all funding lines. All the Research Councils and the Academies provided detailed delivery plans, which set out what future investment would deliver against the overarching objectives. Other key programmes, such as the Higher Education Innovation Fund and the Science Research Investment Fund, were subject to independent evaluation.

The following factors were taken into account in determining the Science Budget Allocations to individual Research Councils and Academies:

- a thorough assessment of draft Research Council and Academy Delivery Plans for CSR07;
- the strength of the case for increasing the investment in any particular area of research in CSR07; and
- a full evaluation of the performance of each of the Research Councils and Academies through the SR04 period (see the annex for more detail on the performance measurement of the Research Councils).

7. In oral evidence (transcript reference: Q9) Graeme Reid noted that “on advice from an independent review, we opened up the description of the impact of the research base”. Can you provide the Committee with a copy of the independent review?

69. The document referred to is the Warry Report, attached separately (received but not printed).

The Committee would also like to seek clarification on the following issues:

http://tinyurl.com/sciencebudget07
1. To what extent is the science and research budget ring-fenced? Can parts of it be moved to other funding streams for innovation for example, or can other activities be moved within the ring-fence? Where does the TSB’s funding come from, inside or outside of the ring-fence?

70. There are three relevant ring-fenced budgets in the science and innovation area. These are (amounts are for 2010–11):

- Science and Research Budget £3.9 billion.
- HE Research funding £1.9 billion.
- Technology Strategy Board £288.8 million.

The Science and Research Budget

71. Any breach of the Science and Research budget ring-fence would require Treasury and Parliamentary approval. As a separate Request for Resource, the Science and Research Budget can only fund activities which fall within the scope of the Request for Resource. The scope covers funding of “public good” research activities in the UK Research Base, which consists of (1) University research departments, and analogous bodies; (2) Research Institutes and facilities owned by Research Councils; and (3) the UK’s involvement in international science organisations and facilities such as CERN and the European Space Agency.

72. The research funded from the Science and Research Budget covers all areas of research (for example from arts and humanities to particle physics) and helps generate the knowledge base which underpins a wide range of applications throughout the economy and the public service.

73. The Science and Research Budget does not fund industrial research and development, and support for business innovation including the funding of R&D is provided separately through the TSB.

74. Research Councils do however have a strong track record in collaborating with business, including funding academic research as part of a co-ordinated programme (for example with the TSB) involving complementary business research activities. Research Councils work directly with over 2,900 businesses, in sectors ranging from engineering to insurance, broadcasting to biotechnology, for example the EPSRC invests 40 per cent of its budget in collaboration with business.

HE Research Funding

75. The Higher Education ring-fence is administrative which means that the funding cannot be used for any other purpose without Treasury approval. The HE research ring fence covers the block-grant funding provided to English universities for research (the devolved administrations provide similar funding within their own territories). The Science and Research Budget ring-fence and the HE research ring-fence give effect to the Government’s commitment to public science spending in the 10 Year Science and Innovation Investment Framework.

TSB ring-fence

76. Like the HE Research Funding ring-fence, the TSB ring fence is administrative and ensures that the funding is only used for its intended purpose.

2. Does the Council for Science and Technology participate in the allocation process for the science and research budget and, if so, how? What role does the Government Office for Science play in this process?

77. The CST is one of the consultees in the allocations process. Government Office for Science provides secretariat support for the CST and for the Chief Scientific Advisors’ Committee, which are also consulted.

3. Lord Mandelson, on 14 September, said that there would be “a comprehensive review of the role played by national level institutions such as HEFCE, the Skills Funding Agency, the Research Councils, and Technology Strategy Board and their relationship to central government”. When will this review take place and by whom?

78. The Government continually assesses its relationship with all Arms Length Bodies. In particular, these issues are being reviewed through our skills and universities papers (Higher Ambitions and Skills for Growth) and as part of the Treasury’s Public Value Programme (PVP), which looks at all major areas of spending across Government.
4. In “Science and Engineering in Government” it is noted that “Departments should consult the GCSA and HM Treasury, in advance, of any potential cuts to research budgets or expenditure, including those that have implications for the funding of cross-cutting research”. Was the CSA consulted prior to the recent cut in the Department of Health’s budget reported in the Times (November 25th, Cancer research at risk in scramble for care funds)?

79. The GCSA has been assured by DH that, contrary to how this was reported in The Times, no decisions have been taken to divert R&D funds into the provision of social care and there has not been a cut in the ring-fenced DH R&D budget, which will rise to over £1 billion in 2010–11.

January 2010
WEDNESDAY 28 OCTOBER 2009

Examination of Witness

Witness: LORD SAINSBURY OF TURVILLE, a Member of the House, examined.

Q34 Chairman: Lord Sainsbury, we felt that it was very important that we talked to you early in this inquiry because of the huge and positive role you have played in establishing the science environment in the UK and, as you probably know, today is our first evidence session. Before we proceed to questions, is there anything you would like to say as an opening statement?

Lord Sainsbury of Turville: No. I have always enjoyed my appearances before Select Committees, so it is rather nice to be back.

Q35 Chairman: Welcome. Let me open with the first question. It relates to your review. What progress has been made in the areas you identified in your 2007 review, The Race to the Top, as requiring attention and improvement? What further developments have taken place and what additional aspects merit attention in 2009?

Lord Sainsbury of Turville: My basic feeling is that some very good progress has been made on the implementation report. I am very happy with the way things have gone. If the Committee asked the Department, I think that they would be very happy to show you the progress which has been made against each of the recommendations in that report. It is very good and I am sure they would be happy to give it to you. What I would like to do is mention four areas where there have been successes and one or two areas where I think there is still further work to be done. Of the four successes, one is that the SBRI—which I have struggled with for five or six years, to try to get it set up in the right way and for the Department to take it seriously—is now being implemented. There have been 17 competitions and in the first six months 956 companies applied and 269 have been awarded contracts of £8.8 million in total. That is nowhere near where it should get to but it is beginning to work, and work in the way that it is supposed to work. I mention it because I think this is an area where the pressure needs to be kept up. It is modelled on the American model and it is enormously important in helping small high-tech businesses. I think that the TSB—which we gave at that point, through my report, quite a lot of extra responsibilities—is doing an extremely good job. One of the recommendations was about getting more people with industry experience into that. I gather they now have about 96 staff and they have 1,200 years of business experience among them; so this means that they now have some really good people with business experience and, given how much this is about applied commercial research, that is very encouraging. There are two other small things—well, they are not just small things. One is that we mentioned obliquely the King’s Cross development, the science and innovation campus there. That is now going ahead and I think is enormously important. We have Daresbury and Harwell. This would be a third science and innovation campus and, in terms of knowledge transfer, support for medical research, particularly that has an application, that is extremely good news. Another small point was that we recommended there should be one big competition—it had a lot of fanfare—young people competitions in science and technology. There has been a Big Bang competition; there will be a second year of that in Manchester—hugely successful—and I think that we need to make certain that all those things are pushed forward. Areas where I think that further work needs to be done are knowledge transfer from FE colleges, which I think is a big opportunity to help industry and FE colleges. It has started but I think that it needs to be watched and pushed along. There is the whole question of careers advice for young people, particularly in science and technology. There are steps being taken. Whether that is yet working along the right lines I think is an interesting question. There is then the famous Strategic and Vulnerable Subjects Committee, which we recommended should be turned into a proper Demand and Supply for Graduates Committee, so that we have much better information in the system of what people actually were taking as undergraduates, what sort of jobs they got afterwards, what sort of needs industry has. I do not think that we have made much progress on that. So some real successes and one or two areas where I think that more work needs to be done.

Q36 Chairman: That is an excellent overall coverage. However, the TSB, which has increased influence, still has a very small amount of money
compared to Research Councils. Do you agree with that or do you think it should be greater?

**Lord Sainsbury of Turville:** I think that one of the most difficult decisions is what money you should allocate to the Research Councils, what to the TSB. You can only do it by saying that if you have an extra £100 at the margin, do you give it to the TSB or do you give it to the Research Councils? I do not think that you can do a calculation on the return you get on these two different things. I think that it is extremely important that, as we see the performance of the TSB getting better all the time, and it shows that this mechanism is a good one, I would be inclined to put extra funding into it.

**Q37 Lord Crickhowell:** You started by saying that good progress is being made on the 2007 recommendations and you were sure that the Department would be happy to give you an account. You are absolutely right, but what worries me about departments giving the account is that they tend to give an account of the good things. We have in front of us a letter from John Beddington to the Prime Minister dated 3 December 2008 and at the top of it I scribbled, before we heard your evidence, “All success and no failures”. You have identified three things that you would like to see more done on. What worries me is whether there is a system. Are you satisfied with the arrangements for following up a report like yours, to ensure that we do not just get, and the Prime Minister does not just get, a rather complacent analysis from the Department, giving it all as good news when shortcomings may be developing? How do we avoid that problem?

**Lord Sainsbury of Turville:** The points I have mentioned are not ones where they did not carry out the recommendation; it is a question of where I think that they need to be pushed along and to make certain that they work. If you read the document, it is fairly clear whether what they are mentioning really achieves what it is said to achieve. They do not say, “Look, we’ve made a failure here”. I do not think that any organisation works like that, but you can read pretty much—

**Lord Sainsbury of Turville:** I think that there is a perfectly good mechanism. The mechanism is the minister; and in this case you have a good minister, who I think would be someone who would review this and would push people along—but that is where it has to come from.

**Q40 Chairman:** I am particularly interested that you identified the demand and supply for graduates. I have just come from a breakfast for the British doctorate. I was alarmed to hear that 80 per cent of people who get PhDs from our universities evidently regard as their first priority as a job to become an academic. That worries me on behalf of industry. Our industry does not seem to know how to use PhD graduates and they need to be helped. How would you go about trying to rectify that situation?

**Lord Sainsbury of Turville:** The first question is what is the particular problem here? Is it that industry is saying; “We can’t get people in these areas”? If they are, then I think it is very important that this kind of information is put into the system, and that is what the committee was for. My experience of this as a Minister was that quite often various bodies would come along and say: “We can’t get enough chemical engineers”, or “We can’t get this or that”. It then usually took quite a bit of effort to find out what were the numbers of people who were being produced by the system in a particular discipline. If you then took action and had, say, a campaign from that particular discipline to get more people into it, the system would respond. What I took away from that was that you just need more information in the system about what is happening and a place where industry can go to and say, for example, “We’re very short of whole systems biologists. Therefore, can we put this into the information in the system?”—because you will then find careers advice people and the vice-chancellor of a university have something to work on in terms of encouraging people to take certain courses or setting courses up.

**Lord May of Oxford:** Can I ask you a question. My Lord Chairman? Eighty per cent are looking for a job in academia but what percentage finds it?

**Chairman:** Much smaller.

**Q41 Lord May of Oxford:** An interesting statistic that is not widely known is that, in relation to the size of the population, for every 100 PhDs in science, medicine and engineering in the US we produce 160. It is not a production problem; it is a placement problem.

**Lord Sainsbury of Turville:** The problems are all very specific to particular disciplines. I think that only 60 per cent of the people who take degrees in science and technology actually go and do a science and technology job. It is not usually a question of producing more; it is that sometimes there are areas
where there are not enough people. It is not the total sum. That is why it seems to me that more information about where there were vacancies, where industry were looking for people, was very important.

Chairman: It is a matter of building very effective links, is it not? Companies like Rolls-Royce do this rather well, because they work in an integrated way with universities; they understand the benefit. There is an interface problem with other industries.

Q42 Lord Haskel: Perhaps we could get back to the allocation of funds and how we ought to set about it. We have been having a discussion about it previously and we have been told that it requires a lot of judgment and that you cannot put things into neat categories. It was also implied that there was some sort of secret formula, and I was not quite sure what that was—but they were not going to tell us. What do you think are the principles and mechanisms that are appropriate for allocating funds to the different streams? The Research Councils, the Higher Education Funding Councils, the government departments, the Regional Development Agencies, et cetera. How do you think that we should decide on the allocation?

Lord Sainsbury of Turville: Can I make a general point first, because I think that it applies to a lot of things that you might want to discuss? There is a view which says it is unhelpful to have this distinction between basic and applied research. I think that this is a complete mistake. It is usually followed, in any evidence I ever see, by a passionate plea that there should then be more basic research or more applied research. It is a very important distinction for two reasons. One is that the economic argument for Government supporting applied research is different from supporting basic research. That is a fundamental issue. The second issue is that the way you fund research, the way you monitor it, and the way you evaluate it is completely different as between basic research and applied research. One of the main things to do in any good funding system is to be clear which of these two modes you are in. Just to make that clearer, if you are funding basic research it is clear that the way you do that is by some kind of responsive-mode funding with peer review. The peer review decides on which are the best projects; you then fund them, and it is very clear how you evaluate them. You evaluate them in terms of scientific papers, citations and so on. When you are dealing with applied research it is a completely different process because, in my experience, applied research does not work unless you very clearly start with a problem and there is a problem that has to be solved. The French refer, rather despairingly, to applied research which cannot be applied—which tells you one of the problems. With applied research you must start with a problem. You fund it because it is a really valuable project to do and then you evaluate it—very simply, “Did you solve the problem? Does it create jobs? Did you create a product?” You therefore need to know which modes you are in, as a kind of starting point. I can give you examples at the European level, where setting up the European Research Council was enormously important, because that very firmly said, “This will do basic research in the following way”. By implication, most of the other Framework Programme then becomes applied research and you can then say, “Is it working or not?” That is therefore the starting point. To make another, slightly historical point, the way this was originally set up in the 1970s, or not set up but changed, was the Rothschild report, which you will remember. The Rothschild report said very clearly that Research Councils do basic research and departments will do the research they require for their policy needs. That is the basis of the system and I think it is a pretty good one. You then have a third leg of this now, the TSB, which is doing the applied research for industry. If you start by saying, “These are essentially the three bodies which we are using for this”, it is then a question, through the Spending Review, of deciding how much money you want to spend on these three different things.

Q43 Lord Haskel: That is very helpful. You have mentioned Europe. In allocating these funds, what sort of attention should we pay towards allocating funds to working with our European partners—because there is quite a lot of work going on there—and the work we do within Britain, because it is British taxpayers’ money?

Lord Sainsbury of Turville: It is very clear, because you have the Framework Programmes. That comes out of the money we give to Europe, obviously. We compete in those areas against other countries. As a whole, we do rather well. For example, in the European Research Council we are doing extremely well, in terms of getting more than our normal share of that, and I think that is very good. In a sense, that therefore takes care of itself. The only other area where we were weak was in terms of various things, like the Eureka programme and the Eurostars programme, where the country had to put some funds in to help companies compete in those areas. We did not really have a mechanism. That is now done by the TSB and I think done rather well. We have a lot of enthusiastic companies who, if the Government—or the TSB in this case—provides funds, can then compete for European funds against other companies. There is a whole range of mid-sized companies who find that a very good mechanism, and I think that it is much improved now.
Q44 Lord May of Oxford: One of the themes that is clearly going to run through this entire inquiry is the following worry, and you will know full well the various indices that document this. We have been extraordinarily good in creating new knowledge and, with the best of intentions—much of it under your guidance—we started doing things to try to put us in better shape to be the people who cash in on the new knowledge thus created. Many of those are things we have to do, they are well-intentioned and they are being rather successful. However, the worry is that an unintended consequence of the more deliberate focus in that direction is having disadvantageous consequences for the people who are doing it, the people who are creating the new knowledge, who are not there for any one of the five clearly articulated, practical reasons we were just given; they are there because this is what they want to do. Letting those kinds of people do what they want to do is what made us so good. The basic thing for the European Research Council, let us not forget, is that it was originally proposed as a form of welfare agency for the accession countries and turned by us and the Germans into something to disseminate best practice. We are in the odd position that countries in Europe are copying styles we used to have, while we are moving in the direction of what they used to have. The discussion of basic and applied or responsive and directive is just as a metaphor for this worry, which is articulated very clearly in the Treasury-DTI joint report in 2004, which said, “What we want is a more strategic priorities for the science base into specific aims and objectives for the Research Councils”; whereas there are people like myself who feel that at least half the Research Councils’ money ought to be given to the best people to do what they think is the best thing. What is your reaction to that, because it will run right through this inquiry?

Lord Sainsbury of Turville: I think that this is an absolutely fundamental point. I am afraid that all the time I was science minister this issue came up again and again. I think that I dealt with one bit of it and totally failed to get people to understand the second bit of it. The first bit of it is that, if you are asking people to do basic research, you should not then produce lots of arguments which say, “We want you to do it in this area and we want you to do that”, because that is not how basic research works. If basic research worked like that, you can just say, “Here are the six most serious illnesses people have and we will put money against each of those”. It does not work like that. You have to let creative people, who are the scientists, come up with the ideas, where they see the problems are tractable and are doing it. I am very keen to keep this tendency; to try to say that we will put in all sorts of other criteria, as opposed to quality research, into what the Research Councils do. There is a second point, however, which is absolutely not understood and it is the one that is causing the most worry. If you then look at where we get the innovation from in our society, it is not from the applied research; it is from the basic research. I can now give you, because it is in my report, the proof of that information. I can even tell you which page it is on, if you want me to. There are two different bits of the report. One shows you where the venture capital money is that goes into supporting high-tech businesses, where it goes in relationship to British universities. Interestingly enough, it correlates almost exactly with RAE scores. Where are we getting the high-tech companies? They are round our world-class research universities. That should not in any way surprise us because, if you look at America, ask yourself where the high-tech clusters are. Where is the biggest impact of science? It is round MIT, Stanford, Berkeley, Duke and Austin, Texas—all world-class research universities. Everyone always makes the mistake of saying, “MIT is applied research, isn’t it?” It is a world-class research university. We can therefore measure our research through Research Councils both in terms of scientific excellence, because we have all the citation data and the data on papers. However, we can also now show how this is having an enormous impact on innovation, because over the last ten years we have solved how we get the knowledge transfer of that basic research into products and services. The chart on that, incidentally, is on page 144. There is one other chart, which I think is on page 58, where we give a comparison of that criteria, ie how much money. It is the toughest criteria. This is not fluffy stuff; this is how much venture capital money goes into companies spun off from a university. We can give you a chart which shows that, compared to American universities, we are probably now as good as they are in doing that knowledge transfer. We are getting the high-tech clusters. They are out there. They are round our top, world-class universities. This is a success story. What we need to do is build on that, because that is beginning to work rather well.

Q45 Lord Oxburgh: I agree with everything you and Lord May have been saying, but I think the crucial question is how you decide what fraction of the people with good ideas, your best people, you are going to support. That is the really hard question. I do not think there is any question but that they should be supported, but how many? To go a little further into what you were saying, drawing on my own experience at Imperial for example, which was pretty successful according to the criteria you have put, it is not the same people who do the basic research necessarily and the applied research; they are part of a single, vigorous, interactive community, striking sparks off each other. They go together.
However, I do not think that, other than in an indirect way, the role of the people doing basic research was to attract the inward investment into start-ups. It was the people who were doing applied research in that environment. Would you care to comment on that?

Lord Sainsbury of Turville: The question is, if you take away the basic research, does it still go on? The answer is absolutely not. Are the people who do the basic research the same people who necessarily spin it out and build a company? Probably not. One of the myths is that the guy who does the basic research should then become a chief executive of a spin-off company. It is a very interesting research project to be done, but my suspicion is that they are not the same people. Most of the best basic research people you would never want in a million years put in charge of a spin-off company. If you look at, say, MIT you will find the well-known professors who have had seven spin-off companies. They do not go and run them themselves; they get people who have experience who were their student ten years ago or someone else to run it for them. If that is the question then, no, you do not necessarily want your basic research people to do it; but it is not a coincidence, as some people seem to think, that our best high-tech cluster, and probably the best in Europe, is Cambridge and that is also one of our best research-intensive universities. This is not a coincidence; there is a good reason for it.

Q46 Chairman: At the same time, of course, we still have suffered from this growth problem in Cambridge. That is, we are yet to grow a very significant company. Do you have a thought about that?

Lord Sainsbury of Turville: I think that this is another issue, but you then have to say what is exactly the standard you are doing this on and on what timeframe. Have we produced a Google? No, but no other country that has produced a Google, and we have actually produced some rather good companies of one sort of another. We have Plastic Electronics that is coming up, but there are lots of others that have come out of that.

Q47 Chairman: That is something that I think we should consider in this inquiry somehow. Plastic Logic is rather a good example, because to grow it we needed American money and the factory is located in Dresden.

Lord Sainsbury of Turville: Yes, but there is a second question. Having got a spin-off company like this, how do you grow it? There are obviously issues about venture capital. In the case of Plastic Logic, I believe that what motivated Hermann Hauser’s choice of Dresden was the quality of the technician skills that you could get in Dresden. There is a quite separate discussion—which I would be very happy to have with you because it is a subject I feel passionate about—which is the failure of our education system to produce enough technicians.

Q48 Chairman: That was one of the reasons, of course. There was also real estate and there was government subsidy.

Lord Sainsbury of Turville: Yes, I agree that there were those issues as well. There is an issue that applies to the work of this Committee, which I think is interesting and perhaps I can put on the table. There is a whole second phase of the development of that technology, which is much more in the applied category, Hermann Hauser would tell you that he needs to have something like a technology development centre for this kind of technology. In fact, the Germans and the Dutch are already beginning to do that, ie they have seen this as a technology to be developed. It does not require absolutely breathtaking, original research; it requires good and much more applied research. I think that is a rather interesting question and if it were a question of how you solve that, I would say that giving some money to the Technology Strategy Board and saying that it can fund that kind of applied research centre would be something that could be done and would be very useful—where you have a new technology like that developing.

Q49 Lord Cunningham of Felling: Is what you are saying a good argument for focusing even more of our research budget on our best-performing universities and taking money away from the poorer-performing universities?

Lord Sainsbury of Turville: If you look at the figures, I think you will see that it has pretty much been moving into becoming more selective. That is probably the right way to go. Would I go to the point of saying, “No, only the following universities can compete for funds”? I would certainly not want to see that. The reason for that is I think it is rather healthy that there is competition and that the top universities compete for funds. I think you will see that it has pretty much been moving into selecting the very useful—where you have a new technology like that developing.

Q50 Lord Cunningham of Felling: Organically?

Lord Sainsbury of Turville: Organically, yes.

Q51 Lord Crickhowell: I am trying to resist the temptation of following up on the whole question of clusters. I spent a lot of time visiting them in the 1980s, trying to develop similar clusters here and I think that the whole way in which, in particular, venture capital is more effectively linked in the
United State with those clusters is something for a separate exploration. I have been briefed to ask about what role publicly funded research plays in innovation. You have already talked about the effect that reduced funding for basic research would have on innovation, but how does investment in publicly funded research affect other parts of the innovation chain? Is the balance of funding along the innovation chain appropriate? Could you say a little more about the general subject of funding in connection with the innovation chain, other than the particular aspects you have already referred to?

Lord Sainsbury of Turville: The two other main bits of the system are obviously the TSB and government departments. My own view is that the TSB is now beginning to do a good job. I think that there is a real question about more funds going into the TSB to strengthen some of that. The area that I am still very concerned about is government departments’ funding of R&D. If you compare us against America, it is pretty clear that where America scores extremely well is in its use of funds by government departments to support industry very effectively. We have mentioned the SBRI scheme as an example of this, but if you take the Department of Energy or Department of Defence, you will find that they are doing an enormous amount to support innovation within different bits of the American economy and doing it rather effectively. I do not think that our government departments do that very well yet. If you asked me which bits of this system the Committee should think a lot about, it would be about government departments. There are at least four questions that need to be looked at. John Beddington has done a very good job of getting at least a kind of lock mechanism, making it more difficult for departments to raid their R&D funds. I struggled to try to get this for years and failed. He at least has a system now where the department has to talk to the Treasury and himself before they raid it. As to whether you should have a ring fence around R&D funds in government departments—so that this is not used as a cushion to help them in hard times—I would strongly want to see such a ring fence. Secondly, one needs to ask some very clear questions about what they use the funds for. There are two different issues here. One is to do work which is important from a policy point of view. The second is to support applied research that applies to the industries which they draw on. So should the Home Office have a budget which is supporting the development of innovation in the security industry, which is an important industry? I think absolutely yes. They are the customer; they have the problem; and they should be driving a programme of innovation in that area. Most critical of all is in the energy area, where I think that DECC should much more clearly have a strategy for supporting energy research for the energy industries. So is the money to be used just for policy or for supporting applied research in their industry?—to which I think you can gather that the answer is “It should be”. The third is what are the mechanisms they use for allocating funding? I have to say that I do not know enough about this, but I would be very interested to know exactly how they do allocate funds. I would at least ask the question whether a mechanism like the Technology Strategy Board, but specifically in areas which relate to departments, should be set up, i.e. with people who have a real understanding of the industry. Would one want to see an Energy Technology Board, for example, which allocated money from DECC firmly for applied research in the energy field, which is probably one of our biggest weaknesses today? When the nationalised industries were privatised there was a very sharp decline—and I think it is in my report—in the amount of R&D being done. We have various makeshift mechanisms, like the Carbon Trust and the Energy Technologies Institute, the TSB does a bit of this, but I am not certain that you do not need a body like an Energy Technology Board to do something about this. Another is the whole area of agriculture. This is applied research; this is about solving applied problems. Again, I think that a board which involved people from business and agriculture, which had funds against the real problems of the industry, is worth looking at. Those would be areas I would want to have a look at.

Lord Cunningham: I am very pleased to hear that. I think it is in my report—in the amount of R&D being done. I have been concerned about is government departments’ funding of R&D. If you compare us against America, it is pretty clear that where America scores extremely well is in its use of funds by government departments to support industry very effectively. We have mentioned the SBRI scheme as an example of this, but if you take the Department of Energy or Department of Defence, you will find that they are doing an enormous amount to support innovation within different bits of the American economy and doing it rather effectively. I do not think that our government departments do that very well yet. If you asked me which bits of this system the Committee should think a lot about, it would be about government departments. There are at least four questions that need to be looked at. John Beddington has done a very good job of getting at least a kind of lock mechanism, making it more difficult for departments to raid their R&D funds. I struggled to try to get this for years and failed. He at least has a system now where the department has to talk to the Treasury and himself before they raid it. As to whether you should have a ring fence around R&D funds in government departments—so that this is not used as a cushion to help them in hard times—I would strongly want to see such a ring fence. Secondly, one needs to ask some very clear questions about what they use the funds for. There are two different issues here. One is to do work which is important from a policy point of view. The second is to support applied research that applies to the industries which they draw on. So should the Home Office have a budget which is supporting the development of innovation in the security industry, which is an important industry? I think absolutely yes. They are the customer; they have the problem; and they should be driving a programme of innovation in that area. Most critical of all is in the energy area, where I think that DECC should much more clearly have a strategy for supporting energy

Q52 Lord Oxburgh: Can I follow up on energy, because I think that is very important? If you look at expenditure on energy research internationally over the last 15 years, we are way down at the bottom. Which body should have picked that up and how are we going to avoid similar mistakes in future?

Lord Sainsbury of Turville: I think by deciding whose responsibility it is and whether there are mechanisms in place to deal with it. The reason we got into that problem was very clear. It was because this research was being done by the nationalised bodies. Whether it was very good and whether it was really focused on
their problems is an open question; but they were doing it.

Q53 Lord Oxburgh: The CEGB was the prime example there and that was just dissipated; but it did not apply to renewables and things like that, which other countries were spending money on and which we just ignored.

Lord Sainsbury of Turville: I think that was because the energy department in the DTI—I do not know whether I should say this—in my view never recovered from having Nigel Lawson as the minister. He was a most dynamic leadership figure and he absolutely convinced them that the Government should have nothing ever to do with things like R&D or policy for energy. It was all going to be sorted by the market. He was such a charismatic figure that the department bought into it and has gone on saying the same line, “It is nothing to do with Government. The market will sort it out”—long past the point where it was clear that there was a major problem. I am afraid we did not say, “Look, he has departed. It is a new world and we have to have more intervention”. To be quite frank, I think that this is a real issue: as to whether market forces in this particular area at this particular time, when you are going to have to shift the production system hugely, is not going to cause us appalling problems.

Q54 Lord Oxburgh: Or whether they do it in time.

Lord Sainsbury of Turville: Because this is a case where the market signals are not very good.

Q55 Lord May of Oxford: In the light of recent events it might be a good time to revisit it—markets.

Lord Sainsbury of Turville: If we are not careful, my reading of it is that we are getting into very dangerous water now—and this is a different subject—in terms of there actually not being enough electricity.

Q56 Chairman: When it comes to research, is it also that we are not prepared to make difficult decisions and concentrate? This is another version of the problem. I lived through another bit of history in the 1980s where we failed to support the micro-electronics industry. At the same time the Belgians, of all people, set up the Interuniversity Microelectronic Centre, which is now perhaps the number one semiconductor research institute in the world, with over 2,000 people in it and a budget of over $200 million a year. It is nonetheless a university research institute; it works with industry throughout the world; it is a terrific support to the Belgian economy. At the time they made that decision it was proposed by myself and others in this country that we should do the same thing; but of course there was a group in Edinburgh; there was one in Manchester; Plessey was in Roborough; GEC was at Hirst; Southampton had a group; Cambridge had a group. We divided the money up ten ways and now we have nothing. This is an issue, which Lord Oxburgh raises, and perhaps we should have an institute for renewable energy or something; but would we have the courage to do that?

Lord Sainsbury of Turville: I think it is a question of having the mechanisms for being able to take those decisions. That is why I mentioned the use of the TSB in this. A department like BIS is not particularly well equipped to take this kind of decision. I do not know whether I should say this, but it gets too close to a political decision if you are not careful. I think that now, with the TSB, you could say, “Here is some money and this is to support this kind of much nearer-market, applied research centre, which will do exactly what you want. You must make these decisions, but not on a political basis of sharing it among regions but on the basis of what is needed and where you put it”. You now have people who are perfectly competent to make those decisions and do it.

Q57 Lord Cunningham of Felling: How do we measure, if we measure at all, and what conclusions can we reach about whether we are fully realising the potential of our world-class research base in the UK?

Lord Sainsbury of Turville: The figures I would give would be those figures I mentioned in my report, which shows you where the high-tech clusters are taking place and that, in terms of impact they are having, this is pretty much comparable to the American experience now. The main issue, the one I worry about, is that, having got the success, having got this happening, it is as much about a kind of ecosystem as it is about a totally planned activity. However, we now have this mechanism working of high-tech clusters. It is not only at Cambridge; it is at Oxford, York, Manchester; it is beginning to happen at Bristol, and so on. It is that we do not suddenly change our mind and say, “This is not a good thing” instead of saying, “We are getting it right but we have only had this happening for ten years”. To get this really right you have to have another ten or 15 years on which the policy is stable”; that we highlight the success, tell young people and businessmen of the success that is happening here, and keep on down this route—instead of saying, “Let’s try and find some other clever idea to do this”.

Q58 Lord Cunningham of Felling: You said earlier that you would resist the temptation deliberately to shift the resources to reinforce it.

Lord Sainsbury of Turville: Yes, because I rather like competition. It was very interesting taking part in a recent review group of the European Research Council. It is quite clear that our system of funding basic research—you tend to think this is something
that all European countries do. It is not. It is only the biggest countries and the best in science that have a funding system like this. Our system is greatly admired. It produces fantastic research, as we can tell from all the metrics, because it has this competitive basis. It is funding basic research on a peer review basis, like the American system—and I am against stopping the competition. If there is a really good guy or really good department in a particular university and he can compete against other people, that is great as far as I am concerned.

Q59 Lord Cunningham of Felling: On a different subject, what would be gained by the Technology Strategy Board having more formal relationships with the Regional Development Agencies—as you recommend?

Lord Sainsbury of Turville: I think that is beginning to take place and I do not know how well it is working in practice.

Q60 Lord Cunningham of Felling: What is stopping it happening?

Lord Sainsbury of Turville: I think that is happening. They are now having discussions. I would have to say that I think the basic structure of RDAs and what we are asking them to do is essentially right. That is not to say that they are run as well as I think they should be run—and they do some things which they should not be doing, like inward investment and having offices all over the world. However, on these areas I think they are beginning to do quite a good job and they are beginning to develop a good relationship—though I do not know enough about this—with the TSB, so that they do not all do the same kind of research. For example, those who have big aerospace concentrations in the area will get together with the TSB on particular projects.

Q61 Lord Cunningham of Felling: To whom does the TSB report?

Lord Sainsbury of Turville: Unless it has been changed, it reports to BIS.

Lord Cunningham of Felling: We had this chart earlier from the civil servants who came and the TSB does not feature on it anywhere at all.

Q62 Lord Haskel: It has now become more independent.

Lord Sainsbury of Turville: This is TSB as opposed to RDAs?

Q63 Lord Cunningham of Felling: This is supposed to be a chart about how science is managed in government in Britain, and it mentions almost everything except the Technology Strategy Board.

Lord Sainsbury of Turville: And that is not just a mistake of putting it together?
UK’s research base remains world class? Is it just the opportunity to sum up for us!

Lord Sainsbury of Turville: I would first say to have real clarity about which parts of the system are doing what and what their objectives are, and do not get into this kind of muddle where you are saying “Do basic research but also do other things as well and have other impacts”. Be absolutely clear. My experience in Government—but, even more, doing scientific funding for my charity—is that evaluation is usually very easy if you are clear what you are trying to do. It becomes incredibly difficult if you do not know what you are trying to do. Clarity of who is doing what is probably the most important thing. I suppose the second point, which I have hinted at, is that I do think there are some real issues in terms of government departments. I have suggested some questions that might be asked on that. These are quite large sums of money and can be used very creatively to stimulate innovation. Then I would fight very hard to get the maximum amount of funds I could for all the different bits of the science system.

Q68 Chairman: That would particularly apply perhaps to military spending.

Lord Sainsbury of Turville: My view was that we were getting it quite seriously wrong from a defence point of view, in that, as we had to cut back on defence spending generally, we took it out of defence R&D and development instead of saying, “If you have smaller forces you probably want to have a higher percentage of R&D to make it more effective”. I am not a military expert, but I am just suspicious that the kind of day-to-day pressures were driving out a long-term strategic view.

Q69 Lord May of Oxford: Given that you have mentioned that, the history, as you know, that caused the spinning out of QinetiQ was that in the previous spending crunch in the early 1990s we were unique. Germany, France, Sweden, the United States, as they cut their defence departments, differentially did not cut R&D and differentially did not cut within that, longer term—and we did. This is very much something in play. I declare an interest: I am a non-executive of DSTL—the bit that is still in the public sector. But I worry very much that the temptation of these cuts is another swingeing cut on that.

Lord Sainsbury of Turville: As I say, because I think we have now managed—and, Bob, you were very involved in this—the whole process of getting our record of knowledge transfer vastly improved, so that it now competes with the Americans, we have that system in place. As I said, I think it is quite a delicate kind of ecosystem. It is not something you can create overnight. I would strongly be trying to make the case in Government that, in a time of financial stringency, when what you have to do is to come out with a much stronger high-tech manufacturing capability, this is an area where you should say, “No, this is our investment for the future. We must not savage this”. Because what we will then find ourselves doing is, in two to three years, trying to reinvent it and we will have lost not a year or two but ten years, and we will find it very hard to try to recreate this thing—which other countries are now trying to emulate and do. It is something where we are uniquely good as far as industry is concerned and we should try to protect it and develop it, rather than say “This is a good opportunity to have a go at it”.

Chairman: That is a very important note to finish on. Thank you very much, Lord Sainsbury. This has been an extraordinarily useful session.

Supplementary memorandum by Lord Sainsbury

1. What is your response to the proposals to improve departmental working outlined in the Government Office for Science’s “Science and Engineering in Government,” which relate to recommendation 8.4 of “Race to the Top”?

A. I think that the Government’s response to recommendation 8.4 of the Race to the Top is satisfactory. It would be desirable to have a cast-iron ring-fence, but I doubt if any government is going to give such a guarantee at this time. The important point now is that the GCSA acts firmly and energetically if Departments seek to reduce their budgets.

2. Are the mechanisms involved in allocating and managing departmental research and development spend now sufficiently robust? If not, what changes do you recommend the Government introduce?

A. While I am not as close to the situation now as I was when I was a Minister, I would like to see a review done of the management of Government Departments’ R&D funds. This would cover the processes used for determining the research needs of the Department, what advice is used in initiating and assessing projects and whether or not the research is supposed to cover the needs of the industries sponsored by the Department. As far as the last point is concerned, I think it is generally agreed that government R&D funding should support the Defence industry, but I am not certain there is clarity about other areas such as agriculture, energy or
Setting Research and Funding Priorities: Evidence

transport. This is an extremely important point as I think it is difficult to overestimate the value the USA gets from the funding of mission R&D by government departments.

I am aware that there was an attempt a few years ago to carry out such a review, but it took the form of trying to assess the quality of all the research projects of a Department. This, I think, not surprisingly, yielded few benefits. What I would like to see done is a review of the management processes involved by possibly the Government’s Chief Scientific Advisor aided by an R&D director from industry and one of the Directors of the Research Councils.

3. What are your views on the structure and reporting lines in the attached organogram provided by the Department for Business, Innovation and Skills?

A. As far as the organogram of the Department of Business, Innovation and Skills is concerned, I would like to make three points:

1. I have no problem with the Director General, Science and Research Group reporting to the Permanent Secretary, if that is an issue for the Committee. I think it is difficult to argue that he should report directly to the Minister and it is important that he has a clear reporting line to someone.

2. I think it is very regrettable that there is not a Director General with technological and industrial knowledge responsible for innovation policy in the Department. The abolition of this post a number of years ago, so that a Director-General of Administration could be taken on, was in my view, wrong. We should not expect a generalist civil servant to be competent to develop innovation policies.

3. I think it should be made clear on the chart who is the person to whom the Technology Strategy Board reports. It is very important that in Departments there is a clearly designated person responsible for each non-departmental public body so that there is a proper oversight of it. But this is a widespread failure across Whitehall. I hope that a report form the Institute for Government will cover this point in the near future.

February 2010
41

SETTING RESEARCH AND FUNDING PRIORITIES: EVIDENCE

THURSDAY 5 NOVEMBER 2009

Present
Sutherland of Houndwood, L (Chairman)
Broers, L
Colwyn, L
Cunningham of Felling, L
Haskel, L

May of Oxford, L
Methuen, L
Neuberger, B
Warner, L

Memorandum by the Ministry of Defence (MoD)

OBJECTIVES, PROCESSES AND MECHANISMS FOR ESTABLISHING PRIORITIES FOR DEPARTMENTAL R&D.

Introduction
1. The effective and innovative use of S&T research is a key component in generating world-class defence capability now and in the future. The Ministry of Defence (MOD) does not have a centralised research & development (R&D) budget. Development expenditure varies depending on the requirements of each project. Science, innovation and technology throughout Defence is primarily provided through the Science Innovation Technology Top Level Budget of around £0.5 billion annually, including support to decision making, developing and implementing technical solutions, supporting operations with analysis and reducing risk. Military and commercial technological developments across the world are monitored to identify developing threats and opportunities.

2. Comprehensive Spending Reviews set Departmental Expenditure Limits for a three year period. The last was the Spending Review, which reported in autumn 2007 and set budgets for 2008–09 to 2010–11. No date has yet been set for the next Spending Review. The research budget, like other elements of defence expenditure, is set by the Defence Ministerial Committee chaired by the Secretary of State for Defence. Strategic direction and senior official level oversight for the R&D programme is provided by the Defence R&D Board (chaired by the Chief Scientific Adviser (CSA)) which reports to the Defence Board as the senior non-ministerial decision-taking body.

3. The Research Programme is formulated by MOD and then delivered through MOD’s in-house centre of scientific excellence—the Defence Science and Technology Laboratory (Dstl)—or the wider supplier base including Primes, SMEs and Universities.

4. International research collaboration with Allies helps with cost and risk minimisation and expands our research capabilities. Defence research enhances existing technologies, identifies and develops emerging technologies, and supports their cost effective implementation.

Objectives
5. Defence Plan 2009–13 defines the objectives as to:
   - deliver agreed technology targets while pursuing the Defence Technology Plan through a comprehensive research programme which promotes cutting edge technologies and supports military operations;
   - enable a science and technology supplier base that meets current and future defence needs;
   - pursue opportunities to reduce the through life cost of equipment through application of new or novel technologies; and
   - enhance international, industrial and other forms of collaboration to increase interoperability, mutual benefits and value for money.

Processes and mechanisms
6. The Defence Research Programme reflects the priorities set out in Defence Strategic Guidance (DSG) 08 including support to current operations. Scientists and analysts are deployed to operational areas to provide a 24/7 service back to the UK to give immediate support to UK forces. This has provided significant operational benefit and hastened equipment through Urgent Operational Requirements (UORs).
7. In October 2006, the MOD published the Defence Technology Strategy (DTS) as the first open publication to allow MOD and industry to sensibly plan investment in research and development, to realise the benefits of advanced technology on the frontline. The DTS brings clarity to the MOD’s research and development priorities, and provides a strategic view of the UK’s defence R&D requirements for up to the next 10 years.

8. The Defence Technology Plan (DTP), launched in February 2009, is the first time we have openly advertised our technology needs to the whole of the UK science and technology supplier base and represents a major change for MOD research. It builds on the DTS and contains a list of our current Research and Development (R&D) priorities. The DTP provides clear direction to the R&D community on investment in defence technology, aiming to encourage fresh and innovative thinking. The DTP is available at www.science.mod.uk. The online format allows regular updates so industry and academia can better direct investment in defence science and technology.

9. Working alongside the mainstream research programme, Capability Visions add a further dimension in the drive to get the best innovation from the UK science and technology community to deliver step changes in key military capabilities. Capability Visions identify innovative options to address long-term defence challenges with the aim of stimulating new activity in the wider R&D community and acting as a guide for suppliers to seek new applications for existing technologies. The five Capability Visions are: future protected vehicle, novel air concept, reduced operational dependency on fossil fuels, reducing the burden on the dismounted soldier and electronics defeat. They were chosen as areas where development of new technology could lead to significant future benefits when our current world-class capabilities become out-dated.

10. The DTP is owned by the Defence R&D Board. The core membership of the Board is the CSA as Chair, Director General S&T Strategy, Deputy Chief of the Defence Staff (Capability) (DCDS (Cap)), DE&S Chief Operating Officer (DE&S-COO), Chief Executive Defence Science & Technology Laboratory (Dstl), Director General Strategy, Director General Commercial and two Non-Executive Directors.

11. Terms of reference for the Defence R&D Board are to:

— Agree the high level research, technology and development priorities for MOD, which will guide MOD’s R&D investment; including:
  — The strategic oversight and direction for crosscutting R&D and systems engineering work;
  — Ensuring that all stakeholders and wide range of customers’ needs are taken into account in the planning and execution of R&D including both technology and capability pull as well as push;
  — Provide an integrated MOD R&D customer perspective to inform the technical priorities of Dstl and its annual key targets and to review Dstl’s technical capability plans for alignment with the Board’s future requirements;
  — Responsible for ensuring there are processes for producing and reviewing effective R&D plans/roadmaps and exploitation (pull-through) against strategic priorities before they are endorsed;
  — Responsible for aligning R&D investment with the Departmental Strategy and guidance, Defence Industrial Strategy, capability plans and where appropriate with Other Government Departments, industry and overseas investment;
  — Responsible for ensuring there are processes in place to provide effective oversight and data capture for efficient management and assessment of value of MOD’s R&D investment;

Outputs from the Board

— Provide a clear communication of benefits, value and priorities for MOD’s R&D investment.

— Provide an annual assessment:
  — On the quality, delivery and benefits arising from MOD’s research, technology and development investment to the Defence Board;
  — Of scientific or technical risk to the department’s capability programme based on current levels of R&D investment to the Defence Board.
— Approve research expenditure plans for MOD’s Research Programme and assess development R&D activities within MOD’s Equipment Programme, including:
  — Approval of the strategic Balance of Investment across the Research Programme;
  — Confirmation of R&D plans to ensure alignment to strategic direction, priorities and wider MOD needs;
  — Provide a set of annual priorities for the R&D funded elements of Dstl’s work programme.

September 2009

**Memorandum by the Department for Environment, Food and Rural Affairs (Defra)**

**BACKGROUND**

Defra has in place systems to ensure we align our resources to our priorities with the ability to swiftly adapt as circumstances change. This includes:

— A portfolio management approach which provides a means to regularly review what we are doing in light of what we are trying to achieve as a department;
— An approvals process to ensure that activities only start or proceed if they have a robust business case;
— A corporate performance management system to allow the Management Board to monitor progress on our key work programmes and achievement of our strategic objectives, giving them clear sight of achievements and risks;
— A “Policy Cycle” framework has put in place approaches, tools and guidance to support the new ways of working. To ensure delivery is managed effectively, programme and project management (PPM) methodologies are now used across the department, and have been mapped to the Policy Cycle;
— A Flexible Staff Resourcing (FSR) system which enables staff to move quickly onto new work as projects come to an end, thus making the best use of staff resource.

Not all our work in Defra fits into programmes or projects. Some work delivers “business as usual”, eg administering agreed legislation, which we term an “Ongoing Function”. Such work has its own requirements for evidence, usually in the form of monitoring of implementation or impact.

**RESPONSES TO THE QUESTIONS RAISED IN THE HOUSE OF LORDS INQUIRY**

1. **What is the overall objective of publicly-funded science and technology research?**

The overall objective for Defra is to ensure policies are based on sound evidence. Science and technology (evidence) programmes should both cover current priorities and future challenges, and should be cross-cutting and multi-disciplinary. Defra’s three big challenges for the future are adapting to climate change, food security and ecosystems.

2. **How are public funds for science and technology research allocated? Who is involved at each level and what principles apply? Where appropriate, is the Haldane Principles being upheld?**

Funding is allocated based on needs identified in our Corporate Strategy, and decisions are made at the SRO level. Below this level, individual teams prioritise and decide what work to fund, based on policy need and urgency. Defra is currently producing an Evidence Investment Strategy which will guide future investment. All research projects are approved by the Chief Scientific Advisor. The Haldane Principle applies most specifically to research councils, and not to Defra, where funding is allocated according to policy, not scientific, need. However, the Chief Scientific Advisor does have funds for challenge—and this could include funding work which does not align with policy priorities.

3. **Are existing objectives and mechanisms for the allocation of public funds for research appropriate? If not, what changes are necessary?**

We believe that existing mechanisms in Defra are appropriate. However, we continue to strive to improve our processes and are constantly looking to improve value for money. The forthcoming Evidence Investment Strategy will also ensure that processes are as efficient and appropriate as possible.
4. **What governs the allocation of funding for Government policy-directed research through Government departmental and agency initiatives? Are existing mechanisms appropriate? What is the role of Departmental Chief Scientific Advisers?**

Defra’s Chief Scientific Advisor has a number of roles:

- provides scientific advice to Ministers and senior officials within Defra;
- advises Ministers and senior officials on aspects of policy on science and technology;
- ensures and improves the quality and use of evidence in Defra;
- champions the role of evidence specialists within Defra, including leading Defra’s science and engineering profession;
- engages other departments and organisations on evidence-related issues;
- strengthens the interactions between the research community, evidence providers and policy makers.

The CSA is a member of the Management Board, where he performs an important challenge function in relation to the use of evidence within Defra and helps ensure decisions on strategy and resources are fully evidence-based, and departmental structures and processes promote good analysis and use of evidence. External support and challenge to the CSA is provided by an external Science Advisory Council (SAC).

Defra’s CSA works with other departmental CSAs under the leadership of the Government CSA to support each other and to address and advise on cross-cutting issues. They do this primarily through the Chief Scientific Advisers’ Committee (CSAC), which is the principal committee at official level dealing with issues relating to science, engineering and technology.

The background, above, describes the processed used in Defra to decide and manage our priorities. However, Defra does not work alone in deciding its priorities. Defra has numerous links with other bodies (research councils, other government departments, EU etc) eg through joint research and EU framework programmes. When considering evidence we need to be thinking about the wider evidence landscapes as the issues Defra faces and their related evidence needs are too large for Defra to tackle alone. The Defra evidence landscape is represented in figure 1.

Defra is a leading member of the Environment Research Funders Forum (ERFF)\(^1\) that brings together the UK’s major public sector sponsors of environmental science to identify and develop areas of joint activity. Much of this activity is being delivered through Living with Environmental Change (LWEC),\(^2\) a £1 billion 10 year programme funded by research councils, government departments, devolved administrations and delivery agencies. Defra is a major contributor, but LWEC will deliver a wide range of evidence for Defra policy areas well beyond that delivered by our own funding alone.

We are working with the Technology Strategy Board (TSB)\(^3\) that is driving forward innovation in partnership with government and industry on a number of innovation platforms. Innovation platforms are under development to support new technologies for rapid diagnosis of animal pathogens, water supply and sewerage and sustainable food production that should enhance the options for Defra policy in these areas.

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5. **How are science and technology research priorities co-ordinated across Government, and between Government and the relevant funding organisations? Who is responsible for ensuring that research gaps to meet policy needs are filled?**

Within Defra, the Evidence Investment Strategy has reviewed research gaps and will be making recommendations on where new focus needed. In addition, the response to question 4 sets out how we co-ordinate our priorities with those of others.

6. **Is the balance of Government funding for targeted versus response-mode research appropriate? What mechanisms are required to ensure that an appropriate and flexible balance is achieved? Should the funding of science and technology research be protected within the Research Councils or Government departments? How will the current economic climate change the way that funds are allocated in the future?**

The Evidence Investment Strategy does consider the balance between urgent short-term and longer-term research. However, Defra tends not to fund response-mode work although where appropriate we work with research councils on areas of common interest.

7. **How is publicly-funded science and technology research aligned and co-ordinated with non-publicly funded research (for example, industrial and charitable research collaborations)? How can industry be encouraged to participate in research efforts seeking to answer societal needs?**

Defra is using the forthcoming Evidence Investment Strategy to ensure we are aware of other research so we can use it where appropriate. Industry already work with Defra on areas of common interest through a number of mechanisms (LINK schemes and a range of TSB-led initiatives).

8. **To what extent should publicly-funded science and technology research be focused on areas of potential economic importance? How should these areas be identified?**

Defra remains committed to sustainability—balancing the needs of the environment with those of the economy and social considerations. Defra does work with industry to deliver our environmental outcomes.

9. **How does the UK’s science and technology research funding strategy and spend compare with that in other countries and what lessons can be learned? In this regard, how does England compare with the devolved administrations?**

It is very hard to compare Defra’s R&D spend with that of other countries since funding structures are complex and very different. Defra does work with other countries on areas of common interest.

*September 2009*
Examination of Witnesses

Witnesses: Professor Mark Welland, Chief Scientific Adviser, Ministry of Defence, Mr Paul Stein, Director General, Science and Technology, Ministry of Defence, Professor Robert Watson, Chief Scientific Adviser, Department for Environment, Food and Rural Affairs, and Dr Miles Parker, Deputy Chief Scientific Adviser and Director for Evidence, Department for Environment, Food and Rural Affairs, examined.

Q70 Chairman: May I welcome our witnesses. Thank you very much for taking time to come today but also for the submissions which you have already let us have. I think you have some idea of the range of issues that we would like to cover. Can I remind you that this is being recorded and will be part of the published evidence when the Committee does report? That being said, I wonder if I could ask you each, simply for the record, to say who you are and what your role is specifically.

Professor Welland: Mark Welland; I am Chief Scientific Adviser with the Ministry of Defence.

Mr Stein: Paul Stein; I am the Director General of Science and Technology, Ministry of Defence.

Professor Watson: Bob Watson, Chief Scientific Adviser at Defra.

Dr Parker: Miles Parker; I am the Director for Evidence at Defra.

Q71 Chairman: Thank you very much indeed. We have a range of issues we want to raise. May I start by asking what might sound a very blunt question—what is the purpose of departmental research? A lot of money is spent by the government on research elsewhere; why should there be separate departmental budgets? Would you like to comment?

Professor Welland: For defence we have a requirement in respect of fighting future battles and supporting existing operations our research is required to be directed at specific equipment that is simply not available and does not have the challenge that the civil sector would have, that a university would be able to deal with. The other part of that is that there are programmes, such as in the chemical and biological warfare and the nuclear arena, that we need to fund from the classified perspective.

Professor Watson: From a Defra perspective what we need is the best evidence for cost effective and socially relevant and socially sustainable policies. We deal with issues such as climate change, food security and eco-systems. It is not just research and development though, it is also monitoring and surveillance. What we need is good evidence so that policies can be cost effective, help stimulate economic growth and also be socially acceptable and understandable.

Q72 Chairman: Do either of the others want to add anything?

Mr Stein: I would just add to the Chief Scientific Adviser’s comment that we also have specific departmental money to directly support operations with scientists that are embedded in theatre as we speak.

Q73 Chairman: Can I ask slightly more specifically about innovation in the private sector? This clearly is delicate, but how far does departmental spend support such innovation and, alternatively, should it? It may be thought to be a privileged access for certain companies, for example.

Mr Stein: I will answer that on behalf of the Ministry of Defence. Innovation in the private sector is critically important to the Ministry of Defence because it needs the investment and the ideas that come from the private sector. So we put quite a lot of energy into an Innovation Strategy. There are five pillars to that strategy and if the Committee so wishes I can develop the strategy for your interest, but the intent of the Innovation Strategy is to stimulate new thinking and stimulate investment in defence. The Innovation Strategy was put in place in 2007 and so far appears to be a successful approach to that end.

Dr Parker: If I could pick it up for Defra then, there are two things to say about innovation in relation to Defra. On the one hand innovation in the private sector is very important for delivering the environmental goals that we have, so we put a good deal of effort into joint programmes particularly with the support of the TSB in areas like agri-environmental developments in areas like waste and so forth. On the other hand innovation is also very important to us in terms of policy development; finding new and innovative ways of actually meeting the very challenging targets we have is very important to us. We are ourselves consumers for innovative thinking in the policy context.

Q74 Chairman: May I just say to Mr Stein, you suggested there was a statement on the principles of innovations; I am not asking you to make it now but if there were a document available perhaps you could let us have it.

Mr Stein: There certainly is. There is a published document, the MoD Innovation Strategy and we would be delighted to distribute it to members of the Committee.

Chairman: Thank you very much. Equally, just as a general point, if there are further statements after the session that you would like to send to us we would be very happy to receive them. I will ask Lord Broers now to pick up the discussion.

Q75 Lord Broers: Before proceeding with the question I want to ask, I would just like to ask a supplementary on what we have just been discussing. Have there been any cases where you have put specific requirements on the standards of technology...
Professor Mark Welland, Mr Paul Stein, Professor Robert Watson and Dr Miles Parker

5 November 2009

you expect in, for example, weaponry systems? I recall this was done in the United States in an effort to restore their micro-electronics industry; have you ever done such a thing here?

**Mr Stein:** We constantly conduct studies into the relevance and state of innovation of all of the technology we commission in the Ministry of Defence and have had a history of quite formal processes looking at the capability of the technology response and the alignment of it with military need. Most of the spend within the Ministry of Defence is capability aligned rather than technology aligned, meaning that the money that we spend is there to provide an end military effect rather than necessarily to sponsor technology for technology’s sake which is why the alignment to military need is very important to us.

**Q76 Lord Broers:** That leads me to my more general question. What principles or criteria does your department use in making decisions about funding different types of research? What processes are used, for example peer review or external or expert consultation?

**Professor Welland:** We have an R&D Board which I chair and that has representation from the science community, DSTL, from the DE&S (where the equipment is procured) and the capability group (which is where the military requirement is set). We have a board that oversees the totality of the R&D because we need to understand that there is a “R” budget and there is “D” budget which supports equipment and the totality of those two is approximately £2 billion per year. What is very important for us is to have a total oversight of how we spend all of that R&D money and making sure that there is a balance between that which is directly supporting equipment, that which is supporting longer term effect and that which is more on the innovative, more challenging side. We have a process by which we measure that and by which it is managed. We also have an annual assessment of that process; we assess how that research expenditure matches against R&D priorities and the equipment programme and we also set the annual priorities for DSTL’s work programme. We have a number of strands by which we manage the spend and manage the research. In addition we have a Defence Scientific Advisory Council which is our independent body that oversees and gives independent advice to us in respect of our side of the business.

**Q77 Lord Broers:** Do you feel you are well linked in with the science and engineering base in gathering advice?

**Professor Welland:** Certainly across MoD we have a very effective structure that brings all of that together. We need to work with universities and we have a Centre for Defence Enterprise which is a new structure that allows us to engage with companies—SMEs—that we have not historically worked with, and with universities. That is an innovative structure in that you can put a proposal in to the CDE and we will get a response back, yes or no, within a few weeks and fund it within a couple of months. That is something that I personally think has been enormously successful over the past year and something which I anticipate expanding. With MoD R&D spend we cannot do a lot of fundamental work—in fact we do very little fundamental work—so it is crucial to us that we engage with UK academia and the innovation that Paul has talked about in SMEs and we need to grow that. We also have, as I am sure you are aware, a significant relationship with the US on technology across the defence piece. That relationship is secured by us being world experts in key areas that the US will feel we are a good technical partner for. We need to maintain an international perspective of what we are doing in order to make us attractive and viable as far as the US is concerned.

**Professor Watson:** In Defra we have a series of departmental strategic objectives, nine of them to be precise. Within that we have a whole series of policy areas that meet those departmental strategic objectives. We then have a series of advisory panels for some of those policy areas trying to understand quite clearly what is the policy direction, and what information do we need to inform policy making. We have peer review and we have panel review. We are just about to issue within the next few months a new evidence and innovation strategy. The way we got to that was that I have had a couple of workshops with over 120 people each time—scientists, policy makers (not only within Defra but within the research councils), other Government departments and some from the private sector—asking: from their perspective what did they see the key evidence needs were for informed policy in the policy areas that Defra has responsibility for? In the last six months we have been working on this new strategy, heavily involving the academic community, the policy community and, where appropriate, those in the private sector such as the National Farmers Union et cetera. We looked to see what other government departments and other research councils needed. Programmes such as Living With Environmental Change are critically important to Defra; the work going on in EPSRC, ESRC, BBSRC is critical to us. We looked to see what is going on in the European framework programmes—currently European Framework 7—and for the really big global issues like climate change; we looked to see what is going on
in the USA as well. We try to use not only evidence but also information from others. What we also find incredibly helpful for the big global issues such as climate change, biodiversity and food security are major international assessments on each of those. What those assessments do is assess knowledge from right across the world of what is known, what is unknown, what are the links to policy, whether national or international. We use a very wide variety of factors. At the end of the day peer review is an absolutely critical tool.

Q78 Lord May of Oxford: All our interests are of course declared and can be found on the website, but I think in this case I should emphasise that in particular I am a non-executive director of the Defence Science and Technology Laboratory, DSTL which Mark has already referred to. My question is basically, starting with MoD, having described the process, how good a job do you think you actually do? What are the strengths and weaknesses of your priority settings?

Mr Stein: We have a mixture of a very linear top down priority setting process. In fact 90 per cent of our funding in science and technology is derived from a series of very top level research goals that are endorsed by the R&D Board chaired by our Chief Scientific Adviser. Those flow down into a series of capability planning groups where the domain experts translate those research goals into specific objectives. However, the strength of a linear process is that you get the priority and balance right; the weakness is that you can be blindsided by new technology or new ways of approach to solving defence problems. So we set aside ten per cent of the money for a sort of orthogonal approach to defence research and that is enabled through the Centre for Defence Enterprise (that the CSA has already described) and we invite people—especially people not previously connected with defence—to say, “Give us your best ideas for solving this specific problem” and we have a process called the Capability Vision where we set some really big picture challenges to industry and academia, not necessarily telling them the way that we would solve them as defence experts, and invite them to come up with new approaches to this capability vision. So the way we try to mitigate the weaknesses of a linear planning process is to allow a little bit of chaos through his ten per cent of the funding.

Q79 Lord May of Oxford: The reason why DSTL is still in the public sector, as it were—a third of research labs used to be—indeed, it looked very close at one point that the whole lot would be spun out, which would have been disastrous for the connection that you have just emphasised with the Americans—but the reason for it was that in the early '90s, when there was pressure on the budgets, the UK was alone in differentially cutting R&D and within R&D differentially cutting long term R&D. That is not what the Swedes, the Germans, the French, the Americans, the Australians did. Now that we are again going into a budget cutting mode I think it is a question that needs to be asked. Do you think the current management of MoD and its relation to these priority settings still thinks that it alone was right and all the other countries were wrong back then or is it likely to recognise that when you are having to make cuts investment in the future—which is R&D—is differentially important and the longer term R&D is within that differentially important?

Professor Welland: You make a good point. In the budgetary pressures that we have had in the MoD on the budget for the past 18 months there is a constant tension between long term and short term. The argument that I have consistently made is that they are effectively one and the same. You cannot deliver effective short term intelligence effect without a long term investment. It is not simply about speculating into the future and doing the research that is speculative looking forward; it is about equipping, it is about manning and it is about the expertise of the people that you need to deliver the short term. I wrote a paper for the Defence Board in January this year pointing out that some of our most effective military equipment, if you trace it back to where its effect originated, is actually from long term research that was done 20 years ago. So there is a requirement in my view that we invest in long term research. Can we do that in a construct where we have significantly reduced funding in the context of DSTL as you know it? The answer is almost certainly no, but what we have to do is work more with the university sector and have a much more outward looking face. DSTL has been doing that and needs to do more of that. We need to keep a long term capability in order to deliver the short term effect and that is my strong message that I have been trying to push at the Ministry of Defence. We need to keep that balance but that does not mean that we can have within DSTL highly speculative programmes on cyber or space which are not significantly aligned with current military requirements.

Professor Watson: Within the last six months we have taken a very critical look at the evidence spend within Defra. We believe that the amount of money is well justified. We looked at the evidence activities very carefully for value for money; we have looked at the quality and the relevance. However, where the weaknesses are is indeed the short versus long term and it is how do you get the balance between getting the information you need for a policy decision in the
next, say, few months to years, versus more longer term looking at the horizon, the big issues coming over the horizon. I am not convinced we have got the right balance between what I call the shorter term policy needs to the longer term needs. That is one thing we have to look at more carefully and of course with tight budgets you tend to go to your needs for today at the expense of needs in the long term. The other area is that I think we focus too much on the natural sciences and some of the technology issues rather than also bringing in, in a much more inter-disciplinary way, some of the social issues. On an issue such as climate change people believe that if you get the technology right and you get the policy right you have solved the problem which you clearly have not. Understanding behaviour, whether it is a food security issue, an eco-system issue or a climate issue—we need the right technologies, we need the right policies and we need the right financing, but we need to understand behaviour at the individual community, private sector and government level I would say we have not fully integrated the economic research with the technology, with the social science and the natural science as well as we could. There are some areas where it has been done well. Also I would argue that we have tended to look at climate change a little bit too separately from food security and from eco-systems and so we have to look much more in a multi-interdisciplinary way of how to bring these all together.

**Q80 Lord Haskel:** We have been discussing balance and flexibility of budgets, but there is a recommended best practice outlined in *Science and Engineering in Government*. How do your Departments react to that? Do you just follow best practice or do you try to be more flexible and more balanced?

**Professor Welland:** We clearly want to follow best practice in allocation of our budget and funding and we do that with an MoD view clearly but also with a sense that there is a more corporate view to what represents best practice. A lot of what the MoD does actually does appear in the Government Office for Science guidance. For example, we have had a CSA for over 40 years; we have the R&D Board which sets the R&D priorities (as I have already mentioned); we have a Defence Scientific Advisory Committee, we engage with TSB and CDE that we have mentioned; we have a range of government to government international research collaborations formalised and we respond to innovation challenge, as Paul has said, through an articulated published innovation strategy, a defence technology plan and the Capability Vision. So we have a broad range of mechanisms by which we address what is best practice and a lot of those do align with the overall government perspective.

**Dr Parker:** From a Defra point of view I can say that we have been working hard over the last eight to ten years to implement what were initially the May guidelines and have gone through a few revisions since. We were at that time in a position of trying to recover from the immense damage that had been done to us by the experiences of the BSE problem, of foot and mouth and from the Department of Environment side the famous fridge mountains debacle. So we had a long way to go on just pulling our science story round. The guidance that was issued at that time was an extremely useful basis for us to work on. We appointed a Chief Scientific Adviser at that time. I think we pioneered among the civil departments the idea of a Science Advisory Council with an independent remit which has been very successful. We altered quite a number of the internal processes about how we managed our evidence gathering but the most important thing we did there was to make our processes vastly more open so it is possible now for people to find out what we are doing and also to comment and contribute. I think that is typified by the fact that all our Science Advisory Council’s activity is in public in one way or another, including an open meeting at least once a year. I think we have been building on the guidance given reasonably successfully and I think this has had value in terms of the trustworthiness of Defra’s handling of evidence and that I think itself is evidenced by the study that was carried out under Sir David King by what was then the Office of Science and Innovation, which reviewed Defra science and how it was handling it, and broadly said that we were doing well in many cases, we were an exemplar in Whitehall. The big area of challenge we had at the time was about our relationships with the research councils where we have had some very difficult interactions over times of declining budgets and things like that. We have put a lot of work into that and I would typify the outcome of the sort of relationship building we have done as being seen in the Living with Environmental Change Programme which is a major effort by NERC and ourselves to lead those bodies involved in environmental research in joining up and doing our work in a combined way.

**Q81 Lord Haskel:** Do you feel that this guidance, creating various councils and the routine that you have explained to us does the job? Does that give you good guidance as to where you should actually allocate your funds?

**Dr Parker:** The guidance is not directed at the allocation of funds as such. As Professor Watson was saying earlier, the allocation of funds in our case is driven by the policy requirement. We have things to deliver; we need knowledge and evidence to do so. That is what will drive that. It is the way we go about
Professor Mark Welland, Mr Paul Stein, Professor Robert Watson and Dr Miles Parker

making those decisions that I think is influenced by the guidance. The processes we use are open to advice, to information, to new knowledge sources in a way that they were not before.

**Lord Cunningham of Felling:** The MoD memo tells us that you spend about £0.5 billion annually on this internal work which, in a ten year period, is £5 billion. The Defra memo does not tell us anything at all about what you spend. It would be helpful if we knew but can we assume in both cases it is large amounts of public money? Could you tell the Committee what you think the three greatest successes resulting from your internal R&D programmes have been in the last ten years?

**Q82 Lord May of Oxford:** Of course if you go back far enough winning World War II is one of them.

**Professor Watson:** Clearly the research that was done in Defra, the theoretical modelling that was done by the Hadley Centre has to be viewed as one of the most important pieces of research in the world. The Modelling Group at the Hadley Centre would have to be viewed as one of the top three in the world; it has informed national policy and informed international policy. It has been a major player of inter-governmental planning on climate change; it is routinely talked about in the convention process. I would have to say that is something the UK can be incredibly proud of, to say the least. Miles wants to give you one that is a bit older than when I got there; I have only been there two years.

**Dr Parker:** One of the other areas in which we have had immense success and which has gone beyond, I think, the needs of the Department and has actually contributed to the research base, has been in the whole area of development of fisheries population dynamics in which the body which is now the Centre for Environment, Fisheries and Aquaculture Science has had a long and glorious tradition of research and still provides leaders in that particular field. That may sound rather esoteric but it is what delivers fisheries stock management and is quite a key one. Since you asked for three, I would say that one other area in which, with quite considerable difficulty, we have had quite a lot of success on is, with others—and particularly here I am thinking of NERC and the Environment Agency—developing the science around diffuse environmental pollution. This is not an area where you can point to some single outstanding success but it is an area in which the investment we have made with others is actually serving to take forward a very complex and difficult area of science. I believe that we will actually see some serious success coming through from that in the future.

**Q83 Lord Cunningham of Felling:** Where would you put bovine TB in your ranking?

**Dr Parker:** That is a massively complex scientific issue and some very good science has been done. Bob, did you want to say anything on that?

**Professor Watson:** I would say the information needed—the full range of evidence—has to not only the natural science evidence of whether or not culling would or would not be effective, but what would the economics be, the evidence around the economics of different strategies on bovine TB, advances in the vaccination (whether it be of the cattle or of the badger). There we have still got a long way to go; it is a real problem and we still have not cracked that one yet. I would say it was a very important factor behind when Hilary made his decision; he obviously made a decision that some people liked and others did not like, but it was evidence based and it was not just the natural science, it was bringing in economics and some of the social aspects. The other one that does go back about ten years in which the UK played a very major role was understanding stratospheric ozone completion and the work done at Halley Bay of finding the Antarctic ozone hole was critical.

**Q84 Lord Cunningham of Felling:** When you give us your note about how much you actually spend, would you just tag up what you are spending on these things you have mentioned, including bovine TB?

**Professor Watson:** The total we spend on research at the moment is £130 million a year and the monitoring and surveillance about £90 million a year, so a budget somewhere around £220 million a year and we can break it down into the various issues.

**Q85 Lord Cunningham of Felling:** The MoD have had some time to think about this.

**Mr Stein:** We have, Lord Cunningham, and we have had some difficulty. We are going to give you a response, but it is like choosing which child is your favourite, because we are proud of a number of achievements in the programme. You will be aware that the programme covers everything from soldiers’ clothing through to nuclear submarines. That is an enormous span of technology that we have to cover. Our goal is to ensure that our forces have the best equipment in the world and we wish to equip them with none less than that. If we really had to pick three I will describe two of them briefly. In chemical and biological defence the UK is number one by a margin. Many, many other nations aspire to have the capability that we do. It is a tremendous bargaining tool with our relationship with the States, and the US and other nations very much respect what we do in that area. I flag that up as one of your three. In armour—that is body armour and vehicle armour—again we remain world class and our science
technology programme has been very well directed towards making sure our troops and vehicles have the very best kit and we believe we do have the very best kit in theatre. So that would be another area where I would definitely fly a flag and say we have done well with the expenditure in that area.

Professor Welland: I think the final one, because I am Principal of the 1958 Mutual Defence Agreement in the US which covers matters nuclear, is maintaining a safe, reliable weapon stockpile.

Q86 Lord Cunningham of Felling: So if your departments were making assessments or re-assessing how you have allocated your budgets over the last ten years, would you learn any lessons from these examples you have given us about how to do it better in the future?

Mr Stein: It is difficult to answer because hindsight is a wonderful thing in warfare.

Q87 Lord Cunningham of Felling: I do not think we told you the questions would be easy, did we?

Mr Stein: Of course looking back we faced a series of threats to our armed forces, many of which we did not foresee. In some ways that is a natural consequence of our enemies choosing to face us in areas where we have not been strong. It is difficult to answer your question because I think we made the right choices at the time and looking back I think we would have made those choices again. However, if we could get in a time machine and go back ten years then yes we would have made different choices.

Q88 Lord Cunningham of Felling: There is a process of assessment and re-assessment.

Mr Stein: Yes, absolutely.

Professor Welland: The one thing I would say to add to that looking forward is that we need to be technically agile, increasingly so as we look forward, because technology is more and more available and accessible, and whereas we might have led in terms of technical innovation we are now seeing in the commercial sector technology that is much more current in respect of our own technology and it is difficult to keep match. What we can be is agile in retaining the ability to be at least an expert in a range of technologies and we need to be agile to respond to any future threats.

Q89 Lord Broers: With respect to vehicles and IEDs, have we been slower than the Americans?

Professor Welland: Slower in what respect?

Q90 Lord Broers: In ensuring that the vehicles that we send our troops out in are as safe as they possibly could be against IEDs.

Professor Welland: Are you asking me the question in respect of the R&D spend or a more general question?

Q91 Lord Broers: I do not mind; you can answer them both if you like.

Professor Welland: If it is to do with equipment, that is not my responsibility. Let me talk briefly about IEDs. IEDs, as you know, are a major problem for our forces at the moment in Afghanistan, a major cause of death, and we have a very extensive programme in responding to that threat, which is looking at every single possibility that you can imagine, not simply in finding the IEDs but also in following right back up through the network where different materials come from, how they arrive in the country, what sort of communication networks are required. There is a lot there; we do an enormous amount and very rapidly. If we compare ourselves to the US we have nowhere near the funding of the US, but we are certainly competitive with the US in what we do. It is a constant battle because no sooner do we identify one solution than the threat will change. It comes back to the point I made earlier about agility; it is not a matter of producing one solution and then resting.

Q92 Lord May of Oxford: All this discussion about MoD is focussed on the physical and biological sciences; do you think the balance is right and that enough priority is given to the social sciences in relation to many aspects of conflict, not least thinking about the culture in which you are embedded? Had there been more expertise and attention on the social sciences in MoD maybe we would not have had the catastrophic sequel in Iraq that followed from disbanding all civil structures. Do you think you have got that priority right?

Professor Welland: That side of the business is a small side of the business. There is no point in pretending otherwise. It is important. It is represented on the R&D Board, but I am afraid the preponderance is otherwise. It is important. It is represented on the R&D Board, but I am afraid the preponderance is physical and biological, as you have already mentioned, and social science is something that we do but the weakness we have is that the social does not match up with the technical. So we provide a technical solution, look at the downstream consequences and we might be more focussed on the technical consequences and not on the consequences on the social network.

Q93 Lord May of Oxford: You have described again what I said is the state. Do you think that is the right assignment of priority?

Mr Stein: The government has a comprehensive approach to this issue, Lord May, where the Foreign and Commonwealth Office, the Department for International Development and the MoD work
Baroness Neuberger: I think that leads nicely into this whole question about how you coordinate with other departments, because if you are saying that attention is largely given to the physical sciences and you coordinate with other departments, is there, if you like, a push from other departments perhaps for more the social sciences, not only civil society stuff but perhaps also psychology, which is absolutely key? Is that something that happens?

Mr Stein: It is hard for us to speak for those Government departments not represented here. From a Ministry of Defence perspective the answer we gave Lord May was that we do not do very much in the social science area.

Baroness Neuberger: How do you coordinate with those other departments?

Professor Welland: I sit on a CSA cross-government department group which meets regularly and issues such as that would naturally come up at that group. Where there are cross-departmental pressures and where there are cross-departmental interests that could be raised at that group and I would feed that directly back into the MoD. We have all the connectivity into the government departments but have I in my 18 months in post had any sense that this was at the top of the agenda, then no.

Baroness Neuberger: That is very helpful. Can I just pursue this with both departments? To what extent is your research and unit R&D spending actually coordinated both within the department and who does it, and then with other departments. I think that is a key question for both of you.

Professor Watson: What we learned looking backwards is that we should have had far more research on biofuels before deciding what the biofuel policy was in my opinion. I think there should have been more balance into understanding the impact of climate change, not just with climate change but with other pressures so we had an understanding of the implications for socio-economic sectors and on biodiversity, and clearly, as I have already said, we should have had more emphasis, in my opinion, across the board on social sciences. This is an issue right across government and in universities. All the big issues are now inter-disciplinary. Universities are stove piped still to a large extent; our research councils are stove piped, so we have to break through the stove pipes. What we are now doing with this evidence and investment strategy is to get more coordination within Defra. Those working on climate change cannot do their job without looking at food security, they cannot do their job without looking at eco-systems and then there are quality issues. So we have come up with a mechanism which is nice and light touch but much more coordination. We have several mechanisms across the board of environmental issues. We have Living With Environmental Change, which now has 20 government departments and research councils all working on six big policy areas, and it is actually starting to work really well. It is meant to be about a £1 billion programme over ten years; we have already got a significant improvement in the way we are working with NERC or ESRC. The direction of travel is good but there is still a way to go. John Beddington, I believe, has done a good job of following up and getting the CSAs together, as Mark just said. We meet every six weeks; and we meet with heads of the research councils every three months. We have had four meetings in the last year where we have asked, “What are the big issues? How do we work together on Living With Environmental Change, on issues such as counter-terrorism, on issues such as human health, on how is science and technology helping in the green economy?” We have written papers on how will the various departments and the various research councils work together on these issues. Direction of travel is good but there is still progress to be made. If I compare it to the US where I worked for 34 years I would actually say the UK is doing a much better job than most, than any other country I know, or at least recognising the need both in a research effort, evidence and policy formulation; they have to be interconnected. I am not an expert on this, but are we as well connected with the European Union framework conventions or could we leverage it better and I think I do have a question mark by that.

Baroness Neuberger: That sounds very impressive and very hopeful. Do you think it is yet affecting the way decisions are made within individual departments? You can only really answer to your own.

Professor Watson: The answer is absolutely yes, there is no question whatsoever.

Baroness Neuberger: I have one other question which I think is important. The Chief Scientific Adviser, John Beddington, said that problems arise in what he calls orphan issues that fall through the cracks in the system. This coordination ought to prevent that; does it?
Professor Watson: Yes and no. I can give you examples on many issues. We have a sub-committee on climate change; I think we are quite well glued together. We have one on food security not only within government but with the private sector and that is really starting to bear fruit. How do we fund big space projects? I would say we are totally dysfunctional in the UK at the moment on funding big space projects. After they have gone through the research phase which NERC funds and they become more operational, where do they sit and how are they funded if we need a big infrastructure, a new super computer, let us say, for climate change? So there are some issues that we have good ways of discussing, we obviously have Paul Drayson heading it at cabinet level but I think there is still some work to be done.

Professor Welland: I would agree with that. All the structures are there and identifying cross-departmental strands I think is going to be very important in the future because as departmental budgets are individually cut we need to make sure that the consequences across government are properly accounted for, so I think this sort of mechanism will ensure that we can watch that.

Q99 Chairman: Could either of you identify examples where you have gone asking for help from another scientific officer in another department?

Professor Watson: Absolutely. Our Science Advisory Council was concerned that we did not handle the issue of risk adequately within the department and so we recognised this as a weakness and we reached out to NERC, EPSRC and ESRC and we have now got a joint programme on risk; there is a risk unit at Cranfield University; half the time they sit within Defra and half the time sit at Cranfield University. We reached out and put a programme together. It is small but there are several examples like that.

Mr Stein: I will give a narrow example from us. We were looking for a breakthrough in vehicle technology that did not seem to be coming about from defence industry and approached the Technology Strategy Board and had a good link up with them tapping into research that they had been funding in future vehicle technology and future hybrid drive systems. There is a good linkage that has been made there, just to give you one example.

Q100 Lord Warner: One of the areas which is often rather vulnerable to what I would call raiding parties within departments is the R&D budget. Could you tell us a little bit about the extent to which your budgets are ring fenced and what difference ring fencing might make to the ease of your life and ability to do your job?

Dr Parker: Our budgets are not ring fenced; that is the first thing to say. The reason for that is that the budgets are linked to the policy goals that we have. The scale of the activity we need is linked to what it is we have to deliver. That means that from year to year the budgets will vary, the targets of those budgets will also vary. Where we stand back and look at it in the round is at the level of the Chief Scientific Adviser and my team, where we look at what that activity means in the aggregate and we look at what impact that has in terms of our long term capabilities in the science community to provide for our longer term needs. We try to modulate the planned local activity in each of the programmes to ensure that that bit is covered. Ring fencing as such I do not think would help us. In the past in what used to be MAFF there was a ringfenced R&D budget; all that did was to make it a large and highly visible target rather than protect the research. We think what protects research or monitoring or any of the other evidence gathering activities is the fact they are needed to deliver a particular goal.

Q101 Lord Warner: Let us just pursue this a bit. You must presumably start off at the beginning of each financial year with some semblance of something called a budget, whatever it is and however it is formed. If I asked you to look back over the last five years would you in fact have spent all that you were given from the first of April by 31 March of the following year or would someone have dipped their hands into your pockets somewhere along the way?

Dr Parker: I see what you are getting at. The budget and the outturn are rarely identical. It is not necessarily that people are dipping into pockets. Indeed I can think of cases where budgets are actually increased in-year. We do not always commit everything for a number of reasons, some of that has to do with slow processes and some of that has to do with changes of direction. Raiding in the sense that you are thinking of as treating the evidence budget as a target for raiding, no. We have been very pleased over the last couple of years, where budgets have been really under very tight pressure, to see that actually the expenditure has increased, because specific needs were identified and money has been found from somewhere—raided if you like from elsewhere—to actually put to the evidence budget. It is driven by need; it is not driven by a sense that this is simply a soft target.

Professor Watson: You are absolutely right, it is one of the easiest budgets to raid, there is no question whatsoever. What I think has been important in the two years since I have been there, working with not only the Director Generals and the Permanent Secretary as well as with Ministers, is to show how they cannot have informed policy formulation
without the evidence. It has been an education thing. I think you are absolutely right, quite often if you have to deliver something it is easier to hit the R&D budget short term than some of the other budgets because you do not see the implications of the cut for a number of years. I have spent much of my time—as well as Miles and the team—working with the policy makers to show the importance and we often use examples where policy may have got ahead of evidence such as the way we looked at biofuels and we do not want to get into that situation again.

Professor Welland: I think the general context is the same. We need to set our own planning and budgeting in respect of supporting the overall objectives of the MoD. We do not get raided within year, so the budget is set and that is our budget, but as Bob has said it is an easy target when there are financial problems and what is really important is that we can constantly and persistently demonstrate the importance of R&D across defence right through to strategy and policy.

Q102 Lord Warner: If I looked back at five years’ budgets of R&D in the MoD would the latest year in real terms be the equivalent or more than five years back?

Professor Welland: It is less.

Q103 Lord Warner: So you are actually doing more with less.

Professor Welland: We have to trim our programmes. As I am sure you are aware, we have taken a budgetary cut this year and a further cut next year.

Q104 Lord Warner: Would ring fencing have helped prevent that?

Professor Welland: It would have stopped it in the sense that if it was ring fenced at 2007 and 2008 level in either real or flat terms, then that would have helped us, but the Department is under enormous pressure as you are acutely aware and there is no sense from where I sit that the R&D programme should escape that pressure. We need to justify what we spend, how we spend it and do that in the most efficient way we possibly can. If the budget is cut then it is important for the Department to understand before it makes that decision what the consequences of that are in terms of the totality of its programmes and it has to be accepted, but it is not going to be the same programme it was two years ago if you have taken a substantial cut.

Chairman: Our time I am afraid has gone and we have another group of witnesses waiting whom we ought not to keep waiting for too long. It has been very helpful. We have not managed to cover all of the areas that we would have wished to cover and if there are comments that you would like to add in written form that would be very useful indeed. I thank you both for your written evidence and once again for coming and being the target of some quite difficult questions which I am sure you handled with your customary skill. Thank you very much indeed.

Supplementary memorandum by the Ministry of Defence (MoD)

Q8. What is the role of the departmental Chief Scientific Adviser? To what extent are the resources available to those who provide the department with independent expert scientific advice sufficient to enable them to be effective? What influence do such advisers have over your department’s research and development strategy and budget?

MOD’s CSA (appointment at Permanent under Secretary (PUS) level) provides strategic advice to Defence on science and technology in support of military operations and future capabilities. He reports to the PUS. He is a member of the Defence Council and the Defence Board, and attends the Defence Ministerial Committee by invitation.

He chairs the Investment Approvals Board (IAB) and the Research and Development (R&D) Board and is the UK Principal for the 1958 UK-US Mutual Defence Agreement. Participation in the highest management and policy committees in the MOD and Chairmanship of the IAB provides excellent oversight of MOD’s business.

Through the R&D Board, CSA has oversight and is able to set the direction of MOD’s R&D investment.
Q9. How were:
   (i) the Defence Strategic Guidance
   (ii) the Defence Technology Strategy
   (iii) the Defence Technology Plan
   (iv) Capability Visions

identified and developed? Who was involved in those processes? What effect have they had? To what extent might the
processes and practices used provide a model for other departments?

(i) Defence Strategic Guidance (DSG) remains the Defence Board’s principal strategic guidance to the
Department, providing the policy baseline against which key defence planning decisions are made. CSA’s
staffs have been engaged in developing sections relating to R&D within DSG. We plan however to replace
DSG with a more directive document—Defence Strategic Direction (DSD)—following the forthcoming
Defence Review. This forms part of the new Strategy for Defence framework established in October 2009,
which included an unclassified statement of the Department’s Strategy for the forthcoming period (available
on the MOD’s website), and detailed, classified planning direction for staff. For the time being, however—and
until the Defence Review has been completed—Defence Strategic Guidance 2008 remains the policy baseline,
except where modified by the first iteration of the Strategy for Defence.

(ii & iii) The Defence Technology Strategy (DTS) was produced three years ago primarily in association with
the National Defence Industrial Council’s R&D Group (NDIC RDG) as a follow on from the Defence
Industrial Strategy. The DTS was the first clear statement of MOD’s R&D intent, brought clarity to the
MOD’s R&D priorities and provided a strategic view of the UK’s defence R&D requirements for up to the
next 10 years. It gave industry a better understanding of where the MOD will invest its limited research budget
and thereby encourage industry to increase its investment in areas that are of importance to us.

— The DTS was well received by industry and pursued through the development of the Defence
Technology Plan (DTP), a dynamic document setting out specific and resourced priorities for R&D
over the next four years.

— The R&D Board approve and set the priorities for the DTP and its updates. The first DTP was
launched in February 2009 and an update is expected soon.

(iv) Capability Visions again were developed by DG S&T and CSA’s staffs to identify innovative options to
address long-term Defence challenges and to achieve a step change in military capability. Capability Visions
are part of the DTP and approved by the R&D Board. Three Capability Visions that have been chosen are
Future Protected Vehicle, Reduced Operational Dependency on Fossil Fuels and Reducing the Burden on the
Dismounted Soldier. Two further Capability Visions have been identified, but they are significantly classified,
so their detailed description on the openly published DTP will be limited.

Q10. What criteria have been used over the past year to review and revise the Ministry of Defence’s research and
development budget, which has recently been subject to significant cuts?

The Department regularly re-examines the budgetary allocations made to different activities and adjusts them
to reflect the need to ensure funds are spent on those activities which are of the highest priority. The SIT budget
was adjusted as part of this process, with the Department making a judgement that a re-allocation of this sort
provided the best outcome for the defence programme as a whole.

While the Department must balance resources to best effect across Defence it continues to recognise the
importance of long-term R&D and its impact on current capability. This is clearly demonstrated in S&T
support to current operations. While the MOD must continue to prioritise its activities and the resources to
undertake them there are currently no plans to further cut defence research spending at this time.

There have been major changes to the global availability of high quality science and technology. MOD is
adapting to this broader availability and has developed an approach to better access and exploit sources of
innovation, increasingly from small businesses and academia. This is facilitating the adjustments the
Department has made to the research programme as it seeks to balance resources to best effect across defence.
HoL S&T Committee Oral Evidence Session with MoD CSA and DG S&T Supplementary Question

Q79. [Lord May] In the early 1990s UK differentially cut long-term R&D, other countries did not. Does the UK believe it was/is right or is long-term R&D important?

While the Department must balance resources to best effect across Defence it continues to recognise the importance of long-term R&D and its impact on current capability.

For example the UK has a leading position in armour, exemplified in the CHOBHAM armour pack for Challenger 1 & 2 and the Front Toe Armour Pack protecting against Rocket Propelled Grenades (RPGs). This capability allowed crucial collaboration and sharing of vital information with US allies. Expertise developed over the last 30 years in Dstl covering armour and Improvised Explosive Devices (IED) protection has allowed solutions for mine blast defeat and mitigation. Such an understanding comes from our long-term investment in R&D, not merely procurement of the armour itself.

The full paper is being withheld for classification reasons.

26 February 2010

REQUEST FOR SUPPLEMENTARY EVIDENCE FROM THE MINISTRY OF DEFENCE

R&D Spend

1. Please can you provide the Committee with a breakdown of the department’s spend on research over the past five years, including: (i) total research spend, (ii) percentage of total departmental spend, (iii) percentage allocated to PSREs.

(i)

<table>
<thead>
<tr>
<th>Year</th>
<th>£ million</th>
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<tbody>
<tr>
<td>2003–04</td>
<td>548</td>
</tr>
<tr>
<td>2004–05</td>
<td>639</td>
</tr>
<tr>
<td>2005–06</td>
<td>598</td>
</tr>
<tr>
<td>2006–07</td>
<td>632</td>
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<tr>
<td>2007–08</td>
<td>635</td>
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(ii)

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage of total Defence Expenditure</th>
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<tr>
<td>2003–04</td>
<td>1.8</td>
</tr>
<tr>
<td>2004–05</td>
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</tr>
<tr>
<td>2005–06</td>
<td>1.8</td>
</tr>
<tr>
<td>2006–07</td>
<td>1.9</td>
</tr>
<tr>
<td>2007–08</td>
<td>1.7</td>
</tr>
</tbody>
</table>

4 The figures provided are the latest that are available. MoD reports financial figures after collation and authentication by the Defence Analytical Services Agency (DASA). As the total investment in research comes from a variety of internal budgets, accurate estimates of future spend are not available. Figures for the current financial year, 2008–09, are subject to a data quality review and should be issued this summer.
(iii) MOD does not allocate research funding to any organisation but rather places contracts (or tasking) for specific services or goods. The majority of research investment is placed with industry and academia. However, certain activities are only appropriate to be undertaken by government and as such, the Defence Science and Technology Laboratory (Dstl), a MOD Trading Fund Agency, receives tasking to deliver a variety of essential science and technology tasks. The investment by year as reported by Dstl is:

<table>
<thead>
<tr>
<th>Year</th>
<th>£ million</th>
<th>Estimated percentage of total Research Expenditure</th>
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</thead>
<tbody>
<tr>
<td>2003–04</td>
<td>162.8</td>
<td>29.7</td>
</tr>
<tr>
<td>2004–05</td>
<td>165.3</td>
<td>25.9</td>
</tr>
<tr>
<td>2005–06</td>
<td>159.6</td>
<td>26.7</td>
</tr>
<tr>
<td>2006–07</td>
<td>161.3</td>
<td>25.5</td>
</tr>
<tr>
<td>2007–08</td>
<td>181.7</td>
<td>28.6</td>
</tr>
</tbody>
</table>

(iv) percentage allocated to collaborative programmes with research councils; and

MOD does not allocate research funding but places contracts for specific goods and services. Certain specific projects receive MOD contracts and Research Councils funding where there is mutual interest in the output. Figures are not collated centrally.

(iv) figures for each research or policy area.

MOD does not hold centrally information in this format. The specific areas of research under investigation at any time is very broad in scope and changes dynamically depending on the priorities of Defence. The Defence Technology Plan provides an open indication of these changing requirements and the likely investment to be made. This is a web-based publication available at www.science.mod.uk.

PRIORITISATION PROCESSES

2. What is the role of your departmental Chief Scientific Adviser in the process of setting research priorities? What grade is he?

MOD’s CSA (appointment at Permanent under Secretary (PUS) level) provides strategic advice to Defence on science and technology in support of military operations and future capabilities. He reports to the PUS.

He is a member of the Defence Council and the Defence Board, and attends the Defence Ministerial Committee by invitation. He chairs the Investment Approvals Board (IAB) and the Research and Development (R&D) Board and is the UK Principal for the 1958 UK-US Mutual Defence Agreement.

Participation in the highest management and policy committees in the MOD and Chairmanship of the IAB provides excellent oversight of MOD’s business.

Through the R&D Board, CSA is able to set the direction of MOD’s R&D investment.

3. Who is present at meetings at which departmental budgets are discussed? In particular, who represents the research and development element of the department’s budget at such meetings?

The Defence Board, of which CSA is a member (and thus represents the R&D element), meets on a monthly basis. As the senior non-Ministerial decision-taking body in MOD, its principal function is to make the high level decisions necessary to ensure that Defence delivers its final outputs. It also provides strategic direction and manages performance. It is the Defence Board which sets the budget, which is then advised to Secretary of State.

In attendance at these meetings are the Permanent Secretary (PUS), the Chief of the Defence Staff (CDS), the 2nd Permanent Secretary (2nd PUS), the Vice Chief of the Defence Staff (VCDS), the three single Service Chiefs of Staff, the Chief of Defence Materiel, the Chief Scientific Adviser, the Director General Finance and the Non-Executive Directors.
4. To what extent does MOD follow the best practice outlined in the Government Office for Science’s report on Science and Engineering in Government for the use of science in Government? What interaction do you have with other departments on best practice for setting R&D priorities and encouraging innovation?

MOD always seeks to use best practice in the allocation of funding and with regard to research has in place processes which align well with the recent Government Office for Science guidance. Specifically, MOD has:

- A CSA in a senior decision-making and advisory position;
- An R&D Board to set R&D priorities and subsequently monitors performance against these priorities;
- A Defence Science Advisory Council (DSAC) which specifically audits the quality of defence science and undertakes rolling reviews on behalf of the Secretary of State for Defence;
- Engagement with others via the Technology Strategy Board and seeking unsolicited R&D proposals via the Centre for Defence Enterprise;
- A broad range of formalised Government to Government International Research Collaboration across a wide range of Defence Research and Technologies;
- Responds to the innovation challenge through its Innovation Strategy, the Defence Technology Plan, Centre for Defence Enterprise and Capability Visions. Together, these encourage input from a wide range of organisations and individuals with the common goal of meeting MOD’s S&T capability requirements;
- Run the “Grand Challenge”—competition to encourage innovation and competition between SMEs, academia and larger Defence-sector organisations.

The Centre for Defence Enterprise (CDE) is at the forefront of the Government’s Small Business Research Initiative (SBRI). The CDE is seen as a shining example of what can be achieved to encourage innovation.

MOD was the first Department to publish its Innovation Procurement Plan (a requirement of all Government Departments following the 2008 “Innovation Nation” White Paper), and thus has led the way for in terms of addressing the need to intelligently and efficiently harness innovation.

5. Do your department’s Public Service Agreements require you to demonstrate that your policies are sufficiently evidence-based, and that you have robust mechanisms in place to commission research to underpin these policies?

MOD activities are assessed annually against a set of Strategic Objectives, some of which also contribute to Home Office and Foreign Office-led Public Service Agreements. Our research strategy is aimed at meeting our Strategic Objectives and thus the majority of research spending goes toward developing equipment for the future.

MOD research is a fundamental part of its remit, and in the normal course of business, it also contributes to the delivery of a number of other crosscutting PSAs including PSA 4 (Promote world class science and innovation in the UK).

The MOD considers science and technology as essential for the success of the Defence mission now and in the future. This is recognised within MOD by ensuring that CSA is involved in all major procurement and policy decisions by attending the Defence Council, Defence Board and chairing the Investment Approvals Board. CSA owns the S&T sub-strategy of the Defence Strategy.

Departmental procedures ensure high levels of professional technical and analytical scrutiny through Defence business, reflected in MOD employing the largest number of scientists and engineers in central Government Departments.

Science and technology contributes to the formulation of strategic policy particularly through provision of high-level analytical services by Dstl and an in-depth understanding of the threats and opportunities presented by S&T for Defence.

6. To what extent, and how, does your Science Advisory Council advise on your research strategy and priorities? Are your R&D priorities externally peer-reviewed?

External review of our plans and performance is undertaken principally by the Defence Science Advisory Council (DSAC). DSAC is a Non-Departmental Public Body (NDPB) that specifically audits the quality of defence science and undertakes rolling reviews on behalf of the Secretary of State for Defence. It is chaired
by Prof Sir Peter Knight from Imperial College and comprises 14 other eminent external industrialists and academics, all holding Security Clearances. The Council includes official members to ensure engagement and alignment with the Department. Current official membership includes:

- Chief Scientific Adviser of MOD
- Director General Science & Technology
- Deputy Chief of the Defence Staff (Capability)
- Director Science & Technology Strategy (the DSAC Executive Officer)
- Chief Executive Dstl
- Chief Operating Officer, Defence Equipment & Support
- Surgeon General
- Chief Executive, Meteorological Office (or his/her Chief Scientist)
- Chief Scientific Adviser to Government/Head of the Government Office of Science

**Review Processes**

7. *What criteria does your department use to assess its research investments; and how is their impact measured?*

MOD uses a “Performance Assessment Framework” (PAF) to provide a common structure and language across the Research Programme for assessing proposals and on-going work and for measuring success on completion. The PAF aims to provide a continuous improvement environment to optimise pull-through of innovative and relevant research to produce battle-winning technology for the Armed Forces.

The assessment framework records scores against four key qualitative metrics:

- Operational relevance—meeting requirements, as identified by the DTP.
- Likelihood of exploitation.
- Builds critical technical capability to meet future UK needs.
- Scientific quality and/or innovation.

8. *Please can you provide the Committee with a copy of the paper you sent to the Defence board in January 2009 on the impact of research on policy, referred to in the response to Q79?*

The full paper is being withheld for classification reasons.

**Supporting Innovation**

9. *To what extent, and how, does your department’s research and development investment support applied research in the industries that the department draws on to support policy? What mechanisms, such as procurement, or the Technology Strategy Board, are and should be involved?*

We spend the bulk of our £2 billion-a-year investment in applied R&D with industry. We work closely with the National Defence Industry Council (NDIC) and in particular the NDIC R&D sub-group.

Following the split of DERA into Dstl and QinetiQ in 2001, the Department’s research programme has been progressively opened to competition. Only research activity which by its sensitive, operationally critical or international nature, is performed within government and is not put out to tender with industry or academia.

MOD was the first Department to publish its Innovation Procurement Plan, which draws on the Defence Industrial Strategy, the Defence Technology Strategy and the Department’s Innovation Strategy. Innovation is pursued through initiatives such as the Grand Challenge and the Centre for Defence Enterprise, which works closely with the Technology Strategy Board and is at the forefront of the Government’s Small Business Research Initiative (SBRI).

10. *How does the MOD signpost its research needs to alert academia and industry to new funding opportunities and encourage competition between proposers?*

MOD has recognised that there is broader availability of high quality science and technology worldwide. Therefore, MOD has had to adapt to this and has developed an approach to better access and exploit sources of innovation, increasingly from small businesses and academia, as well as from our more traditional defence partners.
The Defence Technology Plan (DTP) provides clear direction to the R&D community on investment in defence technology and seeks fresh, innovative thinking. We are encouraging more joint work and investment between industry, academia and small and medium sized enterprises.

The MOD has for the first time openly advertised its detailed technology needs as an easily accessible online publication to engage the whole of the UK science and technology supplier base, in the form of the DTP at: www.science.mod.uk. This is a change from MOD’s old method of obtaining defence contracts as it allows the whole of the potential supplier base to see what MOD needs and thus allows them to plan and align their own work.

In May 2008, MOD launched the Centre for Defence Enterprise (CDE) to overcome traditional barriers to innovation within the defence environment and for the rapid delivery of cutting edge research and development in support of the front line. By encouraging anyone with a good idea to step forward, the CDE provides a unique and innovative entry point into the defence market. The CDE portal provides a “competition of ideas” approach to solving MOD’s capability problems innovatively.

Since its inception in 2008, the CDE has attracted over 1000 proposals, 90 per cent of which have been assessed within 15 working days and over 150 of which have received funding. 60 per cent of CDE-funded proposals have been placed with SMEs, many of which are new to defence. The CDE portal provides a “competition of ideas” approach to solving MOD’s capability problems innovatively.

The CDE represents a portal tailored to engage with SMEs and academia. MOD works closely through the SIT TLB with the Technology Strategy Board to ensure that future knowledge technology networks align with defence technology call and MOD’s strategic priorities.

MOD holds an industry showcase annually on its Research and Technology programme. This will be held in Birmingham on 23 and 24 March 2010.

11. What effect has the MOD’s defence technology strategy had on the research you commission and on industry research?

Research commissioned by MOD complies with the Defence Technology Strategy (DTS) and is assessed using the Performance Assessment Framework to ensure alignment with MOD’s strategic priorities.

The Defence Technology Plan published in 2009, refines the DTS setting out specific funds for research. Industry has contributed private venture (PV) funding to elements of the DTP (specifically Capability Visions).

### Supplementary memorandum by the Department for Environment, Food and Rural Affairs (Defra)

#### Successes from Defra’s Investment in Evidence

1. This memorandum provides further information on four examples of successes from Defra’s (and its predecessor MAFF’s) evidence programme over the last 10 years: climate change and theoretical modelling at the Met Office Hadley Centre; work on fish stocks research; diffuse environmental pollution; and stratospheric ozone depletion. These examples were raised at the House of Lords Select Committee evidence session on funding priorities by Defra’s Chief Scientific Adviser, Professor Bob Watson, and Deputy Chief Scientific Adviser, Dr Miles Parker, on 5 November 2009.

2. Two further examples of success from Defra’s evidence portfolio are also included: Kew Gardens and biodiversity; and the wide ranging work that Defra funds on animal disease epidemiology.

#### Climate Change and Theoretical Modelling at the Hadley Centre

3. Since the formulation of DECC, Defra’s annual spend on the work at the Met Office’s Hadley Centre (MOHC) has stood at around £4.3 million of £18 million cross-government funding.

4. The MOHC delivers a world-leading climate research and modelling programme which supports policy requirements for both the mitigation and adaptation agendas. The MOHC’s ability to maintain and develop a world class model, and the skill base required to do this has contributed significantly to the UK’s international influence, notably in IPCC and consequently at UNFCCC. The Centre’s strong focus on policy relevant work has also enabled it to deliver products in support of the government’s core strategic needs in the UK, for example, the probabilistic regional scale (25km x 25 km) climate change projections published in August 2009. The projections are fundamental to the evidence underlying the First UK Climate Change Risk Assessment that will be laid before Parliament in 2012 and the consequent National Adaptation Plan, as required under the Climate Change Act 2008.
DIFFUSE ENVIRONMENTAL POLLUTION

5. Two specific examples of the wide ranging nature of Defra’s research which contribute to reducing the impact of environmental pollution caused by UK agricultural methods (including pesticide use) and supporting the sustainability of farming are:

(i) Integrated Control of Wheat Blossom Midge: The larvae of the orange wheat blossom midge attack ripening grain and, as well as affecting yield, reduce the quality of wheat grown for bread and biscuit making. Severe attacks have been more prevalent in recent years, where weather conditions in early June have favoured the activity of the adult midges. Effective control has only been possible through the use of persistent organophosphorus insecticides and, because of the difficulty of predicting or monitoring risks to individual crops, these have been used as a routine measure (on more than 250,000 ha per annum).

Research, carried out in partnership with industry in the Sustainable Arable LINK programme, identified crop resistance and tolerance in wheat to enable variety selection for food quality market requirements, reducing the problem of this difficult economic pest; developed lures and trapping methods for pest monitoring; and used these in combination to develop an integrated pest management approach to reduce pesticide use. This is now helping to meet retailer and consumer needs and Defra’s aims of reducing pesticide use and maintaining biodiversity. Defra provided £250k over 3.5 years. Industry has estimated a saving of £60 million per annum from prevention of losses in yield and quality.

(ii) Water use efficiency in horticulture: Defra funded research at East Malling Research and Lancaster University has developed genetic improvement programmes for improved drought tolerance and the development of irrigation management techniques that improve the efficiency of water use in crops (strawberry, raspberry, runner bean, potato, tomato, lettuce and poinsettia). These techniques, which include Partial Rootzone Drying, Deficit Irrigation and Regulated Deficit Irrigation, involve applying slightly less water than the plant needs so that mild soil water deficits develop. Research at East Malling Research is developing irrigation strategies that produce strawberries with more consistent flavour and quality and an improved shelf-life.

6. Defra also funds research to help minimise the adverse impacts of UK agriculture on water quality. These broad research areas are:

(i) Understanding pressures, processes and ecological impacts: studies to identify sources of pollution including the risks posed by land spreading organic materials; mapping livestock manure production on a national scale; determining the contribution of overland flow on grasslands; understanding the pathways by which pathogens get into water; developing an understanding of the ecological impacts of sediment pollution; and developing a risk assessment framework for predicting diffuse pollutant losses.

(ii) Testing mitigation measures for diffuse pollution: mitigation opportunities including the costs of mitigating multiple interacting pollutants and assessing pollution swapping; better evaluation of the N and P content of manures; manure management on clay soils; field testing of diffuse pollution mitigation measures; optimising measures for reducing faecal indicator organism pressures at a catchment scale, and plant breeding for improved nutrient use efficiency.

(iii) Understanding how climate change is likely to affect water quality.

7. Knowledge exchange is key to our research programmes. Defra’s diffuse pollution research has informed policy development (eg on Cross Compliance and the implementation of the Water Framework Directive), regulatory and advisory activities by delivery bodies such as the Environment Agency and Natural England (eg the England Catchment Sensitive Farming Delivery Initiative), and best practice for implementation by farmers (eg sustainable farming systems). Defra’s spend on research contributing to policy on diffuse water pollution was £4.6 million in 08/09 (this also encompasses the impact of agriculture on water and air quality, and greenhouse gas emissions).

STRATOSPHERIC OZONE DEPLETION

8. Defra’s annual spend on stratospheric ozone and UV baseline monitoring is over £300,000. This project monitors column ozone concentrations at two sites and UV levels at one site in the UK. The longest running dataset is at Lerwick, where measurements have been taken regularly since 1957. Analysis of annual means shows that since the early 1970s ozone has been decreasing by roughly three percent per decade. There is as yet no evidence of ozone recovery.
9. There is undisputed scientific evidence that chlorine and bromine in man-made chemicals are primarily responsible for observed ozone depletion. The monitoring work allows us to see whether the action we are taking to reduce the levels of ozone-depleting substances in the atmosphere is effective. Observations and model calculations suggest that the average global rate of ozone depletion has now stabilised. If there is full compliance with the Montreal Protocol, the ozone layer is expected to begin to recover in coming decades due to declining concentrations of ozone—depleting substances.

10. Defra has also previously been involved in international research programmes which looked to understand stratospheric ozone depletion and the key components of this effect. This was done through providing funding to the European Ozone Research Co-ordinating Unit (EORCU), based at the University of Cambridge. In the last 10 years, this funding contributed to running EORCU theoretical modelling and to the Third European Stratospheric Experiment on Ozone (THESEO).

11. THESEO, the third European measurement campaign, operated from December 1997 to December 2000. Defra funding aided effective preparation of scientific proposals, in particular facilitating communication between scientific partners and EU Member States. Defra also supported balloon measurements as part of this campaign, which contributed to a far more detailed understanding of the state of the ozone layer.

12. The international research consortium co-ordinated by EORCU (and part-funded by Defra) has contributed greatly to understanding the issue of stratospheric ozone depletion. This has been a key component in the success of the Montreal Protocol, described by Kofi Annan as “the single most successful international agreement to date”.

FISH STOCKS

13. Sustainable management of our fish stocks requires monitoring, assessment and modelling of future stock status under different management options. Consequently such assessment and modelling has been a core area of fisheries research and scientists from Defra’s Centre for Environmental, Fisheries and Aquaculture (Cefas) were the first to advance the theory of yield-per-recruit and recruitment overfishing. More recently their work has advanced both international assessment and management modelling. Defra’s policy work on fish stocks is based on two streams of evidence: marine fisheries research and applied or operational science.

Defra, with its Cefas laboratory agency, has a long history of leading the development of the field of fish population dynamics. Currently, two research programmes, with an annual spend of approximately £2.3 million, cover:

(i) Effects of the Environment on fish stocks: helps us understand how environmental variability and climate change affect fisheries productivity at relevant spatial and temporal scales. This research helps us understand how biological processes and the environment help determine stock size which, in turn, enables us to interpret the results emerging from our routine fish stock assessment surveys and, ultimately, in the setting of annual Total Allowable Catches. More strategically, this research is helping us predict the impact that climate change will have on commercial stocks such as cod, and will help alert the fishing industry to likely future changes in stock composition.

(ii) Integrated Fisheries Management: provides the tools, especially computer-based models, for better fisheries management including improved understanding of the status of fish stocks, and biological and fisheries interactions. This research helps support strategic and tactical fisheries management decisions including the development of management plans. Computer models help us answer specific “what if” questions such as how increased mesh sizes will reduce discarding of under-sized fish and what role Marine Protected Areas might play in stock recovery plans.

14. A third area of research, with an annual spend of £1.1 million, focuses on the impact that fishing has on the seabed and helps us in adopting an ecosystem-based approach to fisheries management. Fisheries models need to take account of key biological features including growth, feeding and reproduction. The movement of fish in space and time is a particular priority and for this reason Defra has supported an extensive programme of research into fish migration. Key to our success in this area has been the development of tagging technology. Traditional tags provide relatively little detail apart from distance moved from point of release, and possibly growth rate. The tags that have been developed by Cefas, through Defra’s support, are highly sophisticated, enabling researchers to track daily movement over periods of up to two years. Results from this programme have provided evidence that underpins the assumptions used in fisheries models, or as direct advice on specific issues to Defra, the EU or ICES.

15. Cefas is considered a world leader in this area of work and results from these programmes have shown that commercial fish stocks are structured in a much more complex way than previously thought with implications for regional and closed area management. They have also shown how species such as cod respond to sea temperatures and how they might be affected by climate change. Cefas also uses the tags to study the behaviour of highly migratory and threatened species such as basking and porbeagle sharks. Cefas wins significant support from the EU to lead collaborative research programmes using and integrating electronic tagging technology to assist fisheries management. Cefas, with the encouragement of Defra, has developed a commercial arm that sells its tagging technology to worldwide customers and continues to develop innovative tag technologies without the need for further support from Defra.

16. More recently, the modelling work, developed through work in the 1980s and 1990s by John Shepherd (Extended Survivors Analysis or XSA); and John Pope (technique of combining North Sea fish stocks and predation rates of fish on each other), has combined assessment and management systems analysis to provide a framework for the development and testing of fishery management plans. For example, the haddock management plan and the cod recovery plan. The work has been strongly supported by DG MARE in Europe, and has also been used extensively world-wide.

17. In addition, Defra annual spends £7.4 million on marine fisheries operational science (not including research vessel fixed costs). The aim of this programme is to monitor the health and population of fish stocks. It includes stock assessment surveys, biological sampling, discard monitoring, management advice, and our collaborative programme with the industry, the Fisheries Science Partnership.

18. Defra also has a small research programme on salmon and freshwater fisheries. Research includes assessing human impact on stocks, such as from pesticides, factors affecting the distribution of salmonid populations and predicting the risks and impacts of non-native species. Defra’s annual spend is approximately £1 million.

Kew Gardens and Conservation

19. Kew plays a lead role in many major collaborative projects with a focus on conservation and sustainable use of plants with a view to enhanced quality of life. All of the projects depend on the evidence base embodied in Kew’s unrivalled collections and on the expertise of the scientists who maintain and enhance these collections with support from Defra. Most of the projects have additional support from one or more other funding sources, including other governments, corporate, charitable or private sector funders. Thus Defra’s annual investment in Kew in the form of grant-in-aid leverages funding from a diversity of other sources, resulting in an annual spend on “research and conservation directly related to biodiversity” by Kew of £33 million which focuses, complements and enhances even greater investment by governments, research institutes and NGOs worldwide. A few examples of the international value of Kew’s work are the Millennium Seed Bank Project; the Sampled Red List Index Project; and the Global Plants Initiative Project.

Millennium Seed Bank Project

20. Working with more than 120 institutions in 54 countries, Kew’s Millennium Seed Bank has become the largest wild plant seed bank in the world, and to date has stored nearly two billion seed from 28,000 plant species, with the same number stored in their countries of origin. Funding and support in kind has come from the UK government and partner country governments, as well as corporate, charitable, and private sources. The Millennium Seed Bank’s current 10 year international programme has a total budget of £48 million of which a total of £7 million (c. £700,000 per annum) is from Defra’s grant-in-aid to Kew. The main aims of the Millennium Seed Bank are to store seeds from rare, threatened and useful species for future generations, and enable the use of as wide a range of plant diversity as possible, by providing both seeds and knowledge for human innovation, adaptation and resilience. The Millennium Seed Bank has been a world leader in developing seed storage and germination testing procedures, and is increasingly developing its expertise in sustainable and appropriate use of seeds in recovery and restoration of threatened species and ecosystems. By 2020, 25 per cent of the world’s wild plant species will be banked, prioritising the species of greatest utility to man.

Sampled Red List Index Project

21. Kew is playing a key role in the development of the IUCN Sampled Red List Index, a global index of extinction risk for biodiversity. Kew’s exceptional collections of historical plant specimens and literature provide a wealth of primary and secondary data for analysis, and Kew is leading on the plant species component of the project. The evidence-based approach requires Red List conservation assessments to be produced for a representative sample of the world’s species, and Kew has developed a range of GIS techniques and tools to georeference plant specimens and automate preliminary conservation assessments for this
22. The Sampled Red List Index will be critical for guiding policy—and decision-makers involved in conservation. Developed in response to the adoption of the global target “to achieve a significant reduction in the rate of loss of biodiversity by 2010”, Kew’s work on the Sampled Red List Index has not yet found a firm funding basis but relies on a variety of small grants from charitable trusts and foundations and on the work of a dedicated team of volunteers trained and co-ordinated by Defra-funded staff at Kew. Annual costs for this project are c. £290,000 of which c. £70,000 is from Defra grant-in-aid.

Global Plants Initiative Project

23. Kew is lead partner in the Global Plants Initiative, an international partnership of more than 160 herbaria working to create a co-ordinated database of information and images of the plants of the world. With support from the Andrew W. Mellon Foundation, partner organisations capture data and create high resolution digital images of type specimens from their collections. The goal is a self-sustaining resource which an international community of scholars can access to enable predictive biological enquiry across the spectrum of evidence-based research. The Global Plants Initiative builds on the success of the African Plants Initiative (completed) and the Latin American Plants Initiative (ongoing) for which grants to Kew from the Mellon Foundation averaged in excess of US$1 million per annum in 2008-09. Kew’s participation would not have been possible without Defra’s ongoing support for the collections, which can be valued as a c. £625,000 per annum contribution to this project.

Epidemiology and Modelling

24. Epidemiology and modelling use and capability have developed greatly in Great Britain (GB) over the last decade. Epidemiological analysis of routine surveillance data collected by the regional network of VLA laboratories has allowed the identification of a number of new and emerging conditions in recent times including, psoroptic mange in cattle, bleeding calf syndrome and many others. A very recent enhancement includes the analyses of syndromic data, the so called “Diagnoses Not-Reached” (DNRs) that provide the strongest indication of the occurrence of new and emerging conditions by means of analysis of unusual patterns.

25. Among a number of other programmes, Defra has supported and co-funded the Veterinary Training and Research Initiative (VTRI) with the Higher Education Funding Council for England (HEFCE) and the Scottish Higher Education Funding Council (SHEFC) (total VTRI budget 2004/09—£21.5 million). This initiative has developed epidemiology and modelling centres of excellence in four veterinary schools (Cambridge, Edinburgh, Glasgow and Liverpool) and has recently seen one of the groups being awarded a co-funded project to model the effects and public health risks associated with a potential H1N1 pandemic influenza (“Swine influenza”) infection of pigs in Great Britain.

26. Some specific examples demonstrating the outputs generated by Defra’s improved epidemiological evidence base include:

(i) To give an accurate indication of where and how diseases might spread and what the worst case scenario might be, Defra has progressively developed a surveillance information management system called RADAR (Rapid Analysis and Detection of Animal-related Risks) over the last four years. This system collates information from 11 different GB wide data sources to give vital, continually updated, quality assured information on our key animal populations, in support of epidemiological analyses, modelling and other research. It has been actively and extensively used in all eleven of the exotic disease outbreaks experienced since 2005.

(ii) Defra research funding has also supported the development of a Met office model (NAME—Numerical Atmospheric-dispersion Modelling Environment) and its application to predict the spread of disease, including FMD (Foot and mouth disease) and Bluetongue virus (BTV). For BTV, the model was developed to study the potential spread of vectors from the continent into the UK and accurately demonstrated the probable route of incursion of BTV into the UK during 2007. This enabled the targeting of surveillance activities on the ground and in the development of control zones to help to prevent further spread of BTV in GB. It has since been used to advise on the risks of incursion and appropriate targeting of vaccination campaigns against BTV in 2008 and 2009.

(iii) Defra has a new modelling strategy to provide advice and guidance on exotic disease control and exit strategies to Ministers and the Chief Veterinary Officer both during and between outbreaks. The modelling consortium which supports the implementation of this strategy is made up of experts from a number of internationally recognised university and institute groups from both the UK and
overseas, and works closely with epidemiologists in Defra’s National Emergency Epidemiology Group. This consortium has provided advice on a number of occasions, and notably in relation to the avian influenza outbreaks over the last three years.

(iv) A further research output from the Department has been a full-genome sequencing technology that was applied to track the evolution of FMD virus during the last UK outbreak in 2007. This allowed accurate tracing of the virus as it moved between farms and helped direct control measures and contain the diseases. Using such high resolution techniques to analyse the virus and applying the knowledge in this way has been ground-breaking in the field of epidemiology.

January 2010

Further supplementary memorandum from the Department for Environment, Food and Rural Affairs

R&D SPEND

1. Please can you provide the Committee with a breakdown of the department’s spend on research over the past five years, including

   (i) total research spend
   (ii) percentage of total departmental spend
   (iii) percentage allocated to PSREs

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<tbody>
<tr>
<td>Total research spend</td>
<td>£133m</td>
<td>£141m</td>
<td>£139m</td>
<td>£130m</td>
<td>£125m</td>
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<tr>
<td>As a percentage of total departmental spend</td>
<td>4.7%</td>
<td>4.3%</td>
<td>4.2%</td>
<td>4.3%</td>
<td>4.1%</td>
<td>4% [of departmental budget]</td>
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<td>Percentage allocated to PSREs (as percentage of departmental spend)</td>
<td>2.6%</td>
<td>2.2%</td>
<td>2.2%</td>
<td>2.3%</td>
<td>2.2%</td>
<td>UNKNOWN</td>
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<tr>
<td>Percentage allocated to PSREs (as percentage of Total research spend)</td>
<td>55%</td>
<td>51%</td>
<td>53%</td>
<td>53%</td>
<td>54%</td>
<td>UNKNOWN</td>
</tr>
</tbody>
</table>

Data taken from the Science Information System, which is used to maintain R&D spend data on science programmes for Core Defra, Veterinary Medicines Directorate and Chemicals Regulation Directorate. This excludes other executive agencies and NDPB’s. *with the transfer of Climate Change responsibilities to DECC a number of projects were transferred from Defra, hence the drop in total research spend.

The percentages are UNKNOWN at this time (2 March 2010) because the financial year has not finished so departmental spend is not yet known. However, we have included the budget % for this year as an indication.

(iv) percentage allocated to collaborative programmes with research councils;

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<tr>
<td>Percentage allocated to collaborative programmes with research councils</td>
<td>20%</td>
<td>17%</td>
<td>17%</td>
<td>17%</td>
<td>15%</td>
<td>12%</td>
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In 2009 the Institute of Grassland and Environmental Research (IGER) became part of IBERS which brought together staff from the Institutes of Rural Sciences and Biological Sciences at Aberystwyth University. The figures have been kept in to provide consistency. Figures represent spend with research councils as a percentage of overall R&D spend. The Science Information System does not specifically record collaborative programme spend.
(v) figures for each research or policy area

Defra’s evidence budget breakdown for 2009–10 across Defra policy areas (please note that all figures have been rounded to the nearest million)

<table>
<thead>
<tr>
<th>Total R&amp;D</th>
<th>Total other evidence</th>
<th>Total evidence staff</th>
<th>Total capital</th>
<th>TOTAL</th>
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</thead>
<tbody>
<tr>
<td>Animal Health &amp; Welfare</td>
<td>36</td>
<td>45</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Food &amp; Farming Group</td>
<td>29</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Environmental &amp; Rural Group</td>
<td>48</td>
<td>36</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Strategy &amp; Evidence Group</td>
<td>13</td>
<td>4</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>125</td>
<td>88</td>
<td>13</td>
<td>9</td>
</tr>
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Note: The figures presented in this response are for core Defra only. They do not include:

- Research spending in Arms Length Bodies such as Environment Agency, Natural England or Royal Botanical Gardens, Kew;
- Income for our Laboratory Agencies from non-Defra sources;
- Internal staff costs associated with managing the research programmes.

As a result the figures presented here are a sub-set of those attributed to Defra by the Office of National Statistics in the SET Statistics.

PRIORITISATION PROCESSES

2. What is the role of your departmental Chief Scientific Adviser in the process of setting research priorities? What grade is he?

Robert Watson is Defra’s Chief Scientific Adviser (CSA) at Director-General (DG) grade 2.

Defra’s CSA has a strategic role in the process of setting research priorities and last year he chaired an in-depth analysis of Defra’s evidence program. This has resulted in the recently launched (January 2010) Evidence Investment Strategy (EIS). The EIS identified three inter-connected priority areas of evidence needs; sustainable food supply, climate change adaptation and mitigation and protecting ecosystem services. The EIS also identified those issues which have growing evidence needs, decreasing evidence needs, those that should continue at present levels, and those that need reorganisation or further review. The CSA reviews each project proposal, within the normal business cycle, for consistency with the EIS.

The CSA also interacts with the CSAs from other government departments and the Executive Directors of the Research Councils to ensure we are joined-up across government on our research activities.

3. Who is present at meetings at which departmental budgets are discussed? In particular, who represents the research and development element of the department’s budget at such meetings?

At the highest level the Defra Management Board is responsible for the department’s budget. For a breakdown of who is present at the meetings see the link below:

http://www.defra.gov.uk/corporate/about/who/manboard/index.htm

The CSA is present at these meetings and represents the research and development element of the department’s budget.

The Central and Local Approvals Panels are responsible for day-to-day allocation of budgets, based on business cases submitted by the relevant areas. The Central Approval Panel (CAP) is chaired by an independent Director General and Members are at Management Board and Director level as appropriate. It sits monthly and makes decisions on business cases that have been submitted for approval, either in principle for work going ahead or, more likely, a bid for extra funding. All business cases should have been submitted to a Local Approval Panel (LAP) previously. All new business cases going to the CAP are passed through the Evidence Programme and the CSA and deputy CSA have a chance to comment.

The LAPs are normally chaired by the Director General that heads that Group. The members of the LAP are the Senior Responsible Owners (SROs) in that Director General’s Group and one or two “independent” members to provide challenge.
4. To what extent does the department follow the best practice outlined in the Government Office for Science’s report on Science and Engineering in Government for the use of science in Government? What interaction do you have with other departments on best practice for setting R&D priorities and encouraging innovation?

Defra’s approach to evidence in policy making follows the good practice outlined in the Government Office for Science’s report Science and Engineering in Government. For example:

- As reflected in the responses to these supplementary questions, the CSA sits on Defra’s Management Board and, with the DCSA, is linked to the business case and approvals processes;
- Defra has a new science and innovation strategy that links evidence to PSAs through the Departmental Strategic Objectives;
- The Department’s CSA is actively involved in the cross-government mechanisms of the Chief Scientific Advisers’ Committee and the Core Issues Group; and
- Defra recognises specialists through its Career Home structure (e.g., Science and Engineering; Veterinary; Economics, Statistics, and Research) and expects them to be included, in policy development, as appropriate.

Defra is involved in the Environmental Research Funders Forum which provides a focus for funders of public research to discuss best practice. The Department is also engaged with the Technology Strategy Board (TSB) on encouraging innovation (see the response to question 9).

5. Do your department’s Public Service Agreements require you to demonstrate that your policies are sufficiently evidence-based, and that you have robust mechanisms in place to commission research to underpin these policies?

Defra’s Public Service Agreement (PSA) requires sound evidence to support it. In addition one of the Department’s strategic objectives is to be “A respected department delivering efficient and high quality services and outcomes” which includes the need for clear, well managed, and well focused evidence.

The Office of Science and Innovation “Science review” (2006), commended our approach to maintaining and building on strengths in the quality of our science and our use of scientific expertise in our Department and science agencies. The 2009 Cabinet Office Capability Review of Defra noted that Defra remains well regarded by stakeholders for its use of analysis and its scientific evidence base. Defra plans to maintain the good practice we have in place and continuously improve by implementing the recommendations of the EIS.

We have robust mechanisms in place to commission research to underpin these policies. Decisions on prioritising budget allocations within policy programmes are delegated to SROs with regular checks through the submission of business cases to approval panels. The CSA, assisted by other heads of profession, has an important role in providing challenge to those decisions. This serves several functions: ensuring the quality and improving the use of evidence in Defra; taking a strategic overview to ensure the key challenges and approaches are being adequately addressed; helping to prioritise evidence needs; and suggesting alternative methods of evidence gathering.

At present the CSA is consulted on proposals to let new R&D contracts. This provides an effective and efficient challenge function on a project by project basis.

6. To what extent, and how, does your Science Advisory Council advise on your research strategy and priorities? Are your R&D priorities externally peer-reviewed?

The Science Advisory Council (SAC) helps to ensure the quality and appropriateness of Defra science and its use, by providing strategic advice on Defra’s science activities, their relationship with the wider UK and international science base and the effectiveness with which science is used to inform the development and delivery of Defra’s policy goals.

For instance, the Council’s Capability Sub-Group (SAC-C) has provided on-going advice to a Defra project aimed at assessing the Department’s access to external capabilities; requirements for such advice and capability which helped to inform the development of the current EIS. This approach provided a new model for SAC advice by offering “real time” challenge and support to an ongoing Defra project, while remaining separate from any operational activity.
Defra’s research priorities are not externally peer reviewed as a whole, however, different research programmes do use this process to assure their priorities against what policy needs. In additions, Defra’s new EIS was developed in consultation with a large number of external stakeholders who helped to identify the strategic priorities for evidence spend. The EIS also identifies peer review as an essential stage of gathering the evidence required.

**Review Processes**

7. **What criteria does your department use to assess its research investments; and how is their impact measured?**

The assessment of Defra’s research investment is done at programme level and the criteria will depend on the objectives of each particular research project and policy area. In addition, the Department’s new EIS contains a good practice guide on how to commission and use research. This includes an evidence cycle illustrated alongside the policy cycle and one of the key stages in this is to “assess the impact of evidence on policy development” by, for example using the Value for Money (VfM) tool. Defra is developing a semi-quantitative tool to assess VfM of evidence projects and programmes. This will be trialled and, if suitable, rolled out to policy programmes in early 2010.

In addition, the HM Treasury’s Green Book provides good high level guidance for appraisal of VfM as well as evaluation of the impact a policy investment has had. VfM incorporates relevance, excellence, timeliness and fitness-for-purpose.

**Cross-Government Working**

8. **Please could you send the Committee copies of papers referred to by Professor Watson in Q96 on how departments and research councils will work together on cross-departmental issues?**

The papers mentioned by Professor Watson are internal documents at this stage and we are unable to share them with the Committee.

**Supporting Innovation**

9. **To what extent, and how, does your department’s research and development investment support applied research in the industries that the department draws on to support policy? What mechanisms, such as procurement, or the Technology Strategy Board, are and should be involved?**

Defra’s research and development investment supports applied research, as appropriate. For example, under LINK (a Government scheme which promotes 50:50 collaboration with industry) Defra has funded projects in five agriculture and food programme areas: Food (Advanced Manufacturing Technologies); Horticulture, Renewable Materials, Sustainable Arable; and Sustainable Livestock Production. These programmes have been very successful in supporting projects that solve practical problems for these sectors. The projects funded have strengthened and improved innovation in the UK’s farming and food industries and help them adjust to current pressures. Over the last five years, Defra spend for LINK has been approx. £8 million per year (peaking at £9 million in 2006–07).

Defra is now engaged with the Technology Strategy Board (TSB) to deliver future collaborative R&D with industry through several innovation platforms. These focus on specific societal challenges where the UK Government is taking action through policy, regulation, procurement or fiscal measures to tackle the problem. By improving co-ordination between the key players from industry, academia and government, innovation platforms can identify barriers to meeting the challenge, map possible routes to overcoming the barriers and align activities to support innovative solutions.

Future collaborative research to translate technology to farmers and the agri-food chain will be delivered through a new innovation platform for sustainable agriculture and food, the sustainable agri-food Innovation Platform (TSB, Defra, Biotechnology and Biological Sciences Research Council (BBSRC)); about food-chain sustainability for a total amount of £90 million (£30 million from Defra) to provide match-funding for the industry involvement. The aim is to bring the government, business and researchers together in a major initiative to stimulate the development of new technologies that will increase food productivity, while decreasing the environmental impact of the food and farming industries.

Defra is discussing potential opportunity for collaboration with TSB, ie on water supply/sewerage Innovation Platform.
10. **How does Defra signpost its research needs to alert academia and industry to new funding opportunities and encourage competition between proposers?**

In order to achieve value for money, good quality science, and to seek innovative approaches, Defra’s seeks to commission the majority of its research requirements through open or restricted procurement competitions. All open competitions are advertised on the internet with an alert being sent to a comprehensive list of research suppliers. Single Tender Action is used in exceptional circumstances and only when agreed through an internal approval process.

In addition the Department’s EIS highlights the need for more collaborative working which will help signpost research early to academic and industry.

*March 2010*
INTRODUCTION

1. The Department funds R&D through two main routes:
   - The National Institute for Health Research (NIHR) is a virtual institute specifically designed to deliver the Government’s research strategy Best Research for Best Health. The budget for NIHR is £931 million in 2009–10.

2. The vision of Best Research for Best Health is to create a health research system in which the NHS supports outstanding individuals working in world-class facilities conducting leading-edge research focused on the needs of patients and the public.

3. The goals of Best Research for Best Health have been translated into NIHR work strands, which have started to deliver results. The goals are to:
   - Establish the NHS as an internationally recognised centre of research and excellence (NIHR infrastructure)
   - Attract, develop and retain the best research professionals to conduct people-based research (NIHR Faculty)
   - Commission research focussed on improving health and social care (NIHR Research)
   - Strengthen and streamline systems for research management and governance (NIHR Systems)
   - Act as sound custodians for public money for public good.

4. A report on progress made by the NIHR in implementing these goals during 2008–09 was published in July 2009. Around 60 per cent of the NIHR budget provides the infrastructure and systems in the NHS to support research, 30 per cent is spent on directly commissioned research programmes, including projects and programmes within the NHS, and around 10 per cent is spent on the NIHR Faculty.

RING-FENCED DH R&D BUDGET AND THE 2007 CSR

5. In the 2007 Comprehensive Spending Review, the Chancellor of the Exchequer announced the largest ever increase in Government funding for health research and ring-fenced over £2.9 billion over the three-year CSR period for the DH R&D budget (NIHR and PRP).

6. The total funding increase of over £290 million is enabling the NIHR and Medical Research Council (MRC), under the auspices of the Office for Strategic Coordination of Health Research (OSCHR), to deliver the vision for health research set out in the Cooksey Report. This is for more effective translation of health research into health and economic benefits in the UK.

DIRECTION AND GOVERNANCE OF NIHR

7. The NIHR is directed by Professor Dame Sally Davies, Director General of Research and Development and Chief Scientific Adviser at the Department of Health. The NIHR Advisory Board, which includes Chief Executives of NHS Trusts and Strategic Health Authorities as well as leaders of academic organisations, provides advice and support on the strategic development of NIHR and the strategy and ensures an NHS voice.

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into strategic planning. The Board advises on issues including priorities for allocation of funds between infrastructure, capacity development and programmes or between health groupings.

8. All committees include patient representatives and all grants awarded have passed scientific peer review.

NIHR Programmes

9. The NIHR has a comprehensive range of research programmes aimed at improving health and social care. The programmes use a range of funding modes including direct commissioning in prioritised topic areas, themed calls, and response-mode funding. Details of the priority-setting and governance arrangements for each programme are available on the NIHR website.

10. The largest and longest running of our national research programmes, the Health Technology Assessment (HTA) programme, produces research evidence on the effectiveness of different healthcare treatments and tests for those who use, manage and provide care in the NHS. The annual budget will rise to around £88 million by 2011–12.

11. The HTA programme:
   - supports response-mode clinical trials to investigate issues that are directly relevant to clinical practice in the NHS;
   - commissions primary research and assesses the effectiveness of new technology through Technology Assessment Reviews for the National Institute for Health and Clinical Excellence (NICE);
   - works with the research networks of the UK Clinical Research Network to identify and fund clinical trials of importance to a network’s topic area.

12. The processes used by the programme to determine research priorities are described in the information leaflet Identifying and prioritising HTA research (provided as an annex to this submission). [Not printed]

13. Other NIHR programmes include:
   - Service Delivery and Organisation—commissions research to underpin improvements in the quality of patient care and the efficiency of NHS health services;
   - Public Health Research—evaluates the benefits, costs and acceptability of public health interventions delivered outside the NHS;
   - Health Services Research—complementing the remits of other NIHR programmes, the ultimate aim of this programme is to lead to an increase in service quality and patient safety;
   - Programme Grants for Applied Research—each grant funds a series of interlinked projects on conditions that cause significant impact on the NHS;
   - Research for Patient Benefit—grants awarded in response mode to promote health, prevent disease, overcome illness and improve patients’ everyday experience of the NHS;
   - Invention for Innovation—brings together the work of several smaller programmes to help accelerate the development of new healthcare technologies and devices.

Partnership Programmes

14. Under the auspices of OSCHR, the NIHR and MRC are working together to establish new initiatives to support efficient translation of health research into health and economic benefits:
   - the Efficacy and Mechanism Evaluation Programme was launched in April 2008;
   - in September 2008, 18 NIHR Clinical Trials Units received three-year awards totalling £3.75 million per year;
   - the jointly-funded Methodology Research Programme awards grants for methods research to underpin the whole spectrum of health research from basic to applied;
   - the Patient Research Cohorts initiative has been launched to create small, extensively defined groups of patients to help detect, treat or prevent disease—in areas of high unmet need or where there are bottle-necks in turning research into therapies.

http://www.nihr.ac.uk
NIHR INFRASTRUCTURE

15. The NIHR research networks have been set up to promote patient and public involvement in health research. The networks have significantly increased the number of participants taking part in clinical trials and improved their speed, quality and coordination. The networks recruit patients to participate in NIHR portfolio trials and other well-designed studies funded by industry and by NIHR partners including research charities and the Research Councils.

16. 12 Biomedical Research Centres have been created within our leading NHS and University partnerships to drive progress on innovation and translational research in biomedicine. The five Comprehensive Biomedical Research Centres (covering a range of clinical and research areas) and seven Specialist Biomedical Research Centres were selected through open competition by an independent international expert panel. Each Centre is awarded funding on a five year cycle; the first cycle began in April 2007. The total funding allocated is £450 million over five years, the amount awarded to each centre being determined by the scale and nature of the research activity that it conducts and the anticipated impact of that activity.

17. The NIHR has also established 16 Biomedical Research Units to undertake translational clinical research in priority areas of high disease burden and clinical need that are currently under-represented in the existing NIHR Biomedical Research Centres. Two Research Centres for Patient Safety and Service Quality have been funded to conduct and support the research to improve patient care and the quality of NHS services.

18. We have funded nine CLAHRCs (Collaborations for Leadership in Applied Health Research and Care) to bring together universities and their surrounding NHS organisations (including primary care) to test new treatments and new ways of working predominantly in chronic disease management. The CLAHRCs also play a key role in increasing understanding about how best to improve translation, adoption and diffusion. The local health economy matches the funding to “pull” research into practice.

NIHR FACULTY

19. The NIHR Faculty brings together researchers funded by NIHR. The first cohort of 100 Senior Investigators was appointed in April 2008 and the second cohort in March 2009. These 163 individuals are the leading researchers contributing to health and social care. NIHR also funds traineeships to support the academic training paths of all health professionals and to support training of other professions needed for health research including statisticians and health economists.

NIHR SYSTEMS

20. The Department continues to promote a regulatory and governance environment that both facilitates high-quality research and protects the rights, dignity and safety of those who agree to take part. A “research passport” has been introduced to speed up the process of getting research underway. A national regulatory and governance advice service has been set up in collaboration with other research funders. We are working with NHS Connecting for Health to create better systems for the secure use of patients’ health records in health research.

OFFICE FOR STRATEGIC COORDINATION OF HEALTH RESEARCH

21. OSCHR was jointly set up as a Government office in January 2007 by DH and the then Department for Innovation, Universities and Skills (DIUS). Its mission is to facilitate more efficient translation of health research into health and economic benefits in the UK through better coordination of health research and more coherent funding arrangements to support translation. In doing so, OSCHR supports NIHR, MRC and the other OSCHR Partners. OSCHR has responsibility for:

- Translational Medicine Research
- Public Health Research
- E-Health Records Research
- Methodology Research
- Human Capital

22. Three Boards—a Translational Medicine Board, an E-Health Records Research Board and a Public Health Research Board—have been established to provide strategic oversight in these areas. These Boards do not have a direct funding role, but advise on research priorities and opportunities.
23. In November 2008, the Prime Minister asked DH and DIUS for a new overarching set of national objectives to encourage the translation of major research breakthroughs into new NHS treatments and services within a decade. These “National Ambitions” are being developed independently of government through NIHR and MRC under the auspices of OSCHR.

UK CLINICAL RESEARCH COLLABORATION
24. The UK Clinical Research Collaboration (UKCRC) brings together the NHS, research funders, industry, regulatory bodies, Royal Colleges, patient groups and academia in a UK-wide environment that facilitates and promotes high quality clinical research for the benefit of patients. The UKCRC Board is chaired by Professor Dame Sally Davies.

WORKING WITH INDUSTRY
25. Industry—devices, diagnostics, biotech and pharma (and associated Contract Research Organisations)—is involved at a strategic and operational level in initiatives to enhance the UK’s clinical research environment. For example, it is represented on the Boards of OSCHR and the UKCRC. Industry-specific issues are considered in the UKCRC Industry Reference Group, Industry Road Map Group, NIHR Medical Devices Clinical Research Working Group and the MISG (Ministerial Industry Strategy Group) Clinical Research Working Group.

26. DH has a dedicated industry liaison team which works with industry, trade associations, other Government departments and organisations active in supporting industry research in the NHS, eg the National Innovation Centre, Health Technology Knowledge Transfer Network, NHS Innovation Hubs, and Medilinks to ensure that industry needs concerning clinical research are considered in the development of new infrastructure, processes and practices.

JOINT WORK WITH OTHER GOVERNMENT DEPARTMENTS
27. DH collaborates successfully with other Government departments on a wide range of cross-cutting research supporting Public Service Agreements. Professor Dame Sally Davies has led work with other Chief Scientific Advisers and the Research Councils to develop and implement the first cross-government research and surveillance plan focused on obesity, overweight and their determinants in England.5

28. Other examples of joint working include:

— Safeguarding Children Research Initiative—jointly funded by DH and the Department for Children, Schools and Families to strengthen the evidence base in the area of child protection, and support the Government’s programme of reform to improve early recognition and effective intervention to safeguard and promote the welfare of children;

— English Longitudinal Survey of Ageing (ELSA)—this examines the individual and combined impact of a range of factors, physical, social, economic and environmental, on the ageing process, using both subjective and objective indicators of health and well-being. DH and DWP are the two largest single UK funders of the ELSA, and other Government funders include ONS, HMRC, CLG, Defra and DfT. The US Institute of Ageing provides matched funding.

POLICY RESEARCH PROGRAMME
29. The Policy Research Programme (PRP) commissions research across the full policy remit of DH including public health, NHS policy and adult social care. Priorities for the PRP are primarily determined by DH’s strategic objectives and Public Service Agreements. The PRP also engages in consultation with colleagues across government and other key stakeholders.

30. The primary objective of the PRP is to assist colleagues in DH who are formulating, developing or evaluating policy by:

— providing evidence to inform policy development and implementation in timely and accessible ways, including assessment of its potential impact and cost-effectiveness;

— evaluating existing policies or experimental pilots before policies are fully implemented;

— commissioning research evidence for policy making over the longer-term.

31. To do this, the PRP commissions a wide range of different types of primary and secondary research. In addition to individual projects, the PRP funds multi-study research initiatives and long-term programmes of research in university-based units. The criteria for determining priorities are:

- Ministerial priority and relevance to the aims and objectives of DH;
- size and importance of the problem to be addressed;
- existence of well-defined plans for introducing research results into policy activity;
- timeliness and feasibility of the research;
- likely return on the investment in research;
- availability of other research budgets.

32. The DH Science Review (published by the Government Office for Science in October 2008) highlighted as good practice: “The approach by the Policy Research Programme to the commissioning and use of research evidence for better policy-making. In particular, the effectiveness of the Research Liaison Officer role in ensuring the science meets the policy needs.”

**September 2009**

**Memorandum by the Department for International Development**

**Objectives**

DFID’s research objectives are to understand and identify solutions to the challenges which are preventing us from achieving the millennium development goals by putting research at the centre of our efforts to reduce poverty in developing countries. We have six broad priority research areas; growth, sustainable agriculture, climate change, health and education, governance in challenging environments and future challenges and opportunities. We aim to:

- strike a balance between creating new knowledge and technology and getting new and existing knowledge and technology into use.
- make the most of our ability to influence policy to make sure research has an impact.
- use different methods of funding to achieve different goals.
- increase our effort to strengthen developing countries’ capability to undertake research and use research outputs, and
- help our partners predict and respond to development challenges and opportunities beyond the 2015 MDG target date by being responsive to new issues as they arise.

DFID has as an aim to double its investment in research in this spending cycle reaching £220 million a year by 2010. Decisions on allocation of funding were taken through the comprehensive spending review and internal departmental planning exercises.

**Processes and mechanisms used within the Dept for establishing priorities for Departmental research and Development**

DFID’s research priorities for 2008 to 2013, which are given in the Department’s Research Strategy (submitted as an Annex), resulted from feedback of a 12 month global consultation which took place in 2007–08. The working papers from this consultation are publicly available. In this consultation we talked directly to over 1,000 users and producers of research in seven developing countries and the UK, and we asked 12 major international research funders, UK government and research councils how DFID could help international research to be more effective. We received over 750 replies to a global electronic survey. Our research strategy was designed to incorporate the key elements of this strategic planning exercise.

For example one resounding message that we heard from developing countries in our consultation is that we need to make global development research more usable by improving mechanisms for research uptake, and there was a call for more research on growth and climate change. Our Strategy has as a priority sustainable economic growth and climate change. Also in response to the consultation we will invest by 2010 up to 30 per cent of our research budget in making research available, accessible and useable. We are also scaling up research into health and agriculture and the development challenges of conflict. To prepare us to deal with future challenges and opportunities resources are set aside to tackle fast emerging issues and future “unknowns”; those issues that could take us by surprise in years to come. In addition 5 per cent of the research budget is allocated to short-term policy-relevant research.
To move science and research closer we have appointed an external scientist to lead our research efforts and combined the role of Director of Research with the role of the Chief Scientific Adviser (CSA) DFID. Priorities for research are proposed by specialist research teams in consultation with our policy teams and our recently appointed Senior Research Fellows, who are senior academics working across the thematic areas of the research strategy. These are then reviewed by a high level internal research committee which includes the Director-General Policy & Research, the CSA and Chief Economist. This Committee quality controls the integration of improved scientific advice and evidence with policy in the widest sense. We are also establishing an external committee of independent scientists who will support the CSA and ensure that our research leads to development impact by providing challenge and advice. All DFID research is conducted externally, the great majority after external open competition, and where practical following peer review.

To ensure links are made with the science and technology of other government departments and the wider UK science community, along with links through the Government Chief Scientific Advisers committee we are also core members of the UK Collaborative on Development Sciences (UKCDS). UKCDS brings together key UK funders and stakeholders of the development sciences research base. The members of UKCDS work together to provide a more coordinated approach to development sciences research in the UK in order to provide sustainable improvements and benefits for the lives of the world’s poorest people. Additionally we are members of several international collaborations of research funders such as the International Forum of Research Donors (IFORD) which ensure that DFID research is undertaken in the knowledge of other research initiatives in international development.

Within these broad guidelines DFID makes decisions on individual calls for research which take into account a number of factors including:

(a) *Where would research have the greatest potential impact on changing the way we, or others, can tackle poverty and the effects of poverty?* This includes decisions about the greatest potential need, but also the realistic likelihood that a research output is usable in developing countries in a foreseeable timeframe. For example we are doubling our research in agriculture to £80 million a year to develop the “best bets” to ensure the results reach poor farmers.

(b) *New priorities set by Ministers.* The recent White Paper “Eliminating Global Poverty” placed even greater emphasis on the importance of climate change and this is reflected in funding decisions, including setting up a climate centre that will offer developing countries improved access to high quality research and information in designing climate change policies and programmes. As part of continued funding the International Growth Centre, we will ensure that their research remit includes green growth paths and climate concerns as a major focus. Another new priority is developing research into taxation systems and the development of a new Tax Centre.

(c) *What are other research funders doing or likely to do?* Where possible we prioritise research that has importance for development which others would not undertake if we do not undertake it. Sometimes this means DFID being the sole funder of a project. In other cases we form strategic alliances with other funding bodies including the Research Councils, and foundations such as the Gates Foundation and Wellcome Trust which in addition to leveraging funds to priorities they would not have been able or likely to undertake alone can combine the scientific and research expertise of these organisations with the development expertise within DFID. DFID has collaborative programmes with BBSRC, MRC, ESRC and NERC to ensure we are able to draw on the best of UK science, but the Development Act makes it clear that the purpose of DFID-funded research is to address development needs by the best and most cost-effective route and these alliances are to achieve that rather than support UK science *per se*. Several of the funding alliances are with non-UK bodies, including major investments in for example the Consultative Group on International Agricultural Research (CGIAR) and in research funding collaborations with the World Bank and Gates Foundation.

(d) *What is the opportunity cost of deciding to undertake research in one area compared to others?* Some kinds of research are intrinsically more expensive than others, and this has to be justified by likely impact on development over the longer term.

In addition to this funding under the Research Strategy, individual country offices and specialist units of DFID commission research to address questions which are of relevance to their aims, much of which is high-impact research published in major peer-reviewed journals. We are setting up a team in our Research Department to work more closely with the country offices to link up central and regional research and to ensure that their research informs the international debate.

*September 2009*
Examination of Witnesses

Witnesses: Professor Sally Davies DBE, Director General, Research and Development, and Chief Scientific Adviser, Department of Health, Professor Tom Walley, Director of our Health Technology Assessment Programme, National Institute for Health Research, Dr Andrew Steer, Director General, Policy and Research, Department for International Development, and Dr Gail Marzetti, Deputy Head, DfID Research, Department for International Development, examined.

Q105 Chairman: May I welcome our witnesses. I think some of you are old hands at this game, talking to this Committee, and it is nice to see you back. We will enjoy cross-examining on a different topic. I should also say that we do appreciate that the witnesses from DfID are actually substituting for Chris Whitty who is out of the country at the moment. That does not mean we will be terribly gentle but we will understand that there may have been some questions he would have been more in line to answer than perhaps you are. I remind you that this session is recorded and will be part of the published evidence when we report. You will see a transcript and have an opportunity to comment on that. That being said, we have about an hour and we will be fairly prompt at this end. Could I start by asking you each to say who you are for the record and what your specific responsibilities are?

Professor Davies: I am Sally Davies and I am both the Chief Scientific Adviser to the Department of Health and also the Director General for Research.

Professor Walley: I am Tom Walley; I am a consultant physician and clinical pharmacologist by background, and I am the Director of the Health Technology Assessment Programme on behalf of the NIHR and also some other research programmes.

Dr Marzetti: I am Gail Marzetti and I am the Deputy Head of Research in DfID working as deputy to Chris Whitty.

Dr Steer: I am Andrew Steer; I am the Director General for Policy and Research in DfID and the Chief Scientific Adviser reports to me.

Q106 Chairman: May I start with a fairly blunt question: why should there be departmental budgets for research when the government already spends very large sums of money through other groups for research, down through the research councils, commissioning research from private sectors, from universities and so on. Is there a specific need for each department, not least your departments, to have an identified research budget?

Professor Davies: If you look at the purpose of the Department of Health it is to improve the health and wellbeing of people in England and so the purpose of our research is to support that. We have two main routes of support for that. We have the National Institute for Health Research, which aims predominantly to develop the evidence to support decision making by NHS clinicians, the service managers and patients and to improve the quality of healthcare and its effectiveness and increasingly the social care interface, but we also have the policy research programme whose role is to provide evidence to support decision making about health and social care by the government policy makers to ensure that the policies of our department are informed by relevant, reliable research evidence, and we also play a role in evaluating the roll out of policies and the learning of the roll out of policies as it goes forwards.

Q107 Chairman: To follow up on that, is that best done in-house or could you contract it out equally effectively?

Professor Davies: We have a quite interesting model in government where, for the policy research programme—it has been recognised as an excellent model across government—we have liaison officers who all have postgraduate degrees and work with policy makers as they are developing their ideas in order to ensure the evidence is there and the evaluations are done. When they commission research to support that they do it through a contracted out back office function. We have commissioned the NIHR (National Institute for Health Research) to commission the research for us. We have overall strategic leadership of that but within the programmes they themselves play out what is needed. Perhaps I could ask Professor Walley to address the programmes he is in charge of.

Professor Walley: My main role is the Director of Health Technology Assessment Programme, which was created following the House of Lords vote in 1988 suggesting that the NHS needed a source to identify priorities for research in the NHS and then to deliver that research. So the aim of that programme is specifically to identify the research needs of the NHS, to prioritise those needs—because there are many with different priorities—and then to commission research in those areas. We have been doing that since 1993. We publish our results as monographs like these and also peer review articles. We have just published our 500th this year. The aim of the research is to influence clinicians, managers and of course patients as well to improve healthcare.

Q108 Chairman: Do you do an impact study, as it were?

Professor Walley: There are various ways in which we can measure impact. Academic impact is very strong both in the research assessment exercise and in publications. The monograph series has an impact factor of 5.09.
Q109 Chairman: I was thinking more of the clinicians, in other words what your intention is.
Professor Walley: We can look at specific case studies to do that. An example might be a study which examined the role of endovascular repair of aortic aneurysms. Aortic aneurysms are a swelling of the main blood vessel in the abdomen which can occur, particularly in older patients, and can rupture and if it does rupture your chances of survival are very small unless you get promptly into theatre. Traditionally the repair of this has been by open surgery but in recent years there has been a development of a device; an endovascular device is inserted through a small blood vessel in the leg typically and expanded in place to repair the aneurism. That endovascular repair was not commonly done in the NHS and we undertook a study comparing it to the standard treatment, the open surgery. This had several advantages. First of all, for the first time it linked up surgeons who did the operation of course and radiologists who put the device in.

Q110 Chairman: For the first time?
Professor Walley: Yes, so they were forced to collaborate in this research because the devices were put in by different people. The result has been a reduction in the number of centres undertaking this kind of work so the expertise is now concentrated. It has a definition of which patients should have this type of endovascular repair which is very expensive rather than allowing it to diffuse willy-nilly all over the place. I think that is a clear example where the HTA programme has changed practice substantially. There are several others as well.
Professor Davies: At a broader level there are studies, for instance one was funded by the Wellcome Trust with our support working around Europe with the Health Economics Research Group that we fund and the Office of Health Economics looking at return on investments and funding. What they found was that for one pound of public funding invested that there was a return in perpetuity—so every year—in cardiovascular disease of 39 pence per year and in mental health research 37 pence per year. So we do look at a number of ways of evaluating our programmes. There have been nearly 3.5 million downloads of those monographs in the last year. If you look at the latest data from BIS on world papers and citations you can see that the clinical health and medically related papers are going up by eight per cent and 28 per cent respectively and, even better, the citation impact has gone up dramatically over the last year so the quality is good. We have a prospective programme looking in a lot of different ways at the payback and the impact of our work. What we recognise is that it is not just us funding in this area. We work very closely with the Medical Research Council in particular and I could give you some stories about how research moves between us before it finally makes its impact.

Q111 Chairman: Thank you. DfID?
Dr Steer: We are currently doubling our spend on research simply because there is overwhelming evidence that it is the best way of spending our money. We will be up to £1 billion over the next five years.

Q112 Chairman: Is that over five years?
Dr Steer: Yes, over five years, so £200 million a year. When we decided to double that we did consider creating a non-departmental public body. We did a lot of analysis on that and the conclusion we came to, which Ministers strongly supported, was that actually that would be more expensive and less effective. We have 55 offices around the world; we have 650 professional technical staff with scientific training and not to use them in terms of identifying the right questions would be quite foolish and also not to use them to disseminate through their vast network within the developing countries. What is really important is that the research is done outside DfID by professionals; it is peer reviewed and the choice of who does the research and the endorsement of the quality of the analysis that will be done and then is done afterwards has to be peer reviewed by independent people. Our decision is to try and have the best of both worlds and we have, over the last year and a half, been trying to deepen our own scientific capacity and so our new Chief Scientist has also been made Director of Research so we have put the research budget under him which Sir Gordon Conway did not have and already we are starting to find that that is having a pay off. In addition to that we have brought in so far 15 what we call senior research fellows who are with their universities but they spend between one and four days a week inside DfID just to make sure we have that objective scientific position just as we also want practical on the ground expertise that DfID provides naturally. We have done a lot of independent assessments of rates of return. Our work, for example, through the consultative group on international agricultural research has returns of over 40 per cent. Our work with what we call PDPs—Product Development Partnerships—is developing new drugs we find that actually the rates of return on that are as good in terms of DALY (Disability Adjusted Life Years) saved as some of the very, very best investments such as using insecticide impregnated bed nets. It is a very exciting time for us as we are just figuring out how to generate the knowledge and get the knowledge into use.
Dr Marzetti: All of our research is accessible widely and freely on open access so it is not just for DFID, it is for a wider global view.

Q113 Lord Broers: What principles or criteria does your Department use in making decisions about funding different types of research? What processes are used, for example peer review or external or expert consultation? I would like to ask you to what extent do you think your research and your decisions are linked to the science and engineering base in this country in general? How flexible are you in gaining your advice? Do you have good turnover? Are you up to date?

Professor Davies: If I may start from the health perspective, we have two overarching criteria we use for all decisions about research funding: relevance and quality. We would not fund anything that was not high quality. We fund applied health research, the MRC does the basic and translational which are both very important so for us relevance is also important. We make sure that it is relevant to the policy or practice in the short to medium term because you could describe our role as a market failure role. We are trying to produce the evidence for public services that no-one else would fund. All of our funding decisions are based on external peer review, expert advice, and so the research supported by NIHR is highly practical, focussed on the needs of patients with public and health service managers involved at every stage of the prioritisation and the process in a way that leads the way nationally and internationally for health research funding. The research priorities for individual programmes are identified through very clear published processes and I will ask Professor Walley to address some of those. One of the things we have been doing with our government strategy published in January 2006 Best Research for Best Health is to move from a system where NHS R&D money was locked into the NHS and might have been funding good quality, highly relevant work, but might not have been, to a system now where all the money is delivered transparently following peer review and is monitored very closely. So it is a fully transparent system with rigorous decision making processes. For the policy research programme similarly we use ministerial priority and relevance to goals, aims and objectives of the Department to define the programme and look at the size and importance of the problem, but we would not be commissioning anything that was not peer reviewed both at the start of the process and at the end of the process and we insist on publication and peer review journals. We evolve, for the policy of research programme, our policy with the Departmental Policy Committee, which has director generals and directors on it. To take a recent example, we have been through a year’s process discussing the units we fund to support policy makers in the department—the Policy Research Units—and they are all embedded in universities, so they are refreshed regularly through the university appointment system. We have reviewed within the Department what are the needs, and we are re-tendering, and we have scientists on the panels that will award those contracts. We are expecting to fund about ten areas with £40 million over five years. We use scientists for peer review; we use them to help prioritise; they are the basis of our boards that award the money, and of course there is the peer review both at the end of the projects and at the publication end. Let me just ask Professor Walley to give you a bit of in-depth information.

Professor Walley: The HTA Programme operates in two manners. The first is where we identify the problems that face the NHS and then commission research; the second is a research stream that I will come back to. In the commissioning programme we seek people to identify for us what are the difficulties they face, and typically we review something like 1500 to 2000 suggestions for research a year. These suggestions then go to a panel of mainly NHS experts to consider which are the most important. I say mainly NHS experts, I mean clinicians both medical and non-medical, healthcare managers and of course patients. On a typical panel of around 15 or 16 experts there will be three or four patient experts to advise us of the many things they look at which are the most important. When they take those suggestions they decide which are important. The next stage is to develop what we call a vignette, which is a short three or four page document around what are the particular issues here and that is at the point where we involve particular subject experts. Subject experts get to feed in that prioritisation process which then comes back to our NHS panel to decide whether it is truly an area worthy of funding or not. If they decide that it is worthy of funding it then goes up the line into our Commission Boards which are panels of methodological experts for the most part. So the first part of the process is around whether this is an important question for the NHS; the second part is whether the science is up to scratch here.

Q114 Lord May of Oxford: Do you think you might draw that response to a close if we are going to get through the questions.

Professor Walley: I beg your pardon. So splitting prioritisation from science—but both are extremely important—we have experts involved at both stages, particularly NHS experts around prioritisation and scientific experts around peer review and commissioning of the actual detailed research.
Q115 Chairman: DfID? Something sharp, short and concise? Dr Steer: We have just prepared a new strategy. We took a year to consult, with consultations in seven countries. A thousand experts were consulted; we had a lot of discussions here as well. We came out with six major themes; then the next question is, how do we actually choose which research questions? I mentioned that before, and essentially we use our research fellows, we use our front line and we use the academic community. Then there is the sort of independent review, the peer review takes on from there. You asked to what extent is it linked to UK science, our research funding is non tied of course but it turns out that the UK is a leader—if not the leader—in the kinds of things that we are interested in. We do insist that every major research programme has developing country academics very firmly engaged in it, but I would say the majority would be partnerships between British universities, British institutes and developing country ones, then there are centres of excellence here (such as the Hadley Centre, and we are just going into a special relationship with them) to bring climate change science to Africa. Finally there is the UK Collaborative on Development Sciences, which is about two years old now, which basically brings together the UK expertise on that and we are a key member of that of course.

Q116 Lord Cunningham of Felling: You are spending about a billion pounds a year in the Department of Health, in round numbers, with these two organisations, the National Institute and the PRP. How do you ensure that the major part of that billion pounds a year is actually going to the most important priorities? Professor Davies: There are a number of mechanisms for prioritising and you have to think first about what level of prioritising we are talking about. The strategic level—the high level direction—was set following public consultation in the government’s strategy Best Research for Best Health. That describes the architecture of the system.

Q117 Lord Cunningham of Felling: When was that done? Professor Davies: It was published in January 2006; the consultation was in 2005. We went through the Domestic Affairs Sub-Committee.

Q118 Lord Cunningham of Felling: Will that be reviewed soon? Professor Davies: We said it was a strategy for five years, so I would expect a refreshed strategy after five years which should build on that. That defined the architecture. What we have not discussed is that that billion pounds not only funds research funding but supports the infrastructure in the NHS for carrying out clinical research, and we support the research that is funded by our partners, the MRC, the Wellcome Trust, Cancer Research UK or they would not be able to do theirs. It funds the supporting systems for clinical research and it also funds the training and development of the career scientists that we need which may be clinician scientists but also methodologists and other sorts.

Q119 Lord Cunningham of Felling: It sounds pretty robust on the face of it. Does this mean that clinicians, royal colleges, Age Concern, Help the Aged and everyone else is fully supportive of the allocations of resources as it is currently? Professor Davies: I think you will find the royal colleges, now the system has moved from transition, when we took £550 million away from hospitals and it is all now transparently given back, are all very supportive, as are the universities and medical schools. When you go to individual speciality charities they would always argue—so would I if I were them—that they would like more money in their field, but we fund high quality applications and as yet many of these areas are not submitting high enough level quality applications, so we are having to look at this by developing people who will be able to.

Q120 Lord Cunningham of Felling: So to take elderly people, they would get more allocation of resources if the quality of the proposals were better, would they? Professor Davies: They would not get more allocation, they would win more money—

Q121 Lord Cunningham of Felling: That is the same thing, is it not? Professor Davies: An allocation is a strategic issue; some of this is responsive. For instance, to promote this we fund for about £6 million a year the Dementia and Neurodegenerative Diseases Network to support clinical trials and research in that area, and they have special studies groups which bring scientists together—clinicians and other scientists—to try to design studies. We have one in stroke, if you are interested in old age, and the number of stroke trials has gone up dramatically, not only public sector ones but also industry bringing their new—

Q122 Lord Cunningham of Felling: Let me put the question another way, if I may. Professor Davies: Sorry. Have I misunderstood?

Q123 Lord Cunningham of Felling: No, not at all. I am just trying to get another point. Are there any weaknesses at all in this approach? How do you try to identify weaknesses?
Professor Davies: It is difficult for me as the architect of the system to see the weaknesses.

Q124 Lord Cunningham of Felling: That is quite a dangerous thing to say.
Professor Davies: I think we have built a very robust system, but we have advisory panels and people who are looking at it. We have changed some things as we have gone along in order to improve the system. Let me give you one example. We funded biomedical research centres—international and peer review—and the best universities won them. The other universities said that they do have people who are really good and we had not given them anything, so we created another scheme, biomedical research units, which allowed them to bid in. So we are continually listening and improving organisation. I go, for instance, every year to the Medical Schools Council to hear their views, and we take feedback all round as well as from our advisory panel, discussions with the MRC and other people.

Q125 Chairman: Does DFID want to add anything on this?
Dr Steer: Our funding is allocated competitively, so a portion of what we would channel would go through ESRC, NERC, MRC, BBSRC and so on, and so that process provides for the small grants with a very high degree of accountability. For some of our larger grants we would have an independent process. How do we determine that it is absolutely the best use of the money? Independent reviews of impact and some of the most recent best findings that we have had actually are those that are to some extent failed and saved a lot of money, so, for example, we just discovered that the treatment of vitamin A actually was not having the impact in West Africa on maternal mortality that had been expected. As a result of that Ghana is now saving £20 million a year and is using that for something that will have a bigger impact. We actually have examples of failure which are leading to success as a result. This is work in process. Are there weaknesses? Yes, there are weaknesses. We continually seek to ramp up our effectiveness. We are always looking at the tension between academic independence and relevance on the ground. Development is a messy business and that tension has always looking at the tension between academic effectiveness. We are continually seek to ramp up our effectiveness and that includes our research spend and the administration costs that we put into research. We have increased our staff by 70 per cent in research management over the last 18 months but nonetheless we are going to be having to manage our admin spend quite carefully. That again is a tension that we face. I could not identify one specific weakness but I can assure you that week by week we are identifying things that we would like to improve.

Q126 Lord May of Oxford: You identified your priorities as deriving from the Millennium Development Goals and of course the Millennium Development Goals bizarrely never mentioned population. I realise that is a sensitive issue but it is of course embraced under the heading of education and health. Just recently there is an interesting paper showing broadly girls that finish primary education have one and a half fewer children; those who finish secondary education have another one fewer. Most of your discussion has already entered the more physical biological science things you can be doing, but to what extent do you see it as part of your mission to engage not just in education but in the more vexed and controversial question of education and empowerment of women and making available—often in the teeth of religious opposition from the coalition of the unwilling that removed any mention of population—to educated women or women with a bit more control over their lives, the ability to control fertility?
Dr Steer: Your question is music to our ears. I want to be crystal clear that when we put money into developing new drugs or developing new agricultural seeds, the chemistry, the physics and the biology is only part of the story. The behavioural aspects associated with those are often more important. In our work, for example, on microbicides for HIV/AIDS, quite frankly it is behavioural issues that you had better understand well in order to know whether or not this will be effective.

Q127 Lord May of Oxford: They are also more politically controversial and I wondered how you handle that.
Dr Steer: I would say that we, more than any other funder of development research, have been opening the door to pretty controversial political aspects. We would, I hope, aim at the bull’s-eye of your question and the work we are doing now, as you know, on maternal mortality and maternal health is the most failing of all the Millennium Development Goals; it is a massive effort at the moment. In New York two months ago we convened 22 heads of state and 70 ministers with our Prime Minister to confront some of these tough political issues. Part of it is technical but truthfully the politics and the culture of this are as important as the money. I really want to agree with you. Even on religious issues now, on issues of
I think it worries all of us, Professor Davies: deliver it?

work and then it is falling into a system that does not seem that much more, has happened. recommended that we should be doing much more implementation? Again, on stroke, our report spent any of the money on sexual health, and that was voluntary bodies—out of 191 primary trusts, only 31 recommended that we should be doing much more implementation? Again, on stroke, our report spent any of the money on sexual health, and that was voluntary bodies—out of 191 primary trusts, only 31

an almost trebling of the incidence of HIV, and was going to see a 25 per cent reduction in sexually transmitted diseases over five years; it has in fact seen an almost trebling of the incidence of HIV, and gonorrhoea going back up to almost WWII levels. Of the money that was given for sexual health, to the primary trusts—one only per cent was given to voluntary bodies—out of 191 primary trusts, only 31 spent any of the money on sexual health, and that was all on treatment. Do you worry about implementation? Again, on stroke, our report recommended that we should be doing much more and it does not seem that much more, has happened. Does that not worry you, that you are doing excellent work and then it is falling into a system that does not deliver it?

Professor Davies: I think it worries all of us,

Q128 Lord May of Oxford: What assessment retrospectively and prospectively do you make of the research that you are undertaking and in particular its impact? May I say to the Department of Health there have been several recent select committee studies dealing with different aspects where the research itself is unquestionably brilliant and well managed in my opinion and the opinion of many people, but its impact on the delivery of health is another question altogether that does not have to do so much with the research as the structures in which it is embedded for example, £400 million was committed a few years ago to sexual health, which was going to see a 25 per cent reduction in sexually transmitted diseases over five years; it has in fact seen an almost trebling of the incidence of HIV, and gonorrhoea going back up to almost WWII levels. Of the money that was given for sexual health, to the primary trusts—one only per cent was given to voluntary bodies—out of 191 primary trusts, only 31 spent any of the money on sexual health, and that was all on treatment. Do you worry about implementation? Again, on stroke, our report recommended that we should be doing much more and it does not seem that much more, has happened. Does that not worry you, that you are doing excellent work and then it is falling into a system that does not deliver it?

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Q130 Lord May of Oxford: Excuse me, to put it another way, what do you think is wrong with the system that it does not work properly, translating the research into effective applications?

Professor Davies: I do think it is a cultural issue about the education of our doctors and the system that we work in. I think NICE has played a big role in providing advice and in fact a lot of our programmes feed directly into the NICE guidelines and the NICE appraisals, but it is very difficult to change people’s behaviour. We have an experiment running that looks very interesting called the Centres for Leadership in Applied Health Research and Care. What we commissioned was health economies, so primary care, acute care and their local academics coming together, and we said that if you have a track record of research in chronic diseases across the whole patient journey, we will give you up to £2 million a year to do that, if you put in matching money to get that research into practice. We have funded nine of these, two, interestingly, in mental health. They really are breaking new ground. To add to that we have given a contract to Professor Hugh Davis of Aberdeen, who in expert on this area of knowledge transfer, to work with them to help them increase knowledge transfer and learn the generalisable lessons that we can take into other areas in the NHS.

Q131 Lord Warner: Could I just pursue this a bit more, Sally? There is a conflict between your description of the way the Department of Health prepares for the take-up of the research and what DFID is saying. In DFID they seem much more to have integrated preparation for the reception of the research into the host communities. You have, give or take, 60,000 consultants and GPs—we will just stick with the doctors for the moment—who are potential audiences for your research. Is there not something systemically wrong that you do not prepare them in advance for some of these particular areas of research? What you are describing is a model in which you wait for the research to appear before you go through the way of disseminating if. Let us just stick with stroke, for example, if you have chosen a high quality piece of research—and you have a very good

Q132 Lord Warner: Could I just pursue this a bit more, Sally? There is a conflict between your description of the way the Department of Health prepares for the take-up of the research and what DFID is saying. In DFID they seem much more to have integrated preparation for the reception of the research into the host communities. You have, give or take, 60,000 consultants and GPs—we will just stick with the doctors for the moment—who are potential audiences for your research. Is there not something systemically wrong that you do not prepare them in advance for some of these particular areas of research? What you are describing is a model in which you wait for the research to appear before you go through the way of disseminating if. Let us just stick with stroke, for example, if you have chosen a high quality piece of research—and you have a very good
system now for making sure that it is good, high quality research—there is a better than evens chance that it is going to come up with something which is really rather significant, so why is the community of people working on research not being prepared for that along the way? It seems to me that you have a systemic problem which has not been tackled in the same way as, for example, with DFID.

Professor Davies: Let me go back to how we prioritise work. There is a lot of social science showing that if you deliver the evidence that people felt they wanted or needed they will act on it, which is why we have managers, clinicians and patients involved in prioritisation. Then you move to the processes of research and do we involve people? There is quite a lot of social science showing that people who are involved in the research process also give better care to other patients who are not involved. For that reason we have established, as part of our infrastructure, research networks across the whole country to try to encourage more activity in research to get the quality gains in the slipstream as well as the evidence. One of the sad things that happened in the past was a separation of NHS and university and we all know that the clinical academics are often the more flexible and they are the early uptakers. For a lot of what our work has been doing through the biomedical research centres, the networks and everything else we have totally re-engineered the system in the major parts of the country, bringing back the integration that Lord Broers will have heard about in Cambridge—the impact that our funding has made in bringing people back together again. That will change the culture. We also use the levers that are available—national guidelines and things like that—to try to get things into practice. Could we do more to make sure that the NHS is a more fertile ground to pick things up? There are people whose role it is and that is around the education we give as undergraduates, postgraduates continuing medical education have a key role—I am not responsible for that—and, as you will know from history, we were given the research money but not the development money and that other money to try to develop that. So I think using the levers we have got we are making significant progress. That is not to say that I would not like faster and better progress and we could not potentially do more.

Lord Warner: We could carry on but I am not terribly convinced by the answer. I have to say.

Chairman: I think Baroness Neuberger wants to carry on with this.

Q132 Baroness Neuberger: I am just going to press on one particular issue which Lord May also raised which is the question about the involvement of the voluntary sector. It seems to me that that is particularly important when you are looking at large patient groups. You have cited two of your big mental health programmes where there has been a change of behaviour. Certainly from my past experience at the King’s Fund we found that a collaboration with the Department of Health and a major mental health charity plus us at the King’s Fund was actually rather impressive at changing behaviour because you had different players pulling different levers so you had patients asking for different things. I just wonder the extent to which you are really thinking about that. I take the point completely about the research, the Department of Health and the universities but I think there is a voluntary sector/patients and users bit that is not fitting into the equation that I think could make a huge difference.

Professor Davies: I would accept that it can and it does and there is more to be done there. We work quite closely with some of the third sector particularly in the cancer field, and we have shown the success: we do joint funding; we do a lot of things jointly. We work through shared funders fora with many of the others—there is an ageing funders forum, a cardiovascular funders forum and others like that—to try to bring the different voices to the table, and each of us plays to our strengths so that they can educate patients. I think patient power is one of the ways we will get the change in the clinicians actually; the third sector will play a big role.

Q133 Baroness Neuberger: I agree, but the contrast between what you are saying and what we are hearing from DFID is that in some of the ways that DFID is working, particularly with the women, a lot of the agenda is focussed on getting a change of behaviour, which is the bit I am not hearing.

Professor Davies: We also fund a programme which costs £1 million a year called Involve which is about patient and public participation and involvement in the research process at every level and they run programmes training people and helping people across the country so we are putting our money where our mouth is and trying very hard to work for this.

Q134 Lord Haskel: You have told us about the processes that you go through at DFID and at the Department of Health to allocate funds. Both seem to be robust and both seem to work well, but they are different. How well then does this compare with the recommended practice outlined in Science and Engineering in Government?

Dr Steer: There is no blueprint. We appreciate the guidance from that document, but essentially the line of argument, certainly that we take from it, is to start with what are the questions, and the questions have to be relevant to our task. We have only one task,
which is reducing global poverty. You cannot do that if you do not start in a village in Africa or in South Asia. That has to be your starting point and we have to be there or, quite frankly, the best researchers in the world will not be able to get to what we need to do. That has to be our starting point; it may be quite different in other departments, but for us that is where we start. Then the guidelines lay out processes of interdependence so, if you like, it is a journey and at every stage you need independence and you need relevance, but the further you go along you must have that gap between the policies, people and the researchers; it must grow and then it has to come back together again, it has then got to be transmitted. As Gail was saying, that is why 30 per cent of our entire research budget is now getting it out there. We did a review of a very large ten year programme on agriculture and rural development. We spent £100 million or something on that and we found that it had led to fantastic breakthroughs but none of them were being used. I think there were something like 285 really good discoveries that it had come up with, and apart from where we actually did the research, where generally it was taken up, they were not being mainstreamed. So we started another programme which we put £40 million into called Research into Use and it said, “Look, before we start generating a whole lot of new findings we are going to get the existing ones into use”. I tell you, it is eye opening quite frankly. That is how we come at it.

Professor Davies: Our processes do meet the standards, of course they do. We try very hard to make sure the investments strategically work with a wide range of other research funders and stakeholders. We work with other government departments and I know you have heard from my colleague Robert Watson this morning about some of that, but I, for instance, led the work cross-government involving all the CSAs and research councils on preparing the first ever cross-government research strategy which was on research and surveillance for obesity that we are now taking forward. Our policy research programme with its liaison officers is accepted as a model in government. Let me use pandemic flu as a current example of how we work. We have a Scientific Advisory Group for Emergencies—SAGE—which is co-chaired by Professor Beddington and an external chair, Sir Gordon Duff, and I sit on those as CSA. It has a number of sub groups, for instance modelling behavioural and clinical, and it was clear in the early summer that we did not have all the evidence we needed for the epidemic this autumn, whether severe or mild. Each of those groups teased out what did they think were their evidence needs in order to drive policy, not just department but management policy. This was then sieved through the main SAGE and prioritised. We then, through Tom’s leadership, commissioned £2.3 million worth of research to answer these policy needs. That was in June. In July the funding had been given. I can tell you that we admitted in a three week period 960 patients into the children’s vaccine trial in September. We have the answers coming through very, very fast. So we used a scientific advisory system to generate the priorities. Our standard systems were speeded up to commission and we have used our research networks to deliver this work and it is happening very fast.

Q135 Lord May of Oxford: That is in many ways a good story, but at the same time you are probably aware of the almost 12 month long running discussion between the Select Committee and the Health Protection Agency, who mistook antivirals for antibiotics and were firmly fixed on a policy that they were only going to give them to people who had come into the surgery, been diagnosed, and then given to them by which time they would be of little use, as distinct from informed expert opinion which said that the best use is to give them insofar as possible a kind of local prophylaxis and that translation from the research frontier to the practice was achieved in an interesting discussion with the sorts of questions in the House of Lords actually, when Lord Desai was able to say that we had done just what the Select Committee had been recommending. That was a really quite startling example of a lack of contact between the Health Protection Agency and expert opinion.

Professor Davies: I was not aware of that, but our present system of the SAGE works that through.

Q136 Lord May of Oxford: It is in good shape now.

Professor Davies: Yes.

Q137 Baroness Neuberger: You have covered some of my question about who coordinates your Departments’ research and development priorities. I think we have heard most of that. I have a particular interest in policy areas that are not the responsibility of any particular department, and in a sense, Sally, you have already talked about the work that you have been doing on obesity, which is clearly cross-departmental and nobody’s responsibility in particular. Can you tell us something about how you get the R&D priorities coordinated in a cross-governmental way? I have a particular question for DfID in a moment, but from your obesity experience can you tell us something about that?

Professor Davies: I know that Robert Watson has told you about this. We have a regular meeting of all chief scientific advisors with John Beddington, and that
has allowed us to form a network; we all know each other now, which historically we did not particularly well, so most of us have work going on with a few departments. If you take counter-terrorism we have Home Office funding for people in our department to commission research with a joint pot of money. We have work on drugs and addiction between them; we have work with what used to be the Department of Education but is now Children; we have shared work with them. Sometimes we do this with joint pots of money; sometimes we do it with an agreement about what is needed and one department leads. So there is quite a lot of that work. We work closely with the Medical Research Council, and the CSAs, and Research Councils chief executives are coming more and more together as a group.

Q138 Baroness Neuberger: Indeed Robert Watson did tell us about that. We would particularly like to hear your own experience on obesity and whether there were difficulties in coordinating the research cross departmentally and how do you deal with the money? Whose money gets spent on what?

Professor Davies: It was an experiment, so it was not smooth running. Everyone was keen to be part of it but the difficulty was thinking what were they bringing to the party. Actually, because we were interested in the health aspects, we were prepared to take quite a lot of the money to the party and once people understood that and where we were going everyone was always helpful. What we have—and it comes under Tom’s jurisdiction—is a programme which looks at public health interventions and I was encouraging my colleagues to look at what natural experiments they were setting up with their policies like pavements or walking to work or whatever that might have an impact on health—particularly obesity—that could be explored through our public health programme. It came back very well. Let me give you another example. The National Prevention Research Initiative—there are five funders in that—it is all about trying to reduce heart disease and cancer and doing research where one pot of money has been given by all of us to the MRC to manage on all our behalves into smoking, exercise and a number of things. We do have experience and everyone is keen to do it. It can be difficult if your own departmental research budget is already tied up, but we all have to take those difficult decisions and we would not want to be left out of working with other departments.

Professor Walley: Obesity is an area we were particularly interested in. We have what we call a Themed Call, which has now been advertised and will take place in the New Year looking for bids across the whole spectrum of obesity research, everything from the very biomedical straight through, as Sally said, to pavements, cycle paths and so forth and education at the other extreme. We are pursuing that through the HTA Programme and through public health research programmes.

Q139 Baroness Neuberger: That is in conjunction with other departments; you have been talking across government on that.

Professor Davies: They are inputting, yes. The other thing is that we increasingly, from our money, are funding social sciences as well because it will not just be the clinical trials approach that will get us the right answer; social sciences are becoming increasingly important.

Q140 Baroness Neuberger: Particularly for DFID, we would be very interested to know what your relationship is and how you coordinate with other funders in your area—the village in Africa or wherever it may be—and how do you tie it all together? That might be with research councils, it might be with voluntary sector funders. How does that work?

Dr Steer: Different ways in different settings. An example would be drug development for neglected tropical diseases. Ninety per cent of drug research is for rich people’s diseases. What do you do about the fact that we simply do not have any? So the Gates Foundation, Rockefeller and with our engagement from very early on really established this system of product development partnerships whereby private sector is not willing to invest, we cannot invest on our own, so let us see if we can somehow tweak the incentive structure the private sector faces and as of today there are 65 drugs being prepared for neglected tropical diseases of which three quarters are financed by these PDPs. We could not have done it without Gates, and Gates I think would now say—we would have to check with them—that they would really insist that we are part of the programme too. So there would be a lot of examples by that. We expect six new drugs by 2015 which would change millions of lives. Interestingly we now also work on animal diseases. If we take the East Coast fever; a cow in Africa dies every 30 seconds. That is a livelihood; it is how to get a vaccine for East Coast fever for the production of a vaccine for East Coast fever for the prevention of a disease. There is now, as of today, massive production of a vaccine for East Coast fever for the first time in history and it will change millions of lives. We could not do business without the kinds of partnerships you are talking about. We also do a lot of social research—economics, governance, politics, sociology, anthropology and so on—and with that it
is a much more open process using NGOs, using institutes in developing countries. Even, for example, on climate change we have a £23 million project to look at adaptation in Africa; 40 sites around Africa, 20 countries. That is all financing local institutions, sometimes voluntary institutions, doing very practical on the ground research on malaria belts and all kinds of things like that, but supervised and quality enhanced by northern institutions. We could not do business if we did not do it the way you are suggesting.

**Q141 Lord Broers:** Do you feel in DfID that you have a good overall feeling about the efficiency of your spend? I have heard criticism that some of these charities, such as Gates, are magnificent but they are spending money on high tech drugs where they could get ten times the bang out of the buck by simple water pumps, better water purification, solar cookers and bed nets and things. Do you think you understand that overall financial benefit situation?

**Dr Steer:** I think that we help each other. They have been very good for us and our focus on cost effectiveness is good for us both. I should say that the Gates Foundation has always been very serious about input/output relationships: is what goes in a good cost rate return? As we look at what we are doing together with them and others we can estimate rates of return. I am not saying that every single one is a brilliant success, but it is possible in health, it is certainly possible in agriculture and it is possible in a much wider range of areas to identify cost effectiveness. Could I say every single thing we invest in has a terrific rate of return? No and clearly that is the nature of science, but overall could I truly say I think our money is well spent, given that we are aiming at poverty reduction and the alternative is to use this money to build schools or to provide vaccinations, I would say yes.

**Dr Marzetti:** Could I just add onto that our teams, when they are looking at the next thing to invest in, actually do take value for money decisions and look at the opportunity cost of that money. Everything we invest in is reviewed annually for its impact and against a series of criteria to make sure we get the best value.

**Chairman:** Thank you very much. I fear we must draw to a close. People have commitments and the room has other uses. We thank you all very much for coming and giving us oral evidence today and for your written evidence. On any of the topics we have indicated we might want to ask about, if you do have views do please let us have something in writing. You will see the transcript very shortly. Thank you very much.

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**Supplementary memorandum by the Department of Health**

**R&D Spend**

1. *Please can you provide the Committee with a breakdown of the department’s spend on research over the past five years, including*

   (i) *total research spend*

   (ii) *percentage of total departmental spend*

   (iii) *percentage allocated to PSREs*

   (iv) *percentage allocated to collaborative programmes with research councils; and*

   (v) *figures for each research or policy area.*

A breakdown of DH R&D spend is provided in the following table.

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Since the establishment of the National Health Research Institute (NIHR) in April 2006, an increasing amount of NHS R&D funding has been awarded through NIHR funding streams (as shown in the table). At the same time, transitional R&D funding was allocated at reducing levels, as planned, to all previous recipients of NHS R&D support funding; the transition period ended in March 2009. The table also shows R&D expenditure by the DH Policy Research Programme (PRP), DH-sponsored Public Sector Research Establishments (chiefly the Health Protection Agency), and ad hoc spend on research from departmental policy budgets.

The table shows the high level areas the Department uses in its management and accounting processes. Many funding streams address a generic need within the health research system, eg Flexibility and sustainability funding (under NIHR Infrastructure), Senior Investigators (under NIHR Faculty), Methodology (under NIHR Programmes), and Local research ethics committees (under NIHR Systems).

Joint activity between DH and the Medical Research Council (MRC), and/or other Research Councils, occurs in a diverse range of contexts and DH spend on such activity cannot be fully disaggregated from wider expenditure. Funding is provided through the NIHR Clinical Research Network to meet the NHS service support costs of Research Council-funded clinical trials and studies. Under the auspices of the Office for Strategic Coordination of Health Research (OSCHR), the NIHR and MRC are developing a joint programme for translational research and are working together through a number of research initiatives including the Efficacy and Mechanism Evaluation Programme, Clinical Trials Units priming funds, the Methodology Research Programme, the Patient Research Cohorts initiative, and Hubs for trials methodology research. DH is the joint largest funder of the five Public Health Research Centres of Excellence; other funders include MRC and the Economic and Social Research Council (ESRC). DH is one of a consortium of seven funders supporting the UKCRC (UK Clinical Research Collaboration) Translational Infection Research Initiative; other funders include MRC and the Biotechnology and Biological Sciences Research Council (BBSRC). DH is also collaborating with the Research Councils through other initiatives including Living with Environmental Change, and the National Prevention Research Initiative.

The PRP spends about 30 per cent of its budget through research units and the remainder on single projects, systematic reviews, and linked groups of projects.

2. What is the effect on the department’s research and development of the decision reported in The Times in November 2009 to re-allocate some of the department’s research and development budget to non-research policy requirements? Who was involved in that decision? What protection does ring-fencing provide and have any additional activities been introduced into the ring-fence within the spending review period?

The Department’s budget for the NIHR and the PRP has been ring-fenced since the beginning of the 2007 Comprehensive Spending Review period. The ring fence has ensured protection of this budget from any front line pressures.

In 2010–11, a departmental saving of £62 million will be achieved by transferring responsibility for research activity from other departmental policy budgets to the ring-fenced R&D budget. This was agreed by the Department’s Permanent Secretaries and Director General for R&D, with ministerial sign-off. The research the ring-fenced budget currently funds will continue as planned. Research activity previously funded from other departmental budgets will be managed through the PRP from 2010–11. These changes will help to ensure consistent prioritisation and quality measures with Value for Money across the department’s R&D investment.
Setting Research and Funding Priorities: Evidence

Prioritisation Processes

3. What is the role of your departmental Chief Scientific Adviser in the process of setting research priorities? What grade is she?

Professor Dame Sally Davies is both the Department’s Chief Scientific Adviser and Director General for R&D (the post is equivalent to the old Grade 2). Dame Sally is a member of the NIHR Advisory Board, which advises and supports her on the strategic development and evaluation of Best Research for Best Health and on the strategic development of NIHR, including coordination with MRC and OSCHR. She is also a member of the OSCHR Board and the DH Policy Committee (see response to Q8 for an outline of this committee’s role in setting research priorities), and chairs the UKCRC Board.

4. Who is present at meetings at which departmental budgets are discussed? In particular, who represents the research and development element of the department’s budget at such meetings?

Dame Sally is a member of the DH Corporate Management Board, which provides corporate leadership for the Department and supports the Permanent Secretary in the discharge of his personal responsibility as Accounting Officer for Departmental expenditure.

5. To what extent does the Department of Health follow the best practice outlined in the Government Office for Science’s report on Science and Engineering in Government for the use of science in Government? What interaction do you have with other departments on best practice for setting R&D priorities and encouraging innovation?

The arrangements set out in Science & Engineering in Government as good practice are generally already in place in the Department. DH interacts with other departments on issues relating to research and innovation at ministerial level, through the Cabinet Sub-Committee on Science and Innovation, and at official level, through the network of Departmental Chief Scientific Advisers and the CSAC (Chief Scientific Adviser’s Committee) Core Issues Group.

6. Do your department’s Public Service Agreements require you to demonstrate that your policies are sufficiently evidence-based, and that you have robust mechanisms in place to commission research to underpin these policies?

The Government is committed to improve progressively the evidential underpinning of PSAs and their delivery. The commissioning priorities of the DH PRP are largely determined by the Department’s strategic objectives and PSAs. Many of the PSAs are cross-government and DH works in partnership with other departments in building the evidence base to underpin policies in these areas. For example, DH is funding the Safeguarding Children Research Initiative jointly with the Department for Children, Schools and Families, and has led the development and implementation of Healthy Weight, Health Lives: a cross-government research and surveillance plan for England.

The Science Review of the Department of Health (Government Office for Science, 2008) highlighted as good practice “the approach by the Policy Research Programme to the commissioning and use of research evidence for better policy-making. In particular, the effectiveness of the Research Liaison Officer role in ensuring the science meets the policy needs.”

7. To what extent, and how, does your Science Advisory Council advise on your research strategy and priorities? Are your R&D priorities externally peer-reviewed?

DH does not have a Science Advisory Council. The role and purpose of the NIHR Advisory Board is described under Q3. The research priorities for individual NIHR programmes are identified through clear, published processes, involving external experts, patients and the public. The commissioning priorities of the DH PRP are influenced by stakeholder consultation and expert advice.

8. What mechanisms and processes are used to identify priorities in your Policy Research Programme? Which of the processes and practices used in your Policy Research Programme might be applicable to the work of other departments?

The PRP has engaged with the DH Policy Committee to help embed policy research and effective policy evaluation within the Department. A key aspect of this has been to ensure that the PRP develops a clear priority setting process that is linked closely to business planning objectives, and makes best use of this important resource.
In particular, the Policy Committee has provided strategic direction for the PRP priority setting process by endorsing a summary list of priorities for the commissioning of new research in the short to medium-term. The resulting priorities framework has informed the commissioning of single projects and systematic reviews, as well as larger scale initiatives, comprising linked groups of projects that provide a range of perspectives on key policy issues.

The Policy Committee has also engaged with the PRP on its strategy for commissioning new Policy Research Units (PRUs). This strategy is designed to re-configure investment in PRP units to best meet the Department’s needs for longer-term policy research during 2011–15, as well as to secure capacity for rapid response research and evidence synthesis and provide advice in relevant areas of expertise. Ten new priority areas for PRUs were identified, following stakeholder consultation and workshops with all policy directorates and discussion with the Policy Committee. Following endorsement by the Policy Committee and agreement by Ministers, the PRP has run a major competitive tender for these new units.

Good practice by the PRP with potential application to the work of other Departments is noted under Q6.

**Review Processes**

9. *What criteria does your department use to assess its research investments; and how is their impact measured?*

The performance of NIHR activity is reported internally every quarter to the DH Director General for R&D, who reports through the DH Corporate Management Board to the Secretary of State for Health. Strategic oversight is through the NIHR Advisory Board. Detailed implementation plans for *Best Research for Best Health* are published on the NIHR website and updated at least every six months; these plans include milestones and delivery. NIHR produces regular progress reports; the report for 2009–10 will be published in summer 2010.

Before PRP project reports are signed off, policy customers comment on the extent to which the findings have addressed the relevant policy questions.

**Cross-government Working**

10. *To what extent might the Office for Strategic Coordination of Health Research provide a model for collaboration and coordination for other departments or across Government?*

OSCHR has been useful in its mission to bring the MRC and NIHR closer together in order to facilitate more efficient translation of health research into health and economic benefits in the UK. This has been achieved through better coordination of health research and more coherent funding arrangements to support translation. Now these arrangements are in place, OSCHR could be dissolved. In the current fiscal climate, any specific need for improved research collaboration and coordination that is identified in relation to other departments or across Government is unlikely to be best met through the creation of a joint office or other body incurring cost to the sponsoring department(s), but rather through the research funding organisations working more effectively together without the addition of further structures or bureaucracy.

**Supporting Innovation**

11. *To what extent, and how, does your department’s research and development investment support applied research in the industries that the department draws on to support policy? What mechanisms, such as procurement, or the Technology Strategy Board, are and should be involved?*

Through the NIHR, the Department is funding or supporting infrastructure and programmes which will support the development of interventions for the prevention, diagnosis and treatment of ill health and the evaluation of their safety, effectiveness or performance.

Examples of how NIHR is helping to meet industry needs are shown below:

<table>
<thead>
<tr>
<th>Industry Need</th>
<th>NIHR Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Better target identification and validation</td>
<td>MRC/NIHR Translational Medicine Board initiatives eg MRC Developmental Pathway Funding Scheme</td>
</tr>
<tr>
<td></td>
<td>NIHR Biomedical Research Centres</td>
</tr>
<tr>
<td></td>
<td>NIHR Biomedical Research Units</td>
</tr>
</tbody>
</table>
Industry Need | NIHR Support
--- | ---
Much earlier evidence of efficacy or otherwise (fail early, fail fast, fail cheap) | MRC/NIHR Patient Research Cohort Initiative
High quality clinical research facilities | NIHR and partners including Wellcome Trust—Clinical Research Facilities ukcrcepmadd.org.uk
Effective mechanism for liaison with NHS, academia and patients to develop new devices on the basis of unmet clinical need | Pilot Healthcare Technology Co-operatives
Academic collaborative applied research on future med tech product development. | NIHR Invention for Innovation Programme www.nihr-ccf.org.uk/site/programmes/i4i/
Fast, reliable, cost effective clinical trials and clinical investigations | NIHR Clinical Research Network http://www.crncc.nihr.ac.uk/index.html
More effective trial modelling, feasibility and patient identification | NIHR/Connecting for Health Research Capability Programme www.connectingforhealth.nhs.uk/systemsandservices/research
Better pharmacovigilance, device adverse event monitoring and outcomes research | NIHR/Connecting for Health Research Capability Programme www.connectingforhealth.nhs.uk/systemsandservices/research/
NIHR Research Centres for Patient Safety & Service Quality

The Technology Strategy Board (TSB) is contributing to the pilot Healthcare Technology Co-operatives. The NIHR is a co-funder of TSB-led innovation platforms in Assisted Living, and in Detection and Identification of Infectious Agents.

The National Innovation Centre (NIC) offers a range of pre-commercial approaches for its competitions, one of which is the Small Business Research Initiative, to speed up the procurement of innovation in the NHS. In 2009, NIC ran online competitions seeking solutions from small companies to needs identified directly by clinicians. NIC is planning to launch at least two more rounds of competitions in 2010–11.

12. How does the department signpost its research needs to alert academia and industry to new funding opportunities and encourage competition between proposers?

Calls for proposals are advertised on the DH and NIHR websites and in professional journals.

February 2010

REFERENCES


Supplementary memorandum by the Department for International Development

R&D Spend

1. Please can you provide the Committee with a breakdown of the department’s spend on research over the past five years, including

(i) total research spend

(ii) percentage of total departmental spend

<table>
<thead>
<tr>
<th>Financial Year</th>
<th>Central Research spend</th>
<th>Central research spend as a % of DFID spend</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005–06</td>
<td>£98m</td>
<td>2.2%</td>
</tr>
<tr>
<td>2006–07</td>
<td>£110m</td>
<td>2.2%</td>
</tr>
<tr>
<td>2007–08</td>
<td>£130m</td>
<td>2.5%</td>
</tr>
<tr>
<td>2008–09</td>
<td>£125m</td>
<td>2.2%</td>
</tr>
<tr>
<td>2009–10</td>
<td>£176m</td>
<td>2.6% *</td>
</tr>
</tbody>
</table>

* Forecast as of fourth quarter

(iii) percentage allocated to PSREs

The Department for International Development (DFID) does not pre-specify an amount to go to Public Sector Research Establishments (PSREs), and the International Development Act means research money cannot be tied to UK institutions and it is not DFID’s mandate to support the UK science base. Through joint funding calls with Research Councils, however, a number of PSREs are funded indirectly by DFID; specifically the Concordat between DFID and the Medical Research Council (MRC), where DFID provides approximately £4 million a year, to provide a proportion of the funding for the MRC Units in The Gambia and Uganda.

(iv) percentage allocated to collaborative programmes with research councils

<table>
<thead>
<tr>
<th>Financial Year</th>
<th>Total Collaborative Programmes with Research Council expenditure</th>
<th>Percentage of the Central Research Spend</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005–06</td>
<td>7,703,889</td>
<td>7.8%</td>
</tr>
<tr>
<td>2006–07</td>
<td>15,010,369</td>
<td>13.6%</td>
</tr>
<tr>
<td>2007–08</td>
<td>17,006,419</td>
<td>13.1%</td>
</tr>
<tr>
<td>2008–09</td>
<td>17,949,430</td>
<td>14.3%</td>
</tr>
<tr>
<td>2009–10</td>
<td>18,885,470</td>
<td>10.7%</td>
</tr>
</tbody>
</table>

(v) figures for each research or policy area.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth</td>
<td>£2.59m</td>
<td>£3.3m</td>
<td>£4.07m</td>
<td>£7.31m</td>
<td>£7.20m</td>
</tr>
<tr>
<td>Agriculture</td>
<td>£38.63m</td>
<td>£35.99m</td>
<td>£38.33m</td>
<td>£40.60m</td>
<td>£61.16m</td>
</tr>
<tr>
<td>Governance</td>
<td>£12.18m</td>
<td>£11.42m</td>
<td>£16.97m</td>
<td>£15.68m</td>
<td>£13.39m</td>
</tr>
<tr>
<td>Climate Change</td>
<td>No sep. budget</td>
<td>£5.88m</td>
<td>£7.87m</td>
<td>£3.08m</td>
<td>£9.32</td>
</tr>
<tr>
<td>Human Development</td>
<td>£39.45m</td>
<td>£43.95m</td>
<td>£53.23m</td>
<td>£47.66m</td>
<td>£72.14m</td>
</tr>
<tr>
<td>Research Uptake</td>
<td>£5.24m</td>
<td>£9.12m</td>
<td>£9.23</td>
<td>£11.01m</td>
<td>£11.60m</td>
</tr>
<tr>
<td>Short-term Policy Research</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>£1.1m</td>
</tr>
</tbody>
</table>
PRIORITISATION PROCESSES

2. What is the role of your departmental Chief Scientific Adviser in the process of setting research priorities? What grade is he?

The DFID Chief Scientific Adviser is also the Director of Research so he has a central role in setting our research priorities. He has oversight of delivery of the DFID research strategy and is responsible for all new research scoping and tenders. He oversees the commissioning of all new research and personally authorises all of the larger (over £5 million) research projects of the department. He is Senior Civil Service (SCS) Grade 3 (Director). For context, from April 2010, DFID will only have three Director Generals (DGs) (Grade 2), one of whom will be the DG Policy, Research and International.

3. Who is present at meetings at which departmental budgets are discussed? In particular, who represents the research and development element of the department’s budget at such meetings?

The current budget of £1 billion for research over the five years from 2008–13 was agreed in 2008. An annual figure of £220 million a year for the research necessary to deliver on the ambition of our Research Strategy was estimated by the former Chief Scientific Adviser (Sir Gordon Conway) and Head of Research (Paul Spray) in a joint paper. This was reviewed and agreed by the DFID Management Board, where Research was represented by the Director General of Policy and Research (currently Dr Andrew Steer), who represents research at Management Board level. It was signed off by DFID Ministers.

4. To what extent does the department follow the best practice outlined in the Government Office for Science’s report on Science and Engineering in Government for the use of science in Government? What interaction do you have with other departments on best practice for setting R&D priorities and encouraging innovation?

The key points for DFID in the analytical framework, used for the review and monitoring of the management and use of science and engineering in Departments, and which will form a key part of the Science Assurance Programme (under which DFID is due to be reviewed in 2010), are:

(i) Strategy, policy making and delivery should be effectively informed by science and engineering.

(ii) Individual departments should take a strategic approach to the prioritisation, accessing, resourcing and delivery of science and engineering.

(iii) All science and engineering used by government should be robust, relevant and high quality.

(iv) Science and engineering should be made publicly available unless there is a clear justification for not doing so.

(v) Government should ensure effective knowledge transfer, innovation and pull through of its research to the economic development of new technologies and services.

(vi) Departments should ensure that they have the science and engineering capacity and capability to manage the above sustainably and effectively.

EXTENT TO WHICH DFID FOLLOWS THE GUIDELINES

Generally we have a positive story. Some key areas are more advanced than others, for example our work in getting research into use and making research available, where we have listened to the results of the extensive consultation conducted in developing the new Research Strategy to make improvements across our portfolio. The Chief Scientific Adviser and Chief Economist (DFID’s senior analyst) both sit on the Development Committee which is responsible for setting DFID’s key policy priorities. The Director General of Research and Policy is part of the DFID Management Board (as recommended by the GCSA).

(i) Strategy, policy making and delivery should be effectively informed by science and engineering: this was recognised as an area where we needed to make some improvements. DFID has therefore combined the roles of Director of Research and Chief Scientific Adviser (Prof Christopher Whitty) and successfully recruited a Deputy Chief Scientific Adviser (Prof Tim Wheeler), who will start this month (Feb 2010). Both remain research-active in science and part-time professors at their Universities. Alongside this there has been a restructuring of the policy and research teams and they have been co-located to ensure there is active read across between the two. The Development Committee, on which the Chief Scientist sits, reviews all major new policy initiatives for the Department and provides a check that DFID’s key strategy, policies and delivery agendas are properly evidence based.
(ii) Individual departments should take a strategic approach to the prioritisation, accessing, resourcing and delivery of science and engineering. In 2007 we undertook a year long exercise to determine on what, and how, DFID should spend its research money. This involved an evaluation of our previous funding framework, a review of DFID’s international comparative position in relation to other research funders, and a review of research communications. We talked directly to over 1000 users and producers of research, held face-to-face discussions in seven developing countries, and received over 750 replies to an electronic survey. We asked twelve international funders of research, UK government departments and research councils, together with colleagues in DFID how we could use research better to tackle development challenges.

(iii) All science and engineering used by government should be robust, relevant and high quality. Each spending project is monitored on an annual basis and scored on a five point value for money scoring system for its likelihood of meeting its objectives. Key management and technical recommendations are identified in the annual reviews which are then followed up by the project team over the next year. Off track objectives in particular are closely monitored, as are any projects that are judged to be underperforming. Each project is risk assessed and all risks to successful completion are reviewed annually. These scores are aggregated to give an overview of the effectiveness of our portfolio as a whole.

Over the last year we have worked with Oxford Policy Management to develop a results framework of eleven overarching indicators to monitor progress against the four key results areas in the Results Matrix of the Research Strategy. We recognise that it is not easy to measure the impact that specific research results have on development in a rigorous way, however we are establishing a system that will help us make overall judgements on the effectiveness of our research spend and which will allow us to learn lessons from our research regarding how to make a real difference to peoples’ lives over the long term.

Last year we recruited fifteen Senior Research Fellows (SRFs) to work with our research and policy teams. These academics bring an external perspective to our research agenda. Some, but not all, are scientists; examples are Prof Wendy Graham and Declan Conway. SRFs exercise both a challenge function, helping to ensure our research is robust and of high quality, and provide a window onto the research done by others helping to ensure we remain an intelligent user of and interlocutor on cutting edge science. All research is commissioned with a view to delivering on the objectives of our Departmental Research Strategy.

(iv) Science and engineering should be made publicly available unless there is a clear justification for not doing so. DFID is already well in line with this recommendation. All DFID funded research, past and present, is publicly available through the Research for Development (R4D) portal.

(v) Government should ensure effective knowledge transfer, innovation and pull through of its research to the economic development of new technologies and services. This is an area where we are working to improve to meet best practice guidelines. Research into Use is a key part of our forward strategy and built into the design of all our projects and programmes. Up to a third of budgets are used in research dissemination using different channels to get research to key audiences. Evidence Brokers have been recruited to strengthen our capabilities in this area and we are looking to establish an overseas presence, initially in India, to strengthen our research dissemination and our engagement with in-country stakeholders.

An Innovation Procurement Plan, in line with BIS guidelines, is currently being produced (this plan is a Procurement Department lead and was published in December 2009).

(vi) Departments should ensure that they have the science and engineering capacity and capability to manage the above points sustainably and effectively. We have recognised that increasing the research budget needed to be underpinned by increasing our capacity and capability. In addition to recruiting Senior Research Fellows and Evidence Brokers, we have also significantly increased the human resources available within our Research and Evidence Division. A number of staff in DFID research are still actively engaged in research and thus keeping up to date with advances in their own fields.

What interaction do you have with other departments on best practice for setting R&D priorities and encouraging innovation?

In addition to the on-going coordination of strategy development and existing and new collaborative projects undertaken at all levels with other government departments (including FCO, MOD, DECC, DEFRA, DGLC, DH) and research councils on a bilateral basis, there are regular meetings attended by the Chief Scientific Adviser/Director of Research of the Chief Scientific Advisers Committee and its Core Issues Group (monthly), the Global Science and Innovation Forum (twice yearly) and the UK Collaborative on Development Science (quarterly). All groups are supported by Core Officials Groups. There are also regular theme specific Funders Forum meetings, attended by officials from a range of departments. For instance, the Health Funders Forum meets twice a year and includes officials from Medical Research Council (MRC), Economics and Social
Research Council (ESRC), Dept of Health, DFID and Wellcome Trust. Representatives from other Government Departments also attend if issues of joint interest are discussed.

The Chief Scientific Advisers Committee (CSAC), chaired by Professor Beddington, provides a forum through which all government Chief Scientific Advisers meet to discuss issues relating to science and engineering across government and, in particular, to:

- provide collective advice to Ministers,
- discuss and facilitate the implementation of policy on science and engineering,
- identify and promulgate good practice on science and engineering, including their use in policy making; and
- facilitate communication on high profile science, engineering and technology issues and those posing new challenges for government.

The CSAC Core Issues Group, initiated by the Government CSA, provides a smaller committee that can identify and drive progress on key issues to which CSA’s acting jointly can expect to add value (an example of which was the CSA’s collective engagement with the Gallagher Review of Biofuel’s sustainability).

The Global Science and Innovation Forum (GSIF) is a vehicle for cross-government exchanges of information and ideas to improve co-ordination of the UK effort in international science and innovation collaboration. It provides strategic guidance and systematically scans the horizon for new and emerging issues. Its terms of reference are:

- To monitor implementation of the overarching UK strategy for international engagement in science and innovation, to update it and develop new recommendations where necessary.
- To provide advice on cross-governmental issues relating to the strategy, where there is a clear need for coordination in order to inform UK government policy and/or UK positions in international negotiations.
- To review UK activities with focus countries in line with the strategy, and where necessary provide advice on further coordination or new activities needed.
- To consider the implications of new evidence and trends relating to the UK’s international science and innovation engagement, including evaluations of the various schemes to support this engagement.

GSIF’s membership is drawn from BIS, UK Trade and Investment, FCO, Defra, British Council, Royal Society, Royal Academy of Engineering, British Academy, Research Councils UK, DH, Home Office and HMT).

IFORD (The International Forum of Research Donors) is a network of international research funders that share a mandate to support research-for-development. IFORD is a platform for mutual engagement and for building partnerships while facilitating systematic learning and horizon-setting on development research funding. It meets annually and is represented by participants from foreign ministries private foundations and development organizations.

We also have close interactions with the BIS/FCO Science and Innovation Network in Delhi, Beijing and Washington.

5. Do your department’s Public Service Agreements require you to demonstrate that your policies are sufficiently evidence-based, and that you have robust mechanisms in place to commission research to underpin these policies?

There is no requirement for this, but DFID aims to make sure this is practice anyway.

6. To what extent, and how, does your Science Advisory Council advise on your research strategy and priorities?

Although the Department for International Development (DFID) does not have a Scientific Advisory Committee or any plans to create one, we are in the process of establishing an external Research Advisory Group, which will provide strategic advice and support to DFID’s Chief Scientific Adviser/Head of Research. We expect to have this in place soon. We already have an internal Research Committee, comprising the Director General of Research and Policy, the Director of Research and Chief Scientific Adviser, the Director of Policy and Chief Economist, which advises on all large and innovative research proposals.
Are your R&D priorities externally peer-reviewed?

Yes, although the mechanism varies depending on the type of call. For example, when funding grants, DFID directly invites interested organisations to submit requests for funding through a two stage process. In the first stage, short expressions of interest are received and reviewed by up to three internal reviewers, with a range of research, policy and communications experience. Successful bidders are then invited to submit full proposals. These full proposals are judged by a panel of reviewers including at least one independent external reviewer. DFID also asks for a full and independent scientific assessment of each proposal by up to two internationally recognised experts working in the field and experts in research uptake and communications. Criteria for judgement are published at the time of calls for proposals and normally include the following broad categories: technical/scientific quality and effectiveness; alignment with DFID strategy; an immediate need for DFID funds; Institutional effectiveness and governance mechanisms; impact on poverty and health for people in developing countries and value for money.

In other situations we make use of the peer-review processes of those we co-fund with, especially the UK Research Councils. Examples are the recently launched second DFID and Economic and Social Research Council joint fund for research on poverty reduction. The new scheme (£23 million) aims to enhance the quality and impact of social science research. The scheme has a rigorous process for grant selection. All applicants have to cover specific criteria within their application including clearly articulated research questions, appropriate methodology, excellent programme management, strong partnerships and capacity building. In addition, an impact plan must be submitted which sets out who will benefit from this research, how they will benefit from this research and what will be done to ensure that they have the opportunity to benefit from this research.

A pool of independent peer reviewers grade applications on the basis of academic quality. The highest graded applications (roughly 50 to 60) will then be taken forward for formal review by members of the commissioning panel.

The panel contains both high ranking academics and user members, the latter having the specific task of commenting on the relevance and potential impact of research proposals. The appointment of peer reviewers, panel members and the panel chair has all had significant input from senior staff in DFID.

BBSRC Example of Full Peer Review

DFID and BBSRC have a strategic partnership to support joint funding of new research programmes that aim to enhance the quality and impact of research addressing the goals of sustainable agriculture, improved natural resource management and food security in both the developed and less developed world. The relationship is guided by a strategic framework that builds on BBSRC’s proven expertise to identify and support high quality basic, strategic and applied research and DFID’s proven expertise to carry out pre-commercial research and development work in the poorest countries of the world.

DFID and BBSRC currently jointly provide a total of £16.5 million for two research initiatives designed to combat infectious diseases of livestock and the protection of crops against pests, diseases and harsh environmental conditions in the developing world. All research projects have to meet criteria to ensure the scientific quality of the research and its development relevance. All proposals submitted are reviewed by investment committees composed of respected scientists and development experts.

Similar arrangements exist for work funded through MRC and NERC.

Review Processes

7. What criteria does your department use to assess its research investments; and how is their impact measured?

We conduct annual reviews for programmes greater than £1 million, mid-term reviews of projects, portfolio reviews by teams and internal audit of research management processes recently established within RED. Annual reviews use the goal, purpose, indicators and risk rating of the research project known as a logical framework as criteria for assessment. The logical framework is designed at the outset of the research and may be adapted at each review.

The DFID Research Strategy 2008–13 sets out the Results Matrix against which DFID’s investment in Research will be measured. High level indicators for each of the Results Areas have been developed, against which DFID funded research programmes are required to report, on an annual basis.

Additional in-depth evaluations, including post-hoc evaluations and case studies are/will also be commissioned. It is not easy to measure the impact that specific research results have on development in a rigorous way, however we are establishing a system that will help us to learn lessons from our research and
how to make a real difference to peoples’ lives over the long term. Evaluation systems are designed to take a long term view—as impacts may not be evident for many years after a research programme has ended.

Previous evaluation of the 10 year Rural Natural Resources Research Strategy (RNNRS) recommended focusing on getting the best of the scientific technologies developed into use. This is now being implemented through our £37.5 million Research Into Use programme which is scaling up 280 research outputs.

Evaluation of the previous research funding framework reviewed DFID’s international comparative position in relation to other funders and examined DFID’s research communications. This informed the development of the current 2008–13 Research Strategy.

**Measurement of Impact; Rates of Return**

DFID commissioned a piece of research in November 2005 to examine the international evidence for rates of return to development research. Among the key findings were:

- The existence of a robust, positive relationship between spending on R and D and economic growth;
- Evenson et al (2001), African agriculture rate of return of 27 percent for extension services and 37 percent for applied research.
- A recent finding by Mansfield: worldwide social rate of return of 28 percent for publicly funded health research: health vaccines etc likely to have major benefits
- WHO: central role of health investments in promoting economic growth and poverty reduction; economic returns of $3 or more for every health dollar spent, assuming an ideal policy and implementation environment.

Example: an evaluation of the Consultative Group on International Agricultural Research (which we have enclosed as an example of an independent review) found that for every dollar invested by CGIAR since 1971 a further $9 worth of additional benefits had been produced in the developing world.

In health, the cost effectiveness ratios of subsidised drug and vaccine development compare favourably with existing interventions in terms of dollars per disability adjusted life year averted (DALY)—equivalent to insecticide treated bednets or HIV voluntary counselling and testing programmes. Investing in PDPs is cost effective and compares well to other interventions (DALY).

That being said, we acknowledge that measuring output is easier than impact, especially for research which can have a long lead-time to have its effects. We are trying however, by sharing methodologies with other funders of development research.

8. Please could you provide the Committee with copies of some of your independent reviews of impact referred to by Dr Steer in his response to Q125?

Seven independent reviews from across our themes have been forwarded to the Committee. These are:

*Human Development*
1. International Partnership for Microbicides
2. International AIDS Vaccine Initiative

*Growth*
3. Improving Institutions for Pro-Poor Growth.

*Governance, Conflict and Social Research*

*Sustainable Agriculture*
5. Review of the CGIAR (This was commissioned by members of the CGIAR, we estimate we paid 30 per cent of the cost, and a Senior DFID Adviser was on the independent advisory panel, and along with the Executive Committee selected the consultants).

*Research Uptake*
6. Global Development Network, Output to Purpose Review
7. Makutano Junction Mid Term Review

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*“Rates of Return to Research: A Literature Review and Critique”, Enterplan in association with ODG-DEV and CEG, November 2005.*
CROSS-GOVERNMENT WORKING

9. To what extent might the UK Collaborative on Development Sciences provide a useful model for collaboration and coordination for other departments or between departments?

UKCDS is a very useful model for coordination on research. It brings together the key UK funders and stakeholders who provide support for the development sciences research base. Its membership includes important partners such as government departments (DECC, Defra, DH, DfT, FCO), the heads of Research Councils (BBSRC, ESRC, EPSRC, MRC and NERC), the Wellcome Trust and the Scottish Government.

Therefore the Collaborative provides a framework for a better coordinated approach to development sciences research in the UK, for the purpose of increasing its relevance and impact for national and international policies, and activities aimed at sustainable improvements in the lives of the world’s poorest people. Its primary focus improves information sharing between its members to increase the impact of their individual efforts.

Whether it would work as well in other areas of Government is a more difficult question. International Development research is an area with a particularly wide range of skills and stakeholders making co-ordination much more attractive than where only one department is the key lead.

SUPPORTING INNOVATION

10. To what extent, and how, does your department’s research and development investment support applied research in the industries that the department draws on to support policy? What mechanisms, such as procurement, or the Technology Strategy Board, are and should be involved?

Our biggest contribution is in drug development through Product Development Partnerships, which are collaborations between industry, academia and public funding. This has been very successful in a number of areas. It is however a mechanism which is designed for new technologies, and only a small proportion of the problems DFID aims to address have purely technological solutions. We are exploring whether this mechanism might also be successful in low-carbon and local power generation technology.

We do not currently work with the Technology Strategy Board (TSB). The International Development Act means that we cannot aim selectively to benefit UK industry, but DFID is in principle strongly in favour of tapping into the innovative power of the private sector, including through innovative funding mechanisms such as advance market commitments. We have had discussions with colleagues involved in some of the specific TSB calls and do encourage partners to explore opportunities offered through the TSB calls.

11. How does DFID signpost its research needs to alert academia and industry to new funding opportunities and encourage competition between proposers.

We strongly believe that in order to get the best quality and best value research, we need wide competition. We are therefore advertising widely, not only in the UK but also overseas. For example, a recent call jointly with ESRC was launched in India as well as the UK. In addition to advertising all calls on our R4D website, we advertise major calls in the leading specialist journals, and through networks such as the Development Studies Association in the UK, and for joint calls with Research Councils though RCUK offices overseas.

February 2010

Memorandum by the Environment Agency

SUMMARY

The Environment Agency welcomes the opportunity to submit evidence to the House of Lords Science and Technology Committee inquiry into the setting of science and technology research funding priorities.

Our main points are:

— The Environment Agency uses a variety of methods to deliver the maximum value for money from our investment in research.

— We have an increasing need to work with external research providers.

— UK research funding should support and reward inter- and multi-disciplinary research, the transfer of knowledge and its translation into useful outputs for policy makers and end users.
1. **Introduction**

1.1 This is the Environment Agency’s response to the Select Committee’s call for evidence on setting science and technology research funding priorities. It outlines how we allocate our own funds for research and provides examples of how we have collaborated with Defra and other public sector funders of environmental research. It highlights the need for a funding model that supports knowledge transfer and interdisciplinary research to provide the incentive and skills to support policy and regulatory bodies and other end users.

1.2 The Environment Agency for England and Wales is a Non-Departmental Public Body responsible to the Secretary of State for Environment, Food and Rural Affairs and an Assembly Sponsored Public Body responsible to the National Assembly for Wales. Our principal aims are to protect and improve the environment, and to promote sustainable development.

1.3 The Environment Act 1995 places a duty on the Environment Agency to carry out research and development. It states that the Environment Agency:

> “must make arrangements for carrying out of research and related activities in respect of matters to which its functions relate”.

1.4 The Environment Agency functions as an environmental regulator, an environmental operator and an adviser on the development of environmental policy. Research activity supports the production of the evidence base for these regulatory, operational and advisory roles. The scope of the research covers the breadth of the Environment Agency’s remit, including climate change, flood risk, resource efficiency and integrated catchment management. We also undertake research to improve our approach to regulation and to increase the efficiency of our operational activities.

2. **Allocation of Research Funding in the Environment Agency**

2.1 Our Corporate Strategy dictates our high level research priorities. The allocation of funding for research and prioritisation of research activity is overseen by Environment Agency Directors. This ensures alignment with our strategic direction. Research is delivered over a range of timescales, using a variety of mechanisms, from in-house reviews by our own scientists, to contracted work and EU-funded projects. Longer-term work tends to be delivered in collaboration with others.

2.2 The Environment Agency has very broad research needs that overlap with many other organisations in the UK, Europe and internationally. We recognise that we cannot, and should not, deliver all the research we need on our own, and we have always actively sought to develop collaborations and to participate in research co-ordination initiatives.

3. **How are science and technology priorities co-ordinated across Government?**

3.1 The Environment Agency’s Director of Evidence liaises closely with counterparts in the Department of the Environment, Food and Rural Affairs (Defra), Natural England, the Scottish Environmental Protection Agency (SEPA) and others to define shared evidence needs and research priorities. Our Director of Evidence sits on Defra’s Evidence Programme Board. We are providing input to Defra’s Evidence Investment Strategy and seeking to expand our existing collaboration with Defra.

3.2 A successful example of the existing collaboration between the Environment Agency and Defra is the joint Flood and Coastal Risk Management research and development programme. This long-running collaboration was initiated in 1999. The overall objective of the programme is to develop the evidence, methods and tools required to underpin sustainable flood and coastal erosion risk management policy, process and delivery through the provision of leading-edge science and development of good practice.

3.3 The programme has four research themes that are led by either Defra or the Environment Agency depending on their respective business interests. Work within any theme can be funded and managed by either organisation. In 2007–08 the programme had a research budget of £4.2 million, funded by £1.6 million from Defra and £2.8 million from the Environment Agency.

3.4 The Environmental Regulation Programme, managed by the Scottish and Northern Ireland Forum For Environmental Research (SNIFFER), is an example of research co-ordination between the UK’s environmental regulators. The Environment Agency became a member of the programme steering group in 2008, joining SEPA and the Northern Ireland Environment Agency. The remit of the programme covers the UK environmental regulators’ interests on climate change, better regulation, sustainable resource use and environmental strategy.
3.5 We have been involved in a number of co-funding and collaborative initiatives with Research Councils. For example we are collaborating with the Engineering and Physical Sciences Research Council (EPSRC) and others in the Flood Risk Management Research Consortium; we set up the Environmental Nanosciences Initiative (ENI) with the Natural Environment Research Council (NERC) and Defra; and we are part of the NERC-led Environment and Human Health Programme. We are looking at other opportunities to work together with the Research Councils on thematic programmes but also on their knowledge transfer initiatives.

3.6 The formation of the Environment Research Funders Forum (ERFF) in 2002 brought together environmental research funders in the UK and assisted the co-ordination of research. The ERFF has 19 members including Government departments, regulators and Research Councils.

3.7 The activities of the ERFF support a more strategic approach to co-ordinating the work of public sector research funders. For example, it has been successful in developing the first overview of the UK’s environmental research portfolio. It has developed the thinking on the interface between science and policy and is actively lobbying the Higher Education Funding Council for England on the end-user value aspect of the proposed Research Excellence Framework. However, the level of engagement of the various members with the ERFF is variable. A formal requirement for research funders and Government bodies to play an active role in fora of this type may be needed if they are to realise their potential and increase the level of co-ordination of research funding.

3.8 Collaborative initiatives such as “Living With Environmental Change”, (which has its origins in the work of the ERFF) offer the potential to address gaps in research needs, particularly those defined by policy and regulatory end-users such as Defra and the Environment Agency. But the ability to fill these gaps is dependent on adequate funds being available and the relative priorities of the relevant organisations. We are a member of the “Living With Environmental Change” and have taken an active role in shaping its early direction.

4. **Balance of funding for targeted versus response-mode research**

4.1 We recognise the value of response-mode research, and the role that it has in innovation. The potential benefits and beneficiaries of response-mode research should be considered from the outset. We would also like to see greater emphasis on targeted, end-user focused research. Target-driven research requires a good understanding of the challenges, required outputs and intended outcomes. End-users (eg Government policy-makers, regulatory bodies, etc.) have a responsibility to articulate their needs and commit quality time to the translation and uptake of research outputs. We are working with individual Research Councils to develop improved mechanisms for interacting with them at the research planning stage. We would welcome a co-ordinated approach by Research Councils to end-user engagement.

4.2 Environmental issues and challenges cross the boundaries of scientific disciplines. Future funding models need to encourage increased working across theses boundaries. Cross-Research Council initiatives are being undertaken (eg the Rural Economy and Land Use Programme), but more are required. There is also a need for capacity-building to develop a new breed of researchers adept at taking on challenges that are cross-cutting and require multi-disciplinary skill sets.

5. **Conclusion**

5.1 The Environment Agency uses a variety of methods to deliver the maximum value for money from its investment in research. We have an increasing need to work with external research providers. We believe UK research funding should support and reward inter- and multi-disciplinary research, the transfer of knowledge and its translation into useful outputs for policy makers and end users.

*September 2009*

**Memorandum by the Joint Nature Conservation Committee**

The Joint Nature Conservation Committee (JNCC) is the statutory adviser to Government on UK and international nature conservation, on behalf of the Council for Nature Conservation and the Countryside, the Countryside Council for Wales, Natural England and Scottish Natural Heritage. Its work contributes to maintaining and enriching biological diversity, conserving geological features and sustaining natural systems. In delivering this role, JNCC helps to identify research requirements and uses evidence from a wide range of sources, including JNCC’s own programmes, to provide scientific and technical advice to government.
1. **What is the overall objective of publicly-funded science and technology research?**

1.1. A significant element of publicly-funded science and technology research should be designed to address requirements for developing and informing effective government policy and by so doing be of benefit to society more widely. An appropriate balance between targeted research and more basic responsive mode research should therefore be maintained. In the UK this critical balance is primarily determined through the sum of weakly coordinated research funding strategies across various public sector bodies and as such might not be optimal for achieving societal benefits.

2. **How are public funds for science and technology research allocated? Who is involved at each level and what principles apply? Where appropriate, is the Haldane Principle being upheld?**

2.1. Major funders of environmental science, including government departments and research councils, allocate funds in accordance with their strategic objectives, which are typically developed through consultation with relevant sectoral advisory bodies and organisations. The Research Councils govern their own processes for the allocation of research funds and as such the Haldane Principle is being upheld. The independence of Research Councils to determine research funding priorities should not however preclude them from funding research to directly support government requirements and should not prejudice decisions on the balance between targeted and responsive mode research.

2.2. JNCC directly advises relevant government departments on the funding of biodiversity related science relating to its statutory functions and strategic objectives. We also contribute to several bodies that advise government and research councils on funding of biodiversity and environmental research, including *inter alia* the Global Biodiversity Sub-Committee (GBSC) of the Global Environmental Change Committee, UK Biodiversity Research Advisory Group (UK BRAG), the Marine Science Coordination Committee (MSCC) and the UK Marine Monitoring and Assessment Strategy (UKMMAS), the Overseas Territories Environment Programme Assessment Panel, a recently constituted steering group on biodiversity research in the UK Overseas Territories and the Darwin Advisory Committee (ex-officio).

3. **Are existing objectives and mechanisms for the allocation of public funds for research appropriate? If not, what changes are necessary?**

3.1. Existing objectives and mechanisms are neither adequate for determining the strategic direction of research nor for determining the correct balance between targeted and basic research. Effective mechanisms are also needed to ensure that targeted research remains relevant and useful to the policies it aims to support. Public bodies that have an understanding of both the policy requirements for research and the interests of the researchers, could usefully be given increased responsibility for improving the coherence of research funding strategies and improving the policy relevance and policy uptake of targeted research. This is required at national, European and global level and would have the added advantage of generally increasing the influence of science within policy setting and decision taking at all geographic scales.

3.2. Mechanisms and objectives for assessing research proposals and allocating research funds according to agreed priorities and funding strategies are very effective and well tested but they might need to be reviewed if changes are made to the ways that strategic research priorities are set and if more targeted research is required within responsive mode funding programmes.

3.3. In order to facilitate increased funding of targeted research within responsive mode programmes greater emphasis needs to be placed on assessment criteria that are related to societal benefit. The “Formas” research council in Sweden funds both basic and targeted research but all proposals are assessed against three societal benefit criteria which have equal weight to the three science criteria. Similar models could usefully be considered within UK research proposal assessment processes.

3.4. Greater understanding, by researchers, of how development and policy objectives translate into research requirements is an essential requirement before more targeted research proposals can feed up into responsive mode research funding programmes. Greater incentives and opportunities for researchers to engage in constructive dialogue with stakeholders and decision makers could greatly assist in this respect.

3.5. If decision makers were more aware of how basic research could be applied in the medium to long term, they could more clearly visualise what the future evidence base might look like and hence guide current processes and policies accordingly. They would also be better equipped to defend cases for supporting basic...
research. One mechanism for raising decision makers’ awareness of the value of basic research could be achieved if all futures work (predictive modelling, scenarios work and horizon scanning) placed more emphasis on interpreting its conclusions in terms of medium term requirements for research. Involving researchers in futures work of all types would be required to achieve this and would also provide the type of opportunity for researchers recommended in para 3.4.

3.6. Increasingly, society needs integrated solutions to its problems. For example you cannot take measures to address climate change without consideration of the effect these measures might have on the economy, food security, land-use, rural communities, poverty alleviation and other countries. Because solutions need to embrace all of these different issues, the supporting research also needs to encompass all of the related disciplines. Multi-disciplinary research is usually more directly relevant to achieving societal benefits yet often disadvantage development by current research assessment procedures that above all else are based on excellent science. Obviously excellence is harder to achieve across many disciplines than just one so new ways of assessing multi-disciplinary research proposals on an equal footing to other research proposals are needed.

4. What governs the allocation of funding for Government policy-directed research through Government departmental and agency initiatives? Are existing mechanisms appropriate? What is the role of Departmental Chief Scientific Advisers?

4.1. In the environmental sector, government departments and agencies typically have research (evidence) strategies. However, some strategies may not be sufficiently developed to provide an adequate framework for identifying detailed research needs (implementation plans underpinning research strategies are often lacking). Another weakness is the periodicity with which such strategies are reviewed and refreshed; in some cases reviews might have been undertaken, but the findings not clearly communicated through change to strategies or implementation plans/research agendas. Linkages between discrete horizon scanning activities and research strategies may also benefit from strengthening. One factor influencing effective allocation is coordination between the countries of the UK, reflecting partly on the efficacy of some of the advisory bodies; coordination activities could be strengthened significantly.

5. How are science and technology research priorities co-ordinated across Government, and between Government and the relevant funding organisations? Who is responsible for ensuring that research gaps to meet policy needs are filled?

5.1. A number of coordination bodies exist to aid government and non-government organisations to prioritise funding allocation. The whole research community, including industry, should be responsible for ensuring that policy relevant research is being undertaken, but this depends on effective analysis and communication of policy needs, which could be strengthened in the environmental sector. The suggestions for improvements to mechanisms suggested in section 3 all help to strengthen coordination of research priorities.

6. Is the balance of Government funding for targeted versus response-mode research appropriate? What mechanisms are required to ensure that an appropriate and flexible balance is achieved? Should the funding of science and technology research be protected within the Research Councils or Government departments? How will the current economic climate change the way that funds are allocated in the future?

6.1. The delicate balance between targeted research and responsive mode research needs to be dynamic according to prevailing national and global circumstances. The current global economic crisis coincides with unprecedented pressures on the environment caused by climate change, competing land use demands, food security issues etc. and a growing awareness of the critical need to safeguard vital ecosystem services. Excellent responsive mode research has played a prominent role in helping to identify and raise awareness of these issues but now solutions are needed, so the balance needs to swing towards targeted research in the short to medium term. The divide made in the question between research councils and government departments is false. Both research councils and government departments are both capable of funding responsive and targeted research according to their own requirements.

7. How is publicly-funded science and technology research aligned and co-ordinated with non-publicly funded research (for example, industrial and charitable research collaborations)? How can industry be encouraged to participate in research efforts seeking to answer societal needs?

7.1. Some of the research advisory bodies in the environment sector include membership by non-government organisations, both biodiversity conservation charities and industry. These bodies can help avoid overlap in spending and improve shared understanding of objectives across sectors; they can also foster important collaborations. There are several examples of effective coordination bodies, which could be examined as models for creating or strengthening links between government and industry in responding to societal needs:
the Atlantic Frontier Environment Network, now superseded, was a good example of how (the hydrocarbons) industry can effectively engage with government to meet societal challenges—its success was due to clear objectives and targets, and adequate funding for effective operation.

7.2. Much of JNCC’s marine research on seabirds both within the UK and its Overseas Territories (Falkland Islands) has traditionally been undertaken in collaboration with industry (hydrocarbons).

8. To what extent should publicly-funded science and technology research be focused on areas of potential economic importance? How should these areas be identified?

8.1. If more targeted research is funded it will inevitably include more research of potential economic importance. Economic gains are one of several ways society can benefit from research but economics should not necessarily be seen as of higher priority than other forms of societal benefit such as those that stem from the environment, health and well being, cultural/aesthetic values etc.

9. How does the UK’s science and technology research funding strategy and spend compare with that in other countries and what lessons can be learned? In this regard, how does England compare with the devolved administrations?

9.1. The comparison between England and devolved administrations is very difficult to make because of the distortions caused by the large percentage of research funding provided by the research councils, all of which are UK level institutions.

September 2009
Background on the Food Standards Agency

1. The FSA is a non-ministerial Government department set up in 2000 under an Act of Parliament\(^1\) to protect the public’s health and consumers’ other interests in relation to food.\(^2\) It is governed by an independent Chair and non-executive Board responsible for overall strategic direction of the Agency and to ensure it meets its legal obligations. It is accountable to the British Parliament, the Northern Ireland Assembly, the Scottish Parliament and the National Assembly of Wales through Health Ministers.

2. The Agency has a wide remit for microbiological and chemical food safety across the whole food chain, “farm to fork”. It shares responsibility for nutrition with UK health departments and has a particular role in helping consumers achieve and maintain a healthier diet. It also has a role in ensuring consumers have the information they need to make informed and effective choices about the food they eat, including protection from food fraud and illegal practices.

3. The Agency’s vision is “Safe Food and Healthy Eating for All”, underpinned by our core values of: Putting the consumer first; Openness and transparency; Science and evidence based.

Overview of Agency R&D Programmes—Objectives and Breadth of Portfolio

4. As a science and evidence based organisation, the Agency funds R&D for a number of reasons, including:

(a) where there are gaps in the evidence base, to help support development and implementation of its policies

(b) to ensure Agency advice has a sound evidence base

(c) to ensure the UK has a sound negotiating position to inform development of EU provisions in areas within the Agency remit

(d) tracking/monitoring the safety and composition of the food we eat and progress towards the Agency’s strategic targets

(e) to ensure Agency staff (of which about 46 per cent have a science qualification) maintain and develop their scientific knowledge and skills.

(f) to provide a locus for interaction with other research funders to help develop partnerships

5. The Agency has a broad portfolio of about 50 research and survey programmes in the following thematic areas:

(a) Food safety eg chemical contaminants, chemical risk assessment, food allergy and food intolerance, meat hygiene, microbiological safety, Transmissible Spongiform Encephalopathies (TSEs), radioactivity in food;

(b) Eating for Health eg diet and health, food acceptability and choice, dietary surveys, consumer awareness;

(c) Choice—eg food additives, Novel and GM foods, Food labelling, food authenticity; and

(d) How We Deliver eg economics, Food Law Enforcement, improved methods of analysis, social sciences research.

Social sciences based research is also a key component of various pieces of work across the thematic areas.

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\(^1\) The Food Standards Act 1999.

\(^2\) As defined in the Food Safety Act 1990.
AGENCY PRIORITISATION AND COMMISSIONING

6. The Agency commissions all of its R&D externally, through open competition. It typically spends about £20 million pa (which equates to about 17 per cent of its overall budget) across its portfolio. This work is largely applied research generated to answer specific research questions relating to evidence needs, though in some areas where the issues are more complex, (eg in relation to diet and health and food allergy), the Agency is additionally funding more fundamental work.

7. The Agency’s R&D spend is discussed and prioritised within its annual business planning procedures. These are operated within the context of the Agency’s Strategic Plan and Science Strategy. A multi-criteria based decision support tool has been developed to assist the Agency in its discussions on R&D priorities across its portfolio.

8. As well as the Strategic Plan and Science Strategy, there is a range of other sources of information which help the Agency identify research needs, including:

   (a) Workshops and reviews of the Agency’s (and other funders’) work
   (b) The Agency’s independent Scientific Advisory Committees
   (c) Results of other research (Agency or otherwise)
   (d) UK and EC policy developments
   (e) Ideas/co-ordination with other funders
   (f) Horizon scanning

9. To provide the Agency with the necessary flexibility of operation, the overall spend on R&D is not ring fenced. It is addressed as part of the consideration of the balance of programme activities required to deliver the Agency Strategic Plan objectives, within the context of the financial constraints of the settlement already agreed with Treasury. This is a process within which the Agency’s Chief Scientific Adviser (CSA) is fully engaged as he also is a full member of the Agency’s Executive Management Board. As CSA he is accountable to the Agency’s independent Board for delivery and development of the science and scientific skills required by the Agency’s business. In this role, he is advised and challenged by the Agency’s independent General Advisory Committee on Science (GACS).

10. Most of the Agency’s programmes are based around the natural and physical sciences, but, as mentioned earlier, increasingly the social sciences are a key component of the Agency’s work. The Agency has a strong team of expertise in economics, statistics, operational research and social sciences which is closely involved in developing its overall science priorities and in helping to develop the specifications for relevant research needs across the Agency’s remit. They are also responsible for developing a programme of underpinning research in these areas. An independent Social Sciences Research Committee has also been appointed to advise on where social sciences research can assist the Agency in developing its evidence base.

11. The Agency’s next Strategic Plan and Science Strategy are now being developed in parallel. Identifying the Agency’s science needs to support the new strategic objectives (and the resources needed) is a key part of the process.

COORDINATION AND PARTNERSHIP WORKING

12. A key part of the Agency’s strategy is (and will continue to be) partnership, including in the area of R&D. In a climate of financial constraints, this assumes an ever greater importance. The Agency already has a significant amount of collaborative funding in place, on projects which have originated within the Agency and those that have originated in other fora (eg EU Framework Programme). In 2008-09, the Agency spent approximately a quarter of its R&D budget in co-funding a range of projects with other funders in the UK, EU and beyond.

Key interactions with other funders

13. The Agency works closely with other research funders in the UK and internationally, to ensure that our work is co-ordinated, and to add value by working together. FSA collaborates with a wide range of bodies in the UK, including other government departments, Research Councils and charities. Key areas of interaction include:

   (a) Funders groups which co-ordinate work in specific priority areas of common interest (eg TSE, microbiological safety, nutrition, nanotechnology).
   (b) Work is co-funded by the Agency under the BBSRC Government Partnership Award Scheme.
(c) Strategic partnership with the ESRC to improve the social science evidence base relevant to the work of the Agency

(d) Engagement with the European Commission, helping to shape priorities in the EU’s Seventh Framework Programme for Research (FP7), and through links with other funders in Europe and internationally—including co-funding of projects where appropriate.

(e) Funding partner in large multi-Agency initiatives such as
   (i) the National Prevention Research Initiative (NPRI)—working with other government departments, research councils and major medical charities to encourage and support research into chronic disease prevention. Its core aim is to develop and implement successful, cost-effective interventions that reduce people’s risk of developing major diseases by influencing their health behaviours.
   (ii) an EU-funded ERA-NET project, SAFEFOODERA, which covers 20 countries and regions across Europe, co-funding projects in food safety from a recent joint call. (ERA NET is an EU Framework mechanism to promote closer working between funding organisations)

(f) The recent Cabinet Office “Food Matters” report included a recommendation relating to a joint research strategy. The Agency is involved in the cross departmental secretariat taking this work forward and expects to be an active partner in meeting the aims of the Strategy.

(g) Dialogue with the MRC, BBSRC, ESRC and others in relation to joint interests in diet and health research, and with BBSRC and Defra in relation to future research needs addressing the issue of how to achieve a significant reduction in Campylobacter (one of the main causes of foodborne illness in the UK) contamination in food.

Challenges of partnership working

14. Key factors here are the diversity of organisational remits, the differing reasons why organisations fund research (policy, development of the research base, economic innovation etc), procedural and administrative issues (eg contracts v grants, the timing and extent of availability in the public domain of outputs, freedom to use outputs for future research/policy development). Based on our experience to date in working with other funders, both in the UK and abroad, these are factors that should not be underestimated in their impact on decision making and speed of action, but which can be worked around. Furthermore, each partnership is different, and so the way in which challenges are met has to be addressed on a case by case basis, with varying resource commitment required (by both parties) depending on the nature of the partnership.

15. In our view it is important to establish some key principles about effective collaborative/coordinated working. If this can be done at the outset, then, with flexibility on all sides, the administrative/procedural means to get there should be more easily dealt with (whether by joint funding (a common pot), co-funding (funders agree to fund specific elements of a proposal) or coordinated funding (funders support separate proposals which are linked by a common aim).

16. In particular, there needs to be agreement on the strategic objectives/outcomes which the funding is expected to address and the (realistic) timescales which apply. Having a “mission orientated” approach and an agreement that funded work will be managed with a clear focus on how the work will deliver against the objectives/outcomes will be key. Within this framework, research providers should be encouraged to have the freedom to follow alternative research routes as the work develops, if there are clear advantages (to delivery of desired outcomes) to doing so and they are able to convince the funding bodies of this.

17. We would also expect that proposals, and the reports of funded work, should be subject to independent peer review, in particular looking at the scientific excellence of the work and its relevance to meeting the objectives/outcomes desired.

18. It is also important that, in particular, a comprehensive report of work which is intended to support and inform policy is placed in the public domain as soon as is practicable. In addition, departments who have contributed to the funding of that work, should not be impeded from making available and using the outputs in the normal course of their business (which may include allowing the work to be used by others in follow up research).

September 2009
Examination of Witnesses

Witnesses: Ms Miranda Kavanagh, Director of Evidence, Environment Agency; Dr Andrew Stott, Science Director, Joint Nature Conservation Committee; and Dr Andrew Wadge, Chief Scientist, Food Standards Agency, examined.

Q142 Chairman: May I say welcome to the three of you. My name is Sutherland and I have the honour to chair this Committee. Two or three purely practical points. One is that there are microphones and this is being recorded. A transcript will be prepared and you will receive copies fairly soon after the session. Of course, that is part of the wider point that this is a public meeting and the transcript will be published as part of our evidence. I hope that is all acceptable and understood. May I thank you for the written responses sent in; they are much appreciated. In a sense, our questions assume that we have been through those, but you may wish to emphasise any specific points. I shall start off with a question in just a moment but for the sake of identifying yourselves for the microphone, could you say who you are and the organisations you represent so that when we pick it up later we will be able to match comments to voices.

Dr Stott: I am Dr Andrew Stott from the Joint Nature Conservation Committee.

Ms Kavanagh: I am Miranda Kavanagh from the Environment Agency.

Dr Wadge: I am Andrew Wadge from the Food Standards Agency.

Q143 Chairman: Thank you very much indeed. I start with a fairly general question but it has a more precise sting in the tail. I would invite you to talk a little bit about the role of your organisation and the relationship with your sponsoring department, something of course that has come under scrutiny recently in much greater detail, for obvious reasons. I would like to go a step beyond that and ask if I could couple with that a more specific question that doubtless will keep echoing throughout the whole session. The context of this inquiry is that everyone expects there to be public sector spending cuts in the not-too-distant future. We hope as the Science and Technology Committee that this will not affect deleteriously scientific and technological research but that would be very hopeful indeed. The question is: if there are cuts and they are not simply X per cent across the board, why should your department or organisation particularly be protected? Would you like to start with just a brief description of the work you do, Dr Stott?

Dr Stott: The Joint Nature Conservation Committee is a committee of the country agencies in England, Scotland, Wales and Northern Ireland—that is, the country agencies with responsibility for nature conservation. Our role with relevance to this inquiry is that we provide evidence and advice to assist the UK Government and the devolved administrations in developing and implementing their domestic and international policies on the protection of natural resources as a part of sustainable development. The evidence that we provide covers biodiversity and geodiversity issues (that is, the earth sciences) which arise in one or more of the component countries in the UK, and which affect UK interests as a whole, but also the overseas territories and Crown Dependencies, and, where appropriate, wider internationally. I am setting that out carefully, because that distinguishes our role from the individual country agencies. We also have a role in disseminating knowledge to foster understanding of these issues. The JNCC is a non-departmental public body, sponsored by Defra and the devolved administrations, so we have a number of sponsors. Our funding comes under two headings. One is to cover the reserved functions, those are the functions reserved by the UK Government from devolution, and the other is co-ordination functions, which are given to us by the country agencies to enable them to co-ordinate their activities. We are a small organisation. Our budget this year is just over £9 million, and we employ around about 135 staff. Without the JNCC the UK would not be able to co-ordinate its position on nature conservation issues. The country agencies themselves are set up to provide advice to their respective devolved administrations, and therefore the UK Government requires a body which can consolidate that evidence and provide advice on a UK basis for those issues that need to be dealt with at a UK level, either because we are a party to an international convention or treaty or because the UK wants to operate at that level.

Ms Kavanagh: The Environment Agency is also a non-departmental public body of Defra. It exists to protect and improve the environment and promote sustainable development. It has three main roles—as a regulator, an operator and an adviser on the environment. It is accountable to the Secretary of State at Defra and also the Welsh Assembly Government and it operates in England and Wales. It is a relatively large organisation. It has a budget of about £1.2 billion, of which about two-thirds comes from Defra and about one-third comes from charging income from regulated industries, and it employs about 12,500 or so permanent employees. Within it we have an Evidence Directorate, which is not evidence in the sense of legal evidence; it is evidence in the sense of everything that we know about the state of the environment, air, land and water quality, all that we know about interventions that one might make in the environment to improve it and to protect it, and whether they are effective or not, and how to
target our resources in the right way to promote the best environmental outcome.

**Q144** Chairman: Two supplementaries. One, do you have a remit in the devolved parts of the country?  
**Ms Kavanagh:** In Wales we do. We do answer to the Welsh Assembly Government.

**Q145** Chairman: Do you liaise with the appropriate body in Scotland?  
**Ms Kavanagh:** We do. We also liaise with the Scottish Environmental Protection Agency. I should have added that we have a statutory duty to undertake research into issues to do with the environment.

**Q146** Chairman: I have noticed for example that grey squirrels do not observe the border at Hadrian’s Wall. They come and go at will and, environmentally, the impact is the same. The second supplementary: in the evidence that you provide, do you engage in research, commission research or do you collate the results of other people’s research?  
**Ms Kavanagh:** We do a bit of all of those things. I think something we need to do more of is gathering in information from others. I think that is going to become more and more important, together with partnering with others and looking out for those things.

**Dr Wadge:** The Food Standards Agency is different. We are a non-ministerial government department. We have a board and of course our first Chairman was Lord Krebs.

**Q147** Chairman: Indeed, who sends his apologies; unfortunately he cannot be with us today.  
**Dr Wadge:** Of course, he was very successful in putting science and evidence at the heart of all we do. We are a UK body with a wide remit involving food safety, and putting the interests of consumers first in relation to food across a wide range of issues. We are accountable to the Westminster Parliament and the devolved Parliaments through the health ministers. We have about 700 staff in London and then further staff in Scotland, Wales and Northern Ireland. The Meat Hygiene Service is an executive agency that reports to us. That is based in York, but of course it is dispersed across the UK. We spend about £20 million on research and evidence annually. That is about 17 per cent of our budget, so it is a significant proportion compared to other departments, I would think, and in answer to your question what would happen if we were not funding research: we are a major funder of applied research into food, nutrition, food safety and so forth, so without that funding it would have a significant impact.

**Q148** Chairman: So you commission research as well as perhaps collating it?

**Dr Wadge:** We commission all of our research through open competition, so we do not issue grants, we have contracts through open competition, and it is very much policy-led research that is with a purpose rather than blue skies investigative research.

**Chairman:** Thank you very much. Moving on, Lord Methuen?

**Q149** Lord Methuen: What is the purpose of the research and development that you commission or carry out? What types of research do you fund to meet those objectives and how much of this is targeted rather than responsive?  
**Dr Stott:** JNCC is not a significant research funder but we do have a strong role in research insofar as we aim to assess the needs and influence the funding of research, both in the UK and at European levels. We also support the facilitation of research co-ordination between government and different agencies. We do have a small research programme. Last year we spent just under £2 million on commissioning research, but the bulk of this was towards long-term monitoring projects and most of the rest was on marine survey work. The purpose of the research that we commission is to generate high-quality evidence to support advice on our UK-wide and international commitments. The research is all determined to support our statutory functions and is very policy focused. When I say research I mean long-term monitoring and survey work. It is particularly focused on meeting requirements under international agreements, specifically the European Habitats and Birds Directives, and supporting the UK Biodiversity Strategy, so it is highly applied research. Examples of the long-term surveillance work we do include assessing and monitoring long-term trends in birds, bats and butterflies and work on identification of marine offshore habitats. Given that we are not a large funder of research, we do depend very largely on research undertaken by others, and that is why we have an influencing role and why we try to draw in evidence from many different sources, including the more operational work that is undertaken within each of the country agencies, and so we have a role in collating that evidence together and providing reports to government and reports to international conventions.

**Ms Kavanagh:** The Evidence Directorate’s annual budget is about £27 million and within that we have a small research effort, much along the lines that Dr Stott was talking about, which I will come back to in a minute. You have all the national data sets for the Environment Agency, which is a huge number of national data sets on a variety of different issues to do with the state of the environment, flooding, air, land and water, and so forth. You have got monitoring and modelling policy as well, which is about how we monitor the state of the environment. And you have
got economists and social scientists. The amount we actually spend on commissioning research is about £6 million, of which about two-thirds is on the joint programme on flood risk that we run with Defra, and one-third is on other things, but through that we do tap into and are able to influence expenditure externally of about £8 million, we estimate, and we also work through Europe and also through various relevant bodies such as the Environment Research Funders’ Forum, which we are chairing at the moment, and also a spin-off from that which is Living With Environmental Change, another programme, so we work through programmes like that. We are also talking with the various research councils about how we might work more closely with them. This Directorate is new. It has only been in existence since April so it is a developing area. I have only been there since 28 April so I am looking at how we can grow this really.

Dr Wadge: We fund research to support our strategic aims on safe food and healthy eating, which are our twin objectives in the organisation. I think that the research that we fund really does one of three things. One is it helps improve our risk assessments and the advice that we give and makes sure that that is soundly based on evidence. We fund research and surveys that help track progress against the targets that we might set in relation to perhaps salt targets or other targets that we set on food-borne disease. Also it helps us in terms of our negotiating positions. As most food law is developed and agreed in Brussels, the research will often help inform those negotiating positions. We have a broad portfolio of research. We are currently prioritising that research for our next strategic plan for 2010 to 2015. The types of research that we fund include chemical risk assessment, food allergy, meat hygiene, microbiological safety, radioactivity, diet and health, GM foods, authenticity and additives. Finally, I think it is worth adding that in recent years we have built up a social science capacity within the Agency, so we are now funding social science, either linked in with the ESRC, but also multi-disciplinary work looking at linking together some of the food safety work and the dietary health work but bringing in the benefit of social science alongside the natural sciences.

Q150 Lord Crickhowell: I was going to come in on the numbers in a later question, but I think it might be useful if we get a bit of clarification at this stage, because I suspect we are not all talking about the same thing. I think it may be quite useful if you would let us have a more detailed note on research expenditures afterwards. We heard from Dr Wadge that £20 million was the sort of total budget for the Food Standards Agency. We had a figure of £2 million from the Joint Nature Conservation Committee. Then I am rather more confused about the Environment Agency because you started by putting it in the context of rather wider expenditure on such things as data sets and monitoring and so on, which amounted to about £27 million. You then said you were commissioning research of £6 million specifically, but the paper that you have given us talks about a programme research budget of £4.2 million, funded by £1.4 million from Defra and £2.8 million from the Environment Agency. So I am getting into a little bit of confusion about exactly what is being spent and where and how much you are really spending yourself and how much is actually being directed perhaps by much larger programmes outside. Could you try and get a bit of clarity into my present confusion?

Ms Kavanagh: I am sorry I have confused you, but I think the figure in the paper refers to our Flood Risk programme which is a joint programme with Defra and if you add to that another £2 million you arrive at a figure of approximately £6 million or £7 million.

Q151 Lord Crickhowell: So this is the specific programmes?

Ms Kavanagh: I think in the coming year we will spend about £7 million, so it is between £6 million and £7 million that we spend as a total, of which two-thirds (or about £4 million) is the Flood Risk programme and the balance is on other aspects of the environment. For example, integrated catchment science, which is looking at a river catchment from top to bottom and looking at everything that impacts on it, is one example, or looking at waste streams or looking at the impacts of composting or anaerobic digestion or incineration, things like that, so a variety of different things. The total sum on research is about £6 million or £7 million. About £4 million of that is flood risk jointly with Defra, leaving a balance of £2 million or £3 million on other things in the context of an Evidence Directorate of £27 million. The reason I mention that is because in the Environment Agency there is a phenomenal amount of information. We actually do not need to go very far outside to find information. One of the tasks for me—and I have only been here six months—is to get my arms around everything that is in the Agency, so that is why I emphasise that point as well.

Lord Crickhowell: Could you let us have that in a detailed note. I think it would be helpful.

Chairman: It would be very helpful. Lord May wants to come in.

Q152 Lord May of Oxford: I have two nuts and bolts sorts of questions for the JNCC. I will ask them at this stage because I think they provide specific examples of a point we are going to explore about how the different agencies relate to the science base more generally. As some of you will know, I was a foundation member of the JNCC and what you did
not mention was that it was an afterthought because nobody had realised pre-devolution that the splitting up would leave a lacuna for international themes. That last minute setting-up gave it a difficult birth, so the initial Chairman only lasted six months and then Lord Selborne took over and really made it run. Much of what the JNCC does depends on research councils, individual researchers and long-run databases held elsewhere. The relatively recent review of the Natural Environment Research Council, which closed down many things, and in particular changed the character of Monks Wood, which is the primary centre where we hold these long runs of relevant data. How has that worked, in your opinion? What is your relationship with the long data sets? What has been the effect of that as an example of co-ordination that was messed around with, which was not your fault?

**Dr. Stott:** Okay. We have a continuing contract with the Centre for Ecology and Hydrology which runs the Biological Records Centre, and it will be up for review in this next year. I think this has been a collaborative venture and partly as a result of the lobbying that took place when NERC announced this change, the Biological Records Centre was protected in that move insofar as the resources for that group were protected, but there were implications for the staffing, because not all of the staff were prepared to move. I think the consequence of that is that there has been a bit of a loss of momentum within the Biological Records Centre as there has been some staff turnover and recruitment, but, essentially, I think the Biological Records Centre continues to provide the functions that it did before and is resourced by NERC, in collaboration with ourselves, to maintain those long-term data records. I think one issue that we would have with the role of that body is that we feel that it has not been fully integrated into some of the other lines of scientific enquiry within NERC, so that it is not making full use of all that evidence to understand what are the factors that are impacting on the long-term trends of biodiversity. We rather hope that this change in organisation within CEH will facilitate that, and it is something that we will be looking at more closely as we go through the review of our contract with them over the next year.

**Q154 Lord May of Oxford:** But it goes to the heart of setting research priorities and in a complicated interlocking set of organisations the role of organisations like yours.

**Dr. Stott:** I would say that we are responsive to the policy direction, and the policy direction is set around the more charismatic fauna and flora, and, in particular, we have seen it driven by priorities identified through the UK Biodiversity Action Plan. That has not been just on the larger vertebrates. It includes quite a large number of threatened invertebrate species. However, it does not get down into a lot of detail into soil micro-organisms, for example. Because of that, our largest investment is in maintaining the long-term data records, on birds, for example and we would like to be able to shift our focus, and we are increasingly working in the area of ecosystem services—that is, looking at the ecosystem functions and the benefits that ecosystems provide for society. We have a difficult choice between maintaining existing long-term data series, for example the bird populations, which have been very informative and have strongly driven government policy in recent years, and have been adopted by government as key indicators of the environment, so they are seen as being critical and underpinning a lot of our policy work, and not then having the flexibility and resource to move on to tackle some of these other issues in greater detail. In terms of the policy context we are part of a debate which is looking more seriously at these issues of how ecosystems function and how we depend on ecosystem services and we would work to influence funding within the research councils and others to try to address those issues. In terms of our own resources, we are largely committed to maintaining what are important underpinning data sets.

**Q155 Lord Broers:** How effective is the UK at funding more targeted research to meet policy and other societal needs? I guess this is an example of this to a certain extent. Who is responsible for funding such research?
Dr Stott: The UK has a large number of organisations which fund research relevant to JNCC interests. Amongst these the government departments and agencies and the voluntary sector have a strong focus on policy and societal needs and the evidence also needed for practical conservation measures. To strictly answer that question, there are quite a large number of bodies which have the facilities to address this targeted research. The research councils also have a remit to fund research relevant to JNCC interests but tend to place greater emphasis, through their responsive mode funding, on more fundamental issues that do not necessarily have immediate applications. We would argue that more publicly funded environmental science, particularly that funded by the research councils, should be targeted towards achieving societal benefits and helping to achieve sustainable living in the short to medium term, and from our perspective that would include those issues related to nature conservation. In saying that, I do not want to imply that all research should be tightly bound to immediate policy requirements, as in the case of JNCC’s funding of research, as we have just had the discussion with Lord May, but the strategic research needs to anticipate the requirements of policy development over a longer term, maybe a three to ten-year period, and to identify emerging issues for which policy responses may be required. I think research also needs to achieve a better balance between addressing responses to problems within the UK and tackling wider global issues which have significant impacts on global life support systems, the global economy and the UK as part of that. We have seen that shift particularly in the climate change issue, where there has been a large amount of investment in climate change research in the UK to address global issues. What we do not see is that similar investment in relation to ecosystems and biodiversity which we would argue are as significant as climate change issues.

Ms Kavanagh: I should have said in my earlier answers that the research we do is very applied and it is very policy driven. It is driven by the strategy of the Environment Agency which is signed off by the Secretary of State and by the Welsh Assembly Government, so that is the space that we are in on this really, and I would agree with a lot that Dr Stott said. I think that it is moving in the right direction but more needs to be done and there are some positive developments, I think. I understand that the research councils do not have a specific remit to do this type of research, but they are interested in looking at it and talking with people about it, and I have found them very receptive to the idea of doing greater partnership working. For example, NERC has a partnership with the Met Office and I know they are interested in doing other things like that, so it is a fruitful area of discussion. I know also that the Research Excellence Framework, which is out to consultation now from HEFCE, places far more emphasis on research impact and on shaping and informing policy as a measure of its impact, so that is a step in the right direction. I mentioned briefly earlier on the Living With Environmental Change programme, which is a new collaborative exercise. The thing about that, and I am going to my first programme board of that tomorrow in Cardiff, is that of course it is a voluntary thing. There is no compulsion to be there. It relies on the goodwill of people to be there and they may have different objectives and funding streams. So I think there is a lot of collaboration, it is moving in the right direction, but it depends how far you really want to take it and whether or not it would ever be something that government would want to think about in policy terms and wanting to promote it.

Dr Wadge: I would say that all of our research in the Food Standards Agency is targeted towards policy and societal needs in relation to food safety and dietary health. I think that the other point to say is that the role of partnership, as we have just heard, will be increasingly important, particularly as we come under funding pressures. I think it is worth emphasising the role of the Chief Scientists’ advisory network here under Professor John Beddington. As Chief Scientist within the Food Standards Agency, I play an active part within the core issues group of that committee, working with research councils on cross-cutting issues such as Living with Environmental Change and other programmes on health and wellbeing. So I think it is through that particular network that a lot of influence can be brought to bear to focus research spend on addressing societal needs and policy needs.

Q156 Lord Broers: What principles, criteria and mechanisms should be used to allocate research funding for targeted research? Dr Stott, what caught my eye and a lot of others’ eyes in your report was when you talked about the Swedes and how they used three criteria to assess research you did not tell us what they were, so would you mind talking a bit about the principles, criteria and mechanisms and you might tell us what the three criteria are.

Dr Stott: I think there are differences between the criteria that we use in our organisation and those that I was referring to which are used externally, which I think are some good examples. As far as our own limited budget is concerned, we fund research which is relevant to our sponsors and which will aid policy development. Our research funding is determined by our strategy and business plan. It is strongly influenced by our sponsoring departments and established through various inter-departmental and bilateral discussions. In terms of identifying research priorities, we are a member of a group called the
Biodiversity Research Advisory Group and we provide the secretariat to that group. That group brings together a number of research funders in the UK and also a number of academics and, through that group, we have organised a number of seminars and workshops bringing in scientists to look at particular themes, to review the state of knowledge around a particular theme, identify knowledge gaps, and from that to identify priorities for research. Similarly, at a European scale, we participate in a network called the European Platform for Biodiversity Research Strategy. That body comprises national platforms from the EU Member States and wider, a mixture of science, funding organisations and researchers, and, likewise, that group organises a series of thematic workshops to review issues and identify research priorities. So I think we are well plugged into the mechanisms for identifying research needs and priorities. We are less able to deliver on some of those. In relation to the criteria for assessing research, Formas, the Swedish research council’s criteria include scientific excellence and they also include societal benefit. I am not quite sure what the third one of those criteria is.

Q157 Chairman: Could you drop us a line on that?

Dr Stott: I can clarify that. I would also like to draw attention to another collaborative initiative which is one of the European Research Area Networks, ERA-Nets which you may be familiar with, which have been funded by the European Commission, where again a group of European research councils and more applied research funders like JNCC have agreed to co-operate to undertake research on particular priorities. Through that process we identified a common research theme, we identified a shared budget of around 21 million euros and put out a common call. The interesting thing about that process was that because it brought together research councils and more applied research funders like NERC and Defra, the criteria used for assessing that research were ones of policy relevance and scientific excellence. We had a very heated discussion between the two different types of organisations about how you could apply those criteria to the assessment of proposals, but we did reach agreement on that, and have recently initiated 12 large research projects, shared between three or more different European countries, which have been assessed in terms both of scientific excellence and in terms of their relevance to policy.

Chairman: Since we will doubtless have an equally heated discussion on these matters, I would be interested to see a paper outlining what the agreement was that you finally reached, but I think both Lord Warner and Lord May want to come in on this.

Q158 Lord Warner: This is a question really to the Environment Agency and the Food Standards Agency. How do you know you are not duplicating other activity out there? What is your scanning system and what is your system for perhaps not doing it yourself and relying on some other work which is actually in train or has already been done?

Ms Kavanagh: I think that is a very good question actually because it is a major concern. We do have, I think, good systems in place for scanning what is already out there, reviewing what is available in terms of the literature and looking at the Internet, but I think that we could make more use of it, and I am very concerned to make sure that not only do we eliminate duplication but, frankly, if someone else can do something better, or is doing it instead, we tap into what they are doing. We do work closely with Defra and other bodies in the Defra network and we are forging some links with DECC at the moment to see what they are doing and whether they are better placed than we are. It cuts both ways, so it could be vice versa. In terms of looking at what is out there in universities, some of the people who work in the Evidence Directorate actually do work by being embedded in the university and working with academics so they tap into a huge amount of information and expertise in that way and I think they are very well-placed. I like that model and I would like to do more of that. I think your question is a very well made point. It is something we need to do more of and I am not sure that we are doing enough of it at the moment in terms of seeing what is already out there and eliminating duplication. I think that is tremendously important especially in these resource-constrained times.

Q159 Lord Methuen: What about the international aspect of it?

Ms Kavanagh: We are linked in with Europe. We do have some European funded work, if memory serves me. We are working with Europe and I am going to go and visit the European Environment Agency to see what more I can find out. Our Chairman and Chief Executive visited the USEPA last week to see if we could forge links, so we are looking at that and we are tapping into that. Again, I think that is very important.

Q160 Chairman: And the FSA on this?

Dr Wadge: It is something that we take very seriously. It is a real challenge to make sure that you are not duplicating other work. We do have a benefit that almost 50 per cent of the Agency’s staff have a scientific background, so if they are responsible for a particular area, such as microbiological food safety, they will keep abreast of the literature, but we work in collaboration with others, and we have a whole variety of mechanisms. We carry out workshops and
reviews of our own work. We have a network of ten independent scientific advisory committees who advise us and will identify research gaps but also inform us where other work is under way that we can work alongside. We keep a very close eye on the results of other research funded by the Agency and others nationally and internationally. We keep an eye on UK and EC policy developments and the horizon scanning. We also work to co-ordinate as much as we can, so we work with the Food Matters work coming out of the Cabinet Office report on the developing a Joint Research Strategy. We are part of that. As I mentioned, I am part of the Chief Scientists’ network and we work closely there. We are developing ideas with research councils such as a programme of work on Campylobacter and chicken where we will be jointly funding. At an operational level, the individual staff are a part of joint funders groups on nutrition, nanotechnology; and in the EU we have an ERA-Net that we jointly fund with 20 different partners. So we have a whole variety of means of working with others, but it is for ever a challenge to make sure that we are making the best use of the money and not duplicating.

Lord May of Oxford: You have already discussed how you go about trying to allocate things in a more outcome-oriented way and there are further questions on it. Certainly we have just mentioned assessing the impact of research. How do you go about doing this in a meaningful way?

Q161 Chairman: Any other thoughts? Dr Wadge, why not you?
Dr Wadge: The evaluation of our research and the peer review of that is an important part of it, so when we are identifying needs at the outset we will call together experts and we will discuss and identify what is out there, what are the gaps, what type of work we might do. The proposals that are submitted will be subject to peer review. The programmes of work will also be subject to peer review.

Q162 Lord May of Oxford: That is more prospective. Assessing the impact is more retrospective.
Dr Wadge: Absolutely. The programmes of work will be subject to review and that will include a peer review as well to see whether they have met our policy needs and also met the needs of good science. Would I say that we are doing as much as we could do on evaluation? No, I would not: I think that is something that we can do and would like to do more of, to make sure that we are fully evaluating the information that we gather and making use of the information that we gather, but also making sure that the research that we fund really is having the impact that we hoped it would when we set out to fund it.

Chairman: Any other thoughts?
Ms Kavanagh: We have had some of our programmes assessed by independent panels of experts, for example we have had assessed Integrated Catchment Science and Climate Change Programme. Professor Sir John Beddington visited the other day and said that he would be quite interested in having a look at what we do and putting it under the spotlight, which I would welcome; I would like that. We publish about 65 peer-reviewed papers a year, but the thing that I would like to do in terms of realising the benefit is actually use some of the information that we have got, in conjunction with Defra, to reach a wider group of people in civil society and try and influence behaviour. I think we could do a lot more with it. This is perhaps getting into territory that is outside the ambit of this Committee, but, for example, I do not think there are societal norms in the field of the environment in the way that there are in other areas. For example, things like the smoking ban, the seat belt law, drink driving, eventually there were societal norms on those. Where are the societal norms about whether you throw away food and so on? I think it would be absolutely fantastic to use the science and information we have to try and influence a wider community of people, so for me that would be a measure of success. What are we doing on measuring success at the moment? We are not doing enough. One of the reasons why we now have a separate Evidence Directorate is because the leadership of the organisation would like a clear line of sight from evidence, through policy, through to the people on the ground who are building flood defences, mapping exactly what it is delivering. It has not got that at the moment, so that is one of my tasks.
Dr Stott: I would only say that our own programmes are very tightly managed and have very specific objectives and we are very clear whether those projects have delivered those objectives at the end of the day. Each major project is reviewed by a mixture of the user community and the academic community and the projects are reviewed and refined. We do participate in wider reviews of government research, and I think one of our roles is to participate in that work from a user perspective, to be able to assess whether the research results are useful and are effective in informing policy development.

Chairman: Of course there is the other point you introduced about influencing behaviour. Is that an impact measure? Is there a drop in the number of food poisoning cases nationally or a change in the situation over obesity? Would that be an impact that is measurable or relevant?
Dr Wadge: Absolutely: the aim of the Agency, our strategic plan, is around key outcomes to reduce food-borne disease, make food safer and make it easier for people to make healthier choices, and the
campaign activity and work we have done with the food industry to reformulate salt has already shown a significant reduction in the average salt intake of the population. There is a lot more work to be done. We have seen a reduction in food-borne illness in the UK, although recently in the last couple of years that has levelled off, and so now part of the reason why I have built up a social science expertise and also established a social research committee under Sir Roger Jowell is because I see the tremendous importance of bringing in social science expertise alongside the natural sciences. One particular example of how these two areas of science have worked together has been in relation to listeria amongst the elderly where listeria deaths have more than doubled in recent years. That is unlikely to be due to some change in the organism. It seems far more likely that that has been due to a change in habits of the population. I think behaviour change ultimately is incredibly important but, of course, it is very difficult and it is not something that is done very quickly. That is not to say we should not do it though. It is absolutely important that we should.

**Chairman:** It is tremendously important, but we must move on.

**Q165 Lord Crickhowell:** We have already begun to touch on the next general question, but I am going to ask it and then I am going to direct, if only for nostalgia’s sake, some of my follow-up questions to the Environment Agency representative. What principles or criteria does your organisation use in making decisions about funding different types of research? What are the strengths and weaknesses of your organisation’s mechanism for identifying research priorities? Your paper says the obvious things. You have told us it is policy driven, corporate strategy overseen by the Agency directors and so on, but, looking at the list of research projects which you have given us in the paper, including climate change, flood risk, resource efficiency, integrated catchment management, I was fascinated because they might all have been there, probably were there, when I was Chairman of the National Rivers Authority and yet your responsibilities have vastly widened. There is nothing said here about pollution, the regulation of industries, all that area, so my first question is, has there been a shift? Also, bearing in mind the importance of climate change, one would have expected to see a pretty big concentration in climate change both on the general stance and on such specific hot potatoes as (one I have a particular obsession about) the Severn Barrage, on which I suspect my view is not too different from the Environment Agency’s. Has there been a shift and ought there to be more of a shift? We are in a changing world, other priorities are changing, and yet you are listing all the sorts of research priorities that I think I might have been setting as Chairman of the National Rivers Authority a decade or more ago.

**Ms Kavanagh:** There has been a shift but there is a legacy of things from the past. One of the things I have to do, frankly, is unbundle the legacy and put everything in shape for the future, because, as you rightly identify, climate change is not a golden thread but it is a worrying thread that runs through everything we do, so we definitely need to put more behind that and make sure it is reflected in our work.

You are absolutely right when you identify that it looks as though it has not changed much from when you were there and I think it does need to change. The mechanism we have for doing that is that we have just launched our new corporate strategy to our stakeholders, and climate change is a much bigger area in that, and I will be altering the emphasis of what we do to reflect that and make sure that it aligns with our corporate strategy, so, yes, I agree with you.

**Lord Crickhowell:** I have been asked to put one specific question about the FSA. What is the multi-criteria based decision support tool developed to aid discussion on research and development priorities? It sounds just the kind of jargon one dreads, but what is it and is it valuable?

**Q166 Chairman:** It sounds as if it is something you buy in an airport shop!

**Dr Wadge:** I do hope that it will be valuable. It has been developed by our operational research and analysis team and it is very much to help us guide the decision-making around the priorities of research. I guess it is fair to say that for the Food Standards Agency going forward we are not seeing any major departures in the direction of research; they are things that we were investigating a few years ago on food safety and dietary health, but within that the context does change. The tool will help us focus on the scale of the problem, the impacts on health, the economic impacts, the likely impact of research in relation to the costs and so forth. It provides some information that will help inform what ultimately becomes a judgement around should we be spending money on nutrition research or on research on campylobacter in chickens, for example, as two competing examples.

As I mentioned earlier, we have a wide-ranging portfolio. The other point I would like to mention is that we think it is very important to keep one area under a programme of cross-cutting research so that although we have got some clear areas of research that fall neatly within programmes we do not lose sight of those that might fall between the gaps. We think that cross-cutting area is quite important.

**Q167 Lord Broers:** A quick supplementary for Ms Kavanagh. What is the main thing you have had to introduce because of climate change?
Ms Kavanagh: We need to look at it in two ways. Previously we have looked at it principally in terms of what is known in the jargon, if you like, as adaptation. What that means is getting ready for the fact that sea levels are going to rise, getting ready for altered patterns of rainfall between winter and summer, being prepared for that; in other words, feeding through on the ground into things like flood defences and so forth and preparation for more surface water run-off or looking at the impact of heavier rainfall on combined sewer overflows into the sea on bathing water quality. What we now need to do more of, and under the leadership of our Chairman, Lord Chris Smith, where he is taking us to, is talking more about mitigation, which is in fact helping this country through the way we regulate various industries to deliver its commitments to get to a 20 per cent carbon future by 2050. That is the change in emphasis, and what we need to do on that is look at the impact of regulated industries on that. insofar as they have a bearing on it; a large part of it is not under industries we regulate because a large part of it is down to transport, for example, and see what interventions we can make that might help influence that.

Q168 Lord Broers: Where do you get your predictions of what is going to happen? From the Met?
Ms Kavanagh: The Hadley Centre and the Met Office and the probabilistic predictions that were launched earlier this year. We had a role in that. We were influential on that with the Met Office.

Q169 Lord Cunningham of Felling: You all at different points in this hearing have acknowledged the need for change in your strategies in whole or in part, and two of you, the Environment Agency and the Joint Nature Conservation Committee, imply in your submissions that one of the obstacles to change is the current funding system. Would that be an accurate summation of your view?
Ms Kavanagh: If I may, I would say that it is a catalyst for change. If it came across as an obstacle to change I think that is a drafting issue, but for me it is the catalyst to do things better and smarter by partnering with other people, by looking outwards, by not always trying to invent everything yourself.

Q170 Lord Cunningham of Felling: Forgive me for interrupting. That is not what your evidence says. What your evidence says, unless we have got it wrong here, is that it “highlights the need for a funding model that supports knowledge transfer and interdisciplinary research to provide the incentive and skills to support policy . . . ”. That implies that the existing funding model prevents that, at least in part, if not in whole, and the Joint Nature Conservation Committee says, in much the same language, “Multidisciplinary research is often disadvantaged by current research assessment procedures”. Those are remarkably similar statements. I am not suggesting you have colluded on them but it is a very important point.

Ms Kavanagh: Yes. I have not colluded. I think what we are trying to say is—

Q171 Lord Cunningham of Felling: I do not mind whether you have. That is not the point. The point is that this is key to the whole way forward in changing the direction of research efforts and your organisations and others and at least one government department have acknowledged that there is a weakness here. What I am trying to get at is what would you like to see in its place?
Ms Kavanagh: What we are trying to say is we would like to see more of it.

Q172 Lord Cunningham of Felling: More of?
Ms Kavanagh: More support for this.

Q173 Lord Cunningham of Felling: More support for multidisciplinary research?
Ms Kavanagh: It is not intended as a criticism, is what I am trying to say.

Q174 Lord Cunningham of Felling: And what about you, Dr Stott?
Dr Stott: I gave an example previously. I think there are two key points. One is that we would like to see more co-ordination and that means research funders and research users working together to identify what are the priorities and needs and the best means of delivering that, and there are several mechanisms we have already mentioned. We have mentioned the Living With Environmental Change programme. I mentioned the ERA-net project on biodiversity, so there are some existing mechanisms which do suggest the way forward. I think what we are saying is that this is an approach, that we would want to encourage. It is rather early with the LWEC initiative to assess how successful it could be. There is the co-ordination and the other key thing is this interdisciplinary approach because, as we have said already, it is the issues where the natural environment meets with society in our case and there are societal benefits. We have spent too much of our resource in the past on the natural environment side of it and insufficient on the societal benefit, but trying to get those communities to work together is really very difficult, even within the reward structures which exist for academics and researchers. Going down that multidisciplinary approach does not necessarily produce the same rewards as them being focused within their particular discipline.
Q175 Lord Cunningham of Felling: Would it be fair to say that lots of necessary, worthwhile, perhaps even essential multidisciplinary research is not being taken forward simply because of the system of allocating resources?
Dr Stott: Yes, I think that is probably true.

Q176 Lord Cunningham of Felling: Have you convinced Defra of this, your sponsoring department?
Dr Stott: I think Defra are alert to this issue and are very keen to see a greater involvement of the social scientists and economists.

Q177 Lord Cunningham of Felling: So Defra is not stuck in this silo mentality about interdisciplinary work?
Dr Stott: I cannot answer for Defra.
Ms Kavanagh: It is a big thing in their evidence investment strategy which they have consulted on and are coming out with soon, the multidisciplinary approach and pushing social science, so they recognise it too. Something else that may be of interest to you that I have observed since I have been at the Environment Agency is that the direction of travel in European legislation is pushing us towards being more multidisciplinary, I think. If you take multidisciplinary in a broad sense, so if you include a variety of disciplines, for example, looking at water quality, whereas in the past the Environment Agency looked at water quality in terms of a number of pollutants, it now has to look at it in terms of biology, ecology and a number of pollutants and many more criteria, which is requiring us to work together across a range of disciplines in order to produce the evidence that is required. I do not know whether that is true in other fields but I think it is in ours.

Q178 Lord Cunningham of Felling: So in working with your department you do not have any difficulty in taking this idea forward?
Ms Kavanagh: No. I was formerly in health and I would say that that was more of a challenging relationship. This relationship I think is very good.

Q179 Lord Crickhowell: Can I follow on from what Lord Cunningham has been saying? The very final sentence in the Environment Agency’s submission is, “We believe UK research funding should support and reward inter- and multi-disciplinary research . . . “. You have all said, and I understand exactly, that you would like to see more of it. What you seem to be saying here is something more specific, that there ought to be a structure of funding that makes it work. Have you any suggestions as to what that structure should be? It is one thing to say we all want it, it is even good to say that the department encourages it, but does the funding structure encourage it and could it be different?
Ms Kavanagh: Are you thinking of the funding structure in terms of the way public bodies are funded and how to deliver it?

Q180 Lord Crickhowell: I am asking what your thinking is. It is your comment.
Ms Kavanagh: Okay. In terms of the research that is undertaken in academia, I suppose there are mechanisms for doing this through the criteria whereby research is assessed through HEFCE and maybe through the research councils, so there are mechanisms there that perhaps could be influenced if the right criteria could be put in place to do that. In terms of what we do, I think what we do and the way we look at things is changing to a more multidisciplinary approach because of the direction of travel of legislation, because of the way that Defra are now approaching this and because of the realisation that the environment does not consist of a number of silos; it is an holistic entity and you have to look at it in that way. I do not know if that helps.

Q181 Chairman: There are two ends of the spectrum on this. I am sorry; I am taking the Chairman’s prerogative and asking a last question. One is to say, have a structure that says, “Unless you are signed up to in your research proposal by three different departments . . . “, that is one way of doing it, which is probably a very crude way of doing it. Another is to be problem focused and say, “We do want to deal with water pollution”, or with the impact of salt in food: “What do we need to know to answer the question?”, and that is pretty directive. Do you have any views on where in the spectrum you would lie, any of you?
Dr Wadge: Can I comment on that because I think the mission-orientated approach on identifying the issue is the way forward. My own perspective is that it will be imperative for us to increase the amount of multidisciplinary partnership working simply because of the financial pressures that we will come under. As I said earlier, about 25 per cent of our research is already co-funded.

Q182 Chairman: Can I interrupt? I am not too happy with that response, because if it is financial pressure that is one thing, but if it is, “We need to know this; they know it, we don’t”, that is a very different approach.
Dr Wadge: Yes, but I think that the funding mechanism can be the obstacle, because each department has different funding arrangements and so forth. The key that we have found is to identify the
11 November 2009 Ms Miranda Kavanagh, Dr Andrew Stott and Dr Andrew Wadge

issues on which there is a joint need to research and identify, and if you can clarify a need for research in particular areas, like salt or campylobacter in chicken as two examples, then the funding mechanisms can be overcome. That is our experience.

Chairman: I fear the allocated time has been used. We did indicate that there were another one or two areas which we would be very interested in your responses on and that is still true if you would like to send us anything in writing. Can I thank you very much indeed? You will see the transcript and if there are any points that you feel you would want to have amplified or clarified, and we have asked one or two specific questions, the third Swedish criterion, for example, it would be very helpful to have that in writing from you. Thank you very much indeed; we appreciate it.

Supplementary memorandum by the Environment Agency

1. INTRODUCTION
1.1 The Environment Agency welcomes the opportunity to provide supplementary evidence to the committee following the oral evidence session on the 11th November 2009.

This evidence covers:
   — Clarification of our research funding allocations.

2. Q151 Environment Agency Research Budget 2009–10
2.1 The Evidence Directorate budget is £27 million of which £5.9 million is specifically allocated to fund research projects. These projects are commissioned with six thematic research programmes. The allocation of the budget across the programmes is:

<table>
<thead>
<tr>
<th>Thematic Programme</th>
<th>Budget 09/10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood Risk Science</td>
<td>£3.088m</td>
</tr>
<tr>
<td>Integrated Catchment Science</td>
<td>£1.106m</td>
</tr>
<tr>
<td>Better Regulation</td>
<td>£0.846m</td>
</tr>
<tr>
<td>Climate Change</td>
<td>£0.542m</td>
</tr>
<tr>
<td>Innovation for Efficiency</td>
<td>£0.229m</td>
</tr>
<tr>
<td>Resource Efficiency</td>
<td>£0.166m</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>£5.977m</strong></td>
</tr>
</tbody>
</table>

2.2 The Flood Risk Science programme is a collaboration with Defra and the Environment Agency is financially accountable for all of this budget. Defra and the Environment Agency share the governance, management and co-ordination of the projects within this thematic programme.

2.3 In 2009–10 the Environment Agency has committed £2 million (of the £5.9 million) to collaborative projects and secured £8 million in levered funds.

January 2010

Supplementary memorandum by the Joint Nature Conservation Committee

Additional information from Dr Andrew Stott, Science Director, Joint Nature Conservation Committee, as requested in the oral evidence session on 11 November 2009 with: Environment Agency; Joint Nature Conservation Committee; and, Food Standards Agency.

RELATING TO QUESTION 6

[How effective is research co-ordination across Government and between Government departments, agencies and other funders of research? How successful are existing mechanisms and models in facilitating and funding inter-disciplinary, cross-government and cross-council research? How does each party involved ensure that it achieves its desired objectives from collaborative endeavours?]

In oral evidence I mentioned the ways in which both the Swedish Research Council (FORMAS) and the European Research Area Network BiodivERsA assess applications to responsive mode funding or research calls; this was in the context of good models for improving the relevance of responsive mode funding to Government policy requirements.
The FORMAS approach requires applicants to evaluate Scientific Value and Societal Value using a set of six criteria; all criteria are scored on a seven-point system and have an equal weighting in deciding funding success. The Societal Value criteria are listed below (extracted from the 2009 FORMAS handbook):

FORMAS Criteria of Societal Value

1. Importance for sustainable development
   - Aim addresses important societal issue.
   - Project may contribute to ecologically sustainable growth and development of the society.

Society should be regarded as the greater society at global, EU, national and regional levels within Formas’ areas of responsibility. Both consumer and producer perspectives should be considered.

2. Dialogue with society
   - Project is planned in dialogue with stakeholders.
   - Concrete and realistic plan for deliverables to stakeholders.
   - Adequate experience, including pedagogical skills, of cooperation and communication with stakeholders.

Stakeholders should be regarded as actors who can put the research outcomes to use in society, including government, authorities, industry, and civil society, as a contribution to achieving sustainable development. Dialogue with stakeholders may take different forms depending on the degree of immediate applicability of the intended research results.

3. User values
   - Specific ideas, including time scale, on how to implement project outcomes.
   - Estimated effects of project outcomes on different times scales.

The BiodivERsA criteria for its joint research call were developed to ensure that funded pan-European collaborative research projects were relevant to policy (EU and national) and practice:

BiodivERsA Assessment Criteria

1. Scientific Aspects

Scientific aspects will be assessed by means of the following criteria:

   (a) Scientific quality of the proposed research.
   (b) Novelty/Originality and innovation.
   (c) Clarity of the hypothesis.
   (d) Quality and suitability of the consortium.
   (e) Level of inter/multi/trans-disciplinarity.
   (f) Fit to thematic priorities.

Scientific quality is considered before all other criteria and is a prerequisite for funding.

Interdisciplinary approaches are encouraged, but mono—or multi-disciplinary studies are not excluded a priori; the approach must be adequate to address the question posed.

2. Policy relevance

Policy relevance will be assessed by means of the following criteria:

   (a) Relevance for the identified policy application, importance of the research for solving pressing concerns/issues related to biodiversity.
   (b) Identification of end users.
   (c) Approach to stakeholder engagement.
   (d) Arrangements for knowledge transfer.
3. Project management and added value

Project management and added value will be assessed by means of the following criteria:

(a) European added value.
(b) Feasibility and risk.
(c) Level of integration and collaboration.
(d) Relation to other projects.
(e) Suitability of budget requirements.
(f) Quality of project governance.

All criteria are scored on a five-point scale and if scientific quality meets required standards the other criteria are then used to make decision on funding.

11 December 2009
Memorandum by the National Physical Laboratory

This brief submission outlines the current situation for national laboratories in the UK and makes the case for a national laboratory strategy to better utilise these world leading science assets for the benefit of UK business and society.

1. About the National Physical Laboratory

The National Physical Laboratory (NPL) is the UK’s National Measurement Institute and sits at the intersection between scientific discovery and real world application. Its expertise and original research have underpinned quality of life, innovation and competitiveness for UK citizens and business for more than a century.

— NPL develops and maintains the nation’s primary measurement standards, supporting an infrastructure of traceable measurement throughout the UK and the world to ensure accuracy and consistency—a necessary foundation for a technologically advanced economy.

— NPL provides companies with access to world leading support and technical expertise, inspiring the absolute measurement confidence required to realise competitive advantage from new materials, techniques and technologies.

— NPL has a GOCO structure—Government owned, contractor operated. More detail on the nature and success of this model is in section 5.

It is estimated by government economists that NPL provides benefits of £2 billion pa to the UK GDP.

2. Context

The pressures on public budgets make it vital that the nation’s investment into science and engineering provides the maximum economic, social and environmental benefit. This is particularly true if the competitiveness of UK industry and the innovation of its scientists and engineers are to be maintained at a time that other countries—notably the US, Germany, India and China—are making substantially increased investments in their science infrastructures. There is broad agreement in the UK on the national interdisciplinary challenges that need investigation—including Energy, Sustainability (low carbon), Health Care, Digital Economy, Advanced Manufacturing and Security. However, there is far less consensus on how this can be best achieved.

3. A UK National Laboratory Strategy

There are over 160 public sector research establishments in the UK. The higher profile of these in the fields of measurement, nuclear and reference are constituted as National Laboratories. These are some of the country’s most valuable, yet under-utilised, assets.

Our National Laboratories have the potential to become an effective network enabling pan-government solutions to economic, social and environmental problems of vital national and international importance and, importantly, saving the state significant amounts of money through effective application of science.

There needs to be a conscious commitment, and the mechanisms in place, for all government departments to access and harness their knowledge. No department possesses experts from all scientific and engineering disciplines but the public sector research establishments contain the talent that can be utilised. These independent experts should be the cornerstone of any government policy or science investment.

However, as currently constituted, there are few National Laboratories. Those that there are have limited funding options and are often tied solely to sponsoring departments. There is also very limited cross-departmental use of their services and there is not an agreed model for their operation (they operate under a
range of business models from government agency through government-owned, contractor-operated to private companies). As a result their value to the nation is significantly under exploited. This situation can be contrasted with that in the US, France, Germany, China (indeed most other nations) where networks of laboratories exist to support the application of science and engineering in the national interest.

A coherent government strategy to establish a network of National Laboratories on a truly national, cross-departmental footing, enabling it to act both in concert and in bespoke configurations to address specific issues, would produce a powerful, cost-effective tool in tackling many of the UK’s most challenging long-term issues, such as climate change, national security, energy and health-care.

4. Case study: USA

The model for national laboratories in the US is based on close interactions between universities, national laboratories and industry, with (very broadly) universities leading the research at the early stage of product development (roughly aligned to Technology Readiness Levels (TRLs) 1–3), National Laboratories leading the translational research (TRLs 4–6), and industry leading the effective commercialisation (TRLs 7–9).

5. The GOCO model

NPL is a government-owned, contractor-operated model—effectively a partnership between BIS and the contractor Serco. The GOCO model has proved itself a tremendous success at NPL. Significant efficiencies have been realised with overheads reduced by 30 per cent, productivity increasing by 10 per cent, significant investment into equipment and a doubling of third party investment. The quality of science has also been maintained and increased with a doubling of the number of publications and citations. This efficient delivery of science with economic and social impact could provide an exemplar into defining and delivering research priorities.

September 2009

Memorandum by the Veterinary Laboratories Agency

The Veterinary Laboratories Agency (VLA) is an Executive Agency of the Department for Environment, Food and Rural Affairs (Defra) and is well recognised as a centre of scientific excellence for animal and public health science. For over 100 years, we have been delivering research, surveillance and laboratory services for animal and public health (http://www.defra.gov.uk/vla). We have provided below a response to those specific questions posed by the committee that are particularly relevant to us as a key evidence provider in the fields of animal and public health.

1. What is the overall objective of publicly-funded science and technology research?

Publically funded science and technology has the overarching objectives to:

— Deliver the scientific evidence for sound policy making in the context of societal needs (especially UK).
— Foresee emerging scientific and technical issues and identify practical as well as innovative solutions.
— Continuously advance the scientific and technical knowledge base and champion curiosity lead research.
— Continually review scientific evidence in the light of new and emerging developments.

2. Are existing objectives and mechanisms for the allocation of public funds for research appropriate? If not, what changes are necessary?

From an animal and public health perspective there needs to be further integration between the funders of research to support UK’s overarching animal and public health strategies. Funders have become very process driven with significant differences in funding arrangements across all funders. This makes co-funded projects very complex where contractors have to establish new administrative resources to cope with the complexity. Government and NERC should be commended for initiating the Living With Environmental Change (LWEC) programme but the formation of a central funding pot of money would improve the efficiency, outcomes and benefits of the programme. Within the PSREs there is a growing tendency to micro-manage within the project-programme management landscape that has considerably reduced flexibility and jeopardises sustainability of key national capabilities, skills and expertise. It is also disappointing that there is still not a level playing field in the UK when it comes to the eligibility of researchers and research establishments for funding. PSREs still have very restricted access to Research Council funding whereas other research organisations including
universities have access to all RC and other public sector including Governmental funding streams. In summary there should be:

- Greater integration between funders to support coordinated and strategic planning and development.

- Review of funding procedures across the public sector in order to simplify and harmonise where possible. This could include single pot of funds for tackling some of the big issues such as climate change, food security and increasing the healthy lifespan.

- Removal of all remaining obstacles to ensure a level playing field for all public sector research organisations to compete for funds on merit.

- Review longer-term funding/investment arrangements to ensure they are compatible with the sustainability of UK scientific capabilities, skills and expertise.

3. What governs the allocation of funding for Government policy-directed research through Government departmental and agency initiatives? Are existing mechanisms appropriate? What is the role of Departmental Chief Scientific Advisers?

As a key contractor for animal and public health policy-directed research the budget allocation seems rather arbitrary with limited cross departmental cooperation. Departmental Chief Scientific Advisers have an important role to play across department’s to ensure advances in one particular area of science or technology is optimally exploited across other scientific disciplines. However, their influence and impact in the animal and public health arena appears fairly limited and from our own perspective the policy-directed research is driven more by the Chief Medical and Veterinary Officers and their teams. However, Defra’s new Evidence Investment Strategy lead by the CSA is a welcome opportunity to seek views on the big evidence challenges for Defra and the wider evidence base, to inform stakeholders about the development of the strategy and seek views on its implementation.

4. How are science and technology research priorities co-ordinated across Government, and between Government and the relevant funding organisations? Who is responsible for ensuring research gaps to meet policy needs are filled?

From VLA’s perspective coordination across and between government is patchy with departmental priorities outweighing cross government ones. Strategic fundamental research is the life blood and underpins much of the policy-directed work although the translation of this research and applying it to solve practical problems can be years or even decades away. The translation of this research towards multidisciplinary practical solutions and governmental policies is not very efficient in the UK. Much is lost and kept in specific scientific stove pipes that are sustained in part by the current funding mechanisms and departmental interests. One specific point is that natural and social scientists should be encouraged to work much closer together to solve some of the very large emerging challenges we face such as climate change, ecosystems, food security and the healthy lifespan.

5. Is the balance of Government funding for targeted versus response-mode research appropriate? What mechanisms are required to ensure that an appropriate and flexible balance is achieved? Should the funding of science and technology research be protected within the Research Councils or Government departments? How will the current economic climate change the way that funds are allocated in the future?

In terms of animal and public health the balance of Government funding between targeted versus response-mode research is probably appropriate but should be regularly reviewed since there is always pressure on research budgets. Curiosity driven research is essential to ensure that the UK maintains its position as the leader in scientific and technology innovation. In terms of translating this research into practical solutions and policy making, we believe a significant proportion of applied research should be targeted especially research that is needed to support policy review and formulation. However, the targeting does need to involve scientists from multidisciplinary backgrounds from the natural, social and economic sciences as well as the policy makers themselves. It is our very strong opinion that funding of science and technology research should not be protected in anyway and open to all on merit. However, there is certainly a place for core funding to ensure sustainability of core skills, capabilities and facilities of national importance.

September 2009
Memorandum by the Met Office

CURRENT RESEARCH FUNDING PROCESS

1. The 2007 Comprehensive spending review allocated a Science Budget of just under £4 billion for the period 2008–09 to 2010–11. The budget for scientific research is allocated by the Department for Business Innovation and Skills (BIS) via the UK’s seven Research Councils. These Non-Departmental Public Bodies have formed a strategic partnership, RCUK, who, in discussion with BIS, prioritise the available funding for science research in the UK.

2. Funding is provided via the research councils to organisations meeting strict eligibility criteria: higher education institutions; research council institutions and independent research organisations. The Met Office, a trading fund owned by the MoD, is ineligible under these guidelines to receive research council funding. This means we are prevented from leading—and sometimes participating—in areas where our capability would provide significant benefit. Neither do we participate in the discussions with BIS to prioritise the available funding.

THE MET OFFICE HAS A UNIQUE SCIENCE POSITION AND CAPABILITY

3. The Met Office is a Trading Fund Agency owned by MoD. It operates the Public Weather Service (PWS) which is funded by Government through MoD. The PWS provides operational forecasts to the public—including the Severe Weather Warning System—and also fulfils international commitments on behalf of the UK Government. Although the Met Office has no statutory responsibility it is identified as the preferred supplier of meteorological information and services under the Civil Contingencies Act. A recent independent report stated the Met Office’s PWS services contributed in excess of £600 million per year to the UK’s economy.¹

4. In December 1988 the UK Government announced it was committed to extending its influence internationally to provide information about climate change and to supporting appropriate research. A new centre for climate change research in the Met Office was announced—the, then called, Hadley Centre for Climate Prediction and Research. This dedicated research centre brought together work previously undertaken in three separate areas of the Met Office and since its opening in 1990 has gone on to become the UK’s foremost, and one of the world’s leading, climate change research centre.

5. The Met Office is a scientific organisation employing around 400 of the world’s leading experts in climate science and undertakes and facilitates significant research in the field. It is the Government’s largest single science research institution and provides objective and robust climate advice, on both mitigation and adaptation issues, to decision and policy makers across Government.

6. An independent review of the Met office Hadley Centre in 2007, commissioned by DEFRA and MOD, reported “It is beyond dispute that the Met Office Hadley Centre occupies a position at the pinnacle of world climate science and in translating that science into policy advice.”

7. It is our unique capability and excellence in both weather forecasting and climate research that means we are able to integrate breakthrough developments in climate science into fully operational climate and weather services, quickly and with a true end-user focus. This makes us ideally placed to lead coordination with research councils to ensure a sensible programme of pull-through to operational services.

8. This is in direct contrast with the US model for weather and climate science which maintains research and operational delivery as separate activities carried out in different organisations. This has led to huge spend on research with a less efficient pull through to services.

OPPORTUNITIES EXIST FOR BETTER CROSS-GOVERNMENT WORKING

9. Although the UK is already seeing an extremely positive return on its investment in the Met Office, there remains significant opportunity whereby our national capability could be even better exploited. Professor Julia Slingo, Met Office Chief Scientist, has recently been invited to sit on the Chief Scientific Adviser’s Committee (CSAC), chaired by Professor John Beddington, Government Chief Scientific Adviser. This gives the Met Office, for the first time, an opportunity to take part directly in discussions with scientific peers on issues of immediate relevance to the Government. However, the process described earlier by which research funding is allocated and prioritised, means the extent with which we are engaged in discussions on strategic level Government science policy is lessened.

10. Just as the merger of separate Met Office climate research departments into the Hadley Centre in 1990, and our integrated climate research and weather forecasting capabilities have proven to be more efficient and cost effective than that of other models, wider cross-Government discussions on science funding may also prove to have significant benefits.

11. Cross-Government coordination of an integrated climate research programme would ensure all parties are able to use and respond to the same information base. Common issues would become apparent thereby ensuring research was better targeted—with the risk of multiple funding of core research eliminated. This pay once, use many times approach would allow Departments to directly fund only those services specifically required for their policy area.

30 October 2009

Examination of Witnesses

Witnesses: Dr Brian Bowsher, Director, National Physical Laboratory, Professor Chris Thorns, Science Director, Veterinary Laboratories Agency, and Mr Derrick Ryall, Head of Climate Programme, Met Office, examined.

Q183 Chairman: May I welcome you very warmly. I think one or two of you have been watching us in action and realised that we are a very civilised and nice people and so on. My name is Sutherland, Chairman of the Committee. If initially you could say for the sake of the microphone who you are and what your role is that would be very helpful, because a transcript is prepared and you will receive a copy, but that is a reminder that this is evidence taken in public and will be published.

Mr Ryall: Derrick Ryall from the Met Office.

Professor Thorns: Chris Thorns from the Veterinary Laboratories Agency.

Dr Bowsher: Good afternoon. Brian Bowsher from the National Physical Laboratory.

Q184 Chairman: Thank you very much indeed. Can I ask initially from each of you a very short statement about the main role of your institution, what you would see the primary objectives being, and just tag on to that the question: if in a time of financial pressure you wanted to make a case why you should be less pressed than some, what the key element of that case would be. That would be helpful.

Mr Ryall: The Met Office is a trading fund of the MoD. Its headquarters are in Exeter with about 1,800 staff, of which about 400 to 500 are scientists, with a total budget for science of the order of £40 million to £45 million, which includes the supercomputer we use as well as people. Our business is predicting weather and climate, weather typically from hours to days ahead for the Environment Agency, so, say, flood forecasting at short range, through to hazardous weather at days ahead, and for finance very much from the month scale out to a century and beyond to inform adaptation and mitigation policy within government. We provide gradations over these timescales to a pretty wide range of users, which could be government, such as defence, transport, health, irrigation, industry, and the public and the media, basically to inform decision-making.

Professor Thorns: The Veterinary Laboratories Agency is an executive agency of Defra. It has approximately 1,400 employees at the moment within 16 sites. The main site is near Weybridge in Surrey and we have an annual running cost budget of approximately £110 million. Our main role (we have a number of roles) is to provide evidence to policy makers in terms of disease prevention and control. We are the national eyes and ears of the UK in identifying new and emerging diseases through our regional laboratories. We have a very important role in terms of emergency response, and unfortunately in the last few years we have had to initiate that a number of times with foot and mouth disease, BSE and the various influenzas, to name but three. Also, we have an important national and international reference laboratory role in terms of animal and public health diseases, and we have important roles in terms of European Community commitments, again as reference laboratories for BSE, avian influenzas and tuberculosis.

Dr Bowsher: The National Physical Laboratory is a world-leading national measurement institute. Our primary remit is therefore to maintain and develop the nation’s primary measurement standards and that essentially supports effective trading throughout the international community. We are also concerned with applying our science and technology with effective knowledge transfer. That means we are positioned between the academic sector, the business sector and government, and we are very much about maximising the impact of our work in terms of its economic benefit, its social benefit and its environmental benefit. Our sponsoring department is BIS, Business, Innovation and Skills, through the National Measurement Office (NMO), and they give us about £50 million, which is two-thirds of our funding. The remaining funding comes from a mixture of other government departments and private sector funding. We are a GOCO (government-owned contractor-operated) organisation managed by Serco ever since 1995, and
that we believe has been effective in terms of the efficiency of the operation and the outputs of the activity.

**Chairman:** I will not press the point, if there were cuts why not you, yet. It will doubtless come out in your other answers. I wonder if Lord Haskel wants to continue the discussion.

**Q185 Lord Haskel:** You have told us your role and you have told us what you do, and thank you for that, but what is the purpose of the research and the development work that you do?
**Dr Bowsher:** Me or all of us?

**Q186 Lord Haskel:** All of you.

**Dr Bowsher:** In essence we are supporting industry through the effective transfer of technology. That means, if you take a company like Rolls-Royce, they have got 200,000 measurement machines and we support them in order to give effective application of technology. In the health sector, we provide an effective calibration of the radiotherapy machines used in UK hospitals so that exactly the right dose is targeted to the right organ and as a result help the quality of life for 200,000 cancer patients a year. It is that sort of directly applied work.

**Professor Thorns:** As for the Veterinary Laboratories Agency, our research in my opinion underpins absolutely everything we do. It is absolutely vital. We provide evidence to support new and review existing policies in terms of the control of animal diseases. We provide underpinning research to help develop new tests, for example, to understand new and emerging diseases, which is extremely important. In the case, for example, of avian influenza or pandemic H1N1 influenza, we are currently carrying out research to understand disease dynamics in pigs, to develop new, rapid diagnostic tests to aid control, and these are just a number of the examples of how the evidence can be used with other types of evidence to help refine and improve and deal with existing diseases and new and emerging diseases. Our other important role in terms of disease is horizon scanning. Diseases are dynamic; they change all the time. Our international role, our role around the world, is to gain intelligence to understand how animal and public health diseases are changing, moving geographically or changing in terms of virulence and so on, and this again helps inform policy making. I would like to add one other important role for research, in my view. As we are a national organisation we have one of the largest high security laboratories and animal facilities in the world. It is very important to retain the skills and expertise, and in my view one very important way to underpin and maintain those skills is to have a dynamic research portfolio of work.

**Mr Ryall:** In terms of the Met Office, I think it is fair to say we are fundamentally a science organisation and all our products and services are based on that science and the progress in that science. In essence the science is there to, on the weather side, improve the accuracy of weather predictions and, just as important, to exploit that weather in terms of users. The second element on climate is very much to help develop that evidence base. We have now spent the last few years answering the question, “Is climate change happening?”, “Why?”, and, “Is it serious?”, and now we are entering into, “What do we do about it?”, in terms of mitigation and adaptation, and that drives some fundamentally different science questions to provide predictions at local scales and over the years to decade timescales on which decisions are made, so that is driving a fundamental change and need for research. I will briefly outline the types of research. If we think about developing a weather forecast or a climate prediction the stages are quite simply about observing weather, so we need to help develop those early systems and exploit them. For example, many new satellites are deployed and we need to know how to best use that information to maximise forecast accuracy. We need to understand the processes that impact on climate and weather. At the moment we have a particular focus on natural climate variability to be able to look ahead of the next few years. We need to construct modelling systems that will enable us to predict weather and climate and we need to develop prediction systems on top of that. In development models there is a science in terms of developing prediction systems that are useful, and finally we need to develop tools for exploiting that information directly for users. A current example might be tools being used by the Flood Forecasting Centre, the joint Met Office/EA set-up, to look at some high resolution modelling in terms of flood forecasting. All of that science is fundamentally dependent on collaboration as far as we are concerned, both nationally and internationally. A good illustration of that is that something like three-quarters of our papers have co-authors. I think that summarises our research.

**Dr Bowsher:** I wonder if you would forgive me. I feel I did not answer the question fully, so I will just make a supplementary comment if I may. I first of all should have emphasised the fundamental work in terms of the primary national standards—the accuracy of the second, the kilogram, the Kelvin and so on. For example, at NPL we have been working to get increasing accuracy of time which allows us not only to quantify time but also position in space and hence underpins modern communications and technology. In terms of some of the broader applications, the key areas that we would highlight would be health care, advanced materials, environmental research, energy and environmental...
studies. As a consequence, we put out something in the order of 200 peer-reviewed papers a year; we also sit on about 450 national and international bodies to provide that guidance.

Q187 Lord Haskel: Are you satisfied with the funding that you get for all of this work? In the submission from the Veterinary Laboratories Agency you seem to suggest that there was not a level playing field and you suggested that funding procedures across the public sector be reviewed. Do you all agree with that?

Professor Thorns: Perhaps I can enlarge on that, because this is something I have been highlighting for a number of years now. Some people agree with me; some people disagree with me. The situation is that from our perspective as a public sector research organisation or establishment we do not believe the research playing field in this country is level. The reason I say that is that we are restricted as a public sector research establishment to a very small component of research council funding. That is the themed calls. Responsive mode calls, which are the vast majority and, according to the research council, a strategy that is likely to increase, are restricted only to their own institutes and to universities. The Government funds its own institutes and agencies, for example, the Veterinary Laboratories Agency and other agencies, but government funding also funds work in research council institutes and in universities. For example, the Institute of Animal Health is funded, especially at Pirbright, by government funds. We feel that over time that restricts our flexibility in our research work, because a lot of the collaborations that we currently have—we have many with academia, and we are developing them—are rather restricted, because we are always having to work on a sub-contract basis rather than an equal partnership basis. That is fine. When we work together we do so as an equal partnership, but it does not alter the fact that funds directly from research councils do not find their way in general to the public sector. We are a national research establishment and that is my feeling—that at the moment in this country it is not a level playing field.

Chairman: That is very clear; thank you.

Q188 Lord Haskel: Do you share the view?

Mr Ryall: Perhaps I can approach it from a slightly different direction. Looking at it in an absolute sense of is the funding adequate, I suppose the success of the last few years would imply that there has been appropriate funding to develop things at the pace we are developing them. Looking ahead, and picking up on the point just made, this whole point of collaboration. I would argue that the Met Office already collaborates widely, but the demands for collaboration will increase, both with academic institutes and also internationally with other climate and met centres and academia, and also in thinking about things like interdisciplinary, for example, looking at the social and economic impacts of climate and things like that. In terms of developing programmes and projects, that does pose challenges for us, because at the moment the funding streams per se, the people you would work with at one end, might come from an RCUK fund. We are not eligible for that, so at the moment it can prove quite challenging to set up projects and programmes. To partly alleviate that and for an illustration of some of the ways forward, we have recently set up a joint research programme with NERC, and the idea there is to try and establish a framework with which we could work with NERC colleagues in a more productive manner, looking at IPPR, looking at IT facilities; we have a shared supercomputer capability on stream. Whilst that is a good start and enables us to align the strategies between, say, NERC and us, how do we best get involved where the Met Office has a reasonable role, either a leadership science role or a participation role or simply in trying to pull through the science into some sort of operational capability? It would be useful to look at mechanisms by which we could get involved with some of those projects in a more constructive way to get better value out of the whole system.

Q189 Lord May of Oxford: When I was the Chief Scientific Adviser it was the last time I really knew much about each of you, but at that time the NPL was, it seemed to me, in great shape, the Met Office was about to undergo quite marked transition in management that had many of the research community worried (and still worried) about it, and the Veterinary Labs had areas of strength and areas of serious weakness. My question for the Veterinary Labs is, given the importance of them, given the fact that in order to function properly they have to be interwoven with all sorts of outside people, and we in this country have some of the best units of population level engagement of disease and non-human animal populations—at the time I was involved I spent a huge amount of time locked in bitter struggle with what was then MAFF who simply would not make data available to outside experts, and it is my impression that that appalling weakness, coupled with great strengths in other areas—design of vaccines and so on—has been fixed. Could you say a little bit about how deliberately you think about interacting with the outside world and what part you see as its relation to you?

Professor Thorns: I would agree with you that many of the things you have described there have been fixed and, as for the Veterinary Laboratories Agency, I can say that one of our new initiatives is investing in post-doctoral studentships, and it has proven to be a great
success. We have been pleased to welcome a number of universities that have wanted to collaborate with us, and we have many students now doing PhDs on a variety of subjects. That is very heartening. It still does not get over the fact that we have this divide in terms of funding but it is working well, and we have a lot of external scientists from academia and other areas on our scientific committees and research committees, including very eminent population scientists and so on in this country. In terms of internationally, we have very strong links with WHO, the equivalent in animals, which is the OIE, the FAO and the EU, and all of those are interwoven, in your words, in helping to provide and develop a global network for quick alerting of new and emerging diseases. There are two that are of particular interest to us at the moment in the way that they are spreading; one is Rift Valley fever from north Africa up through the Mediterranean; another one is African swine fever, which is coming in from the east. Of course, blue tongue was a very good example that has spread even quicker. As important is our work with developing countries in trying to bring their laboratories up more or less to the level where they can quickly identify new and emerging problems, in other words, so that the timescale between an incident occurring in a particular country and the identification of it is as short as possible. In all those situations it is extremely interwoven. In some cases we are funded and in some cases, very thankfully, the UK Government, through Defra, recognises the importance of this and funds it. In other cases it is unfunded, and we as an organisation regard it as so important that we use some of our commercial profits, which we are allowed to make, to support this, so it is a combination of things. As an institution we have more international reference laboratories in animal diseases than any other organisation in the world, and that in my view is important for the UK, because it provides added influence in the EU and other trade and influential-type discussions.

**Lord May of Oxford**: If I may say, my impression is that you have really turned things round. In particular, the recent science-based handling of the very controversial thing over badgers and TB is just exemplary.

**Q190 Lord Broers**: You have been talking about this, but my overall question, is what funding mechanisms are available to you? Do not repeat what you have already said, but perhaps all of you could comment on that, and in particular how does your organisation’s commercial imperative—you just mentioned this—affect how you prioritise your research?

**Dr Bowsher**: The simple answer to your question is that there is £50 million coming through the NMO, and that is very much currently through the interactions with the end users, so we have a network of about 3,000 industrial companies, 40 universities and we formulate the programmes to meet their demand. We then have something in the order of £25 million from other contracts. One issue is that we have 200 separate contracts from government departments, which is not the world’s most efficient way of doing things. We also do quite a bit with small and medium enterprise companies and a few big boys like the BP and the Rolls-Royces of this world. One of the issues on the funding and the commercial imperatives is that the core funding is satisfactory to maintain current capabilities. But, but in terms of the impact that we have—the impact typically of about £6 million in investment is something in the order of £400 million of GDP per annum—and some of the concerns from our individual partners, as well as the oversight from the Royal Society and the Royal Academy of Engineering’s science quality, this funding is insufficient to meet the new challenges. It is fine to keep a static organisation, but, as things are emerging, bioscience and nanotechnology, you need to have a critical mass in those areas, and that is a challenge for us. The final point is just to agree with Lord May—NPL is still a fantastic place to work.

**Q191 Chairman**: Mr Ryall?

**Mr Ryall**: From the Met Office perspective, again, there is a distinction between the weather side and the climate side. The fundamental capability for forecasting weather, the observations modelling and the prediction systems, is funded by what is called the Public Weather Service Customer Group, which effectively channels money from the MoD. Of that about £25 million is invested in sites to develop and improve weather forecasting, as discussed before. On the climate side, our funding for Met Office Hadley Centre comes directly from Defra and DECC at the moment and is of the order of £80.5 million, so that is very much a directed programme of research, essentially answering policy-based questions. We also get a certain amount of funding, of the order of a couple of million, from other direct contracts with government, typically other government departments, for example, the Foreign Office, at the moment. We did a four degree poster which some of you may have seen. We also get a certain amount of funding from the EU, of the order of one and a half million, bearing in mind that that only funds 50 per cent, so we need to find co-funding for that, and that comes from the previously mentioned funds. Commercial is a small but growing area. I suggest that most of the work we get from industry is not so much directed at core research; it is focused on the applied research, and one of the challenges we have there is funding we call capability. Everything we do in terms of whether it is for policy for government or whatever depends on an underpinning capability of...
observations, modelling and prediction systems. We have this challenge that, as we grow the business and look at other funding, is that able to fund some of our core funding or is it only paying for the exploitation of that? The risk of that is that you end up with lots of exploitation but no-one funding that core science. We also, going back to the original question, try very hard to make sure that there are no adverse impacts of commercial work on the science; in other words, we try and deliver it to maintain a level playing field from separate consultancy areas of applied science areas which deliver that work, which can draw upon the knowledge of the science within the organisation and deliver it from a separate part.

Q192 Chairman: Professor Thorns, do you want to amplify your previous answer?
Professor Thorns: Most of our funding, research and other science funding comes from Defra. We also have funding from other departments, such as the Home Office and the Ministry of Defence. We have a growing EU portfolio of research. We have money from the Wellcome Trust. We do have money from the research councils; a good example is our recent one on the pandemic H1N1, which is a consortium, and we have growing commercial targets and our commercial programme is quite active and is growing quite well. There are two reasons for having it. First, maintaining high security laboratories and animal facilities and farms is extremely expensive. We use our commercial activities to help financially maintain the skills, expertise and facilities there. It is nearly all applied research, linked quite closely with our research work, but we are able to make profits on our commercial work and that is the one area where we are able to reinvest over the annual period. One point I want to make—

Q193 Chairman: Sorry; can I just be clear about that? Within the same year you have to reinvest the money?
Professor Thorns: No.

Q194 Chairman: You can hold it?
Professor Thorns: We can run it forward to the next year. The one point I do want to make, which we feel is still a little disappointing, is that we have no core funding at all as a national agency. Everything is project and programme based. This means that if we see an unusual observation, as we did a few years ago with BSE, it took us more time to set up the project and the finance to get the work done, and in fact the French did the work by the time we had the bureaucracy and the administration in place. If we had had a small proportion of core funding, which is all we are asking for, we could have done that work. Unfortunately, at the moment, although we are very pleased with the funding we get, it is all very project and programme based.

Q195 Lord May of Oxford: How do you go about allocating the funding between different programmes and types of things, and in particular what is the involvement of the department’s Chief Scientific Adviser in this issue?
Mr Ryall: I guess in terms of allocating funding and looking at science priorities, it is a process with an element of top-down strategic and bottom-up priorities of the science. In terms of weather, we have the Public Weather Service Customer Group and they define the outcomes that they wish from the Met Office in terms of weather forecasting and in terms of accuracy and in terms of the types of products. In terms of climate, we have our DECC and Defra customers who set quite clear requirements in terms of policy, which is informed presumably across government and by ourselves; it is a very iterative process, and I think there is a strong recognition by both sets of customers that there is an element of building those priorities from the science up as well. We then have a large number of leading scientists who are perhaps in some of the best positions to try and decide where some of those areas of research should go, so it becomes an iterative process where we are trying to suggest to some extent what the best priorities are and also looking at it from the top down in terms of requirements, and that pulls together essentially a directed programme.

Q196 Lord May of Oxford: Professor Thorns?
Professor Thorns: This is a very interesting question. The role of chief scientific advisers in terms of animal and public health I think needs to be clarified. I have to say that we have more interaction with the chief veterinary officers and the chief medical officers and from our perspective there needs to be some clarification about the two roles. It is a very iterative process in determining research priorities and I have to say as an organisation we are involved very much with that, but we tend to be involved with the Chief Veterinary Officer and his staff or sometimes the Chief Medical Officer, less so with the Chief Scientific Adviser, who provides perhaps a much higher strategic overview, perhaps a global view rather than a local view.

Q197 Lord May of Oxford: Do you not think that can be useful in a frame-shaking way in an institution which after all does have a history of being rather hermeneutically sealed?
Professor Thorns: Absolutely, but I still think there needs to be clarification on the role of chief scientific advisers in general over arms-length bodies. Their role in terms of core government departments seems to be much clearer than their role in terms of
executive agencies and other bodies. That is our perspective.

Dr Bowsher: To answer the question in two bits, first of all, the programme formulation I think is one of the strengths of how we operate. We work very closely with our NMO customer and a whole series of end users in a very consultative process where we essentially craft the programmes with regard to the end user impact in terms of economic or social impact. That works well also in terms of the time to fruition, so we have advanced things and fairly short-term things, one to three years, and some long-term stuff. I think that is a strength of the programme. In terms of the chief scientific advisers, we have a very good link with Brian Collins, who is the Chief Scientific Adviser for BIS. We also work across some of the other Chief Scientific Advisers, notably people like Mark Welland and Paul Wiles. John Pethica, our Chief Scientist, sits on the Chief Scientific Advisers board, and that is really useful in terms of getting the feedback and some of the direction. The only other point I would make is that there does seem to be some inconsistency in terms of the funding available to some of the chief scientists and the ability to directly influence some of the programmes.

Q198 Lord May of Oxford: Can I just say that it is my impression that this board which brings everybody together is something that John Beddington has brought into much sharper focus. I have the impression that that addresses many of the issues we are talking about. Is that correct?

Dr Bowsher: From my perspective, yes.

Q199 Lord Cunningham of Felling: Professor Thorns, I may unintentionally have upset a previous witness by suggesting that her agency memorandum was asking questions about current funding models and processes, but you would not be upset if I suggested that you thought there were improvements to be made, would you?

Professor Thorns: No.

Q200 Lord Cunningham of Felling: Thank you. Can you tell us, each of you, when you are having discussions with your sponsoring departments, whether you are satisfied that you have sufficient influence or say about the final decision of resource allocation?

Professor Thorns: I must tell you that our relationship with Defra is, I would like to think, very good. We are brought in extremely early in terms of discussions, in terms of research priorities, in terms of prioritisation across programmes. We have an extremely good relationship with them, and I believe that they value our expertise and evidence and advice. They do not always take it, of course; we accept that. We understand that, but we believe that in terms of Defra we have a good relationship with them. I think they value the work that we do, and from my perspective in many areas they champion the work that we do.

Q201 Lord Cunningham of Felling: Perhaps I could ask you in particular then, Professor Thorns, a supplementary to that. Have you convinced your colleagues in Defra, the political leadership of the department as well as the scientific leadership of the department, of the strength of your case for changing the way funding mechanisms work?

Professor Thorns: Some of them. I believe we have partial success in terms of Defra. They recognise that the current funding mechanism that we have, as I mentioned, is very project/programme based, so there is not a great deal of flexibility.

Q202 Lord Cunningham of Felling: You talk about stove pipes in your evidence.

Professor Thorns: There are still stove pipes, and there are two things here. One is refining and improving the stove pipes to make the whole process a lot easier, and I think we are progressing on that. There is also making the stove pipes more flexible, but the more important thing is that each funding organisation has its own stove pipes and each stove pipe is different. Most of our work is collaborative, if I may quickly give you one example. We are currently doing an influenza project co-funded by the MRC, Defra and the Wellcome Trust. We are the project leaders of that, doing a lot of disease dynamics in pigs and epidemiology and so on. The problem is, you recall, that we are not eligible for research council funding, and each of the three organisations has a different way of financially administrating that. Therefore, it took much longer to develop the financial administration process than the scientific programme, which I think is a bit of a shame.

Q203 Lord Cunningham of Felling: I agree; that is crazy.

Professor Thorns: It is crazy. What I would suggest and would like to see is that all three organisations put a pot of money into a central pot which is administered in the same way. That to my mind would be a much more efficient use of funds. I am not sure how easy it would be to get those three organisations to agree to that, but as a contractor often it is the administration that lags behind development of the science.

Q204 Lord Cunningham of Felling: So what you are really saying is that in your opinion the administrative mechanisms are holding back what might be very urgent, if not vital, projects?
In some cases, yes.

Dr Brian Bowsher, Professor Chris Thorns and Mr Derrick Ryall are moving away from climate being a one-look at ahead, there are a couple of challenges. We have a pretty strong, constructive, productive relationship with our customers, whether it is MoD in terms of the impact on some of the funding decisions. Our colleagues do their very best to implement it in an appropriate way but they are essentially given an edict to reduce funding.

Q205 Lord Cunningham of Felling: You are very positive in your memorandum about the structure you operate at the National Physical Laboratory, Is it your view that we could advantageously more widely apply those structures?

Dr Bowsher: Previously in my career I worked at the Atomic Weapons Establishment, which also operates a GOCO, and what I like about the approach both at AWE and NPL is that there are very clear requirements in terms of outcomes, and then you get essentially Serco to bring its private-sector expertise to operate efficiently. In my opinion it has worked very well, because in terms of the bang for your buck, the impact we get is there: we have been able to demonstrate significant efficiencies, but, far more importantly, we can demonstrate that the quality of the science has been improved.

Q206 Lord Cunningham of Felling: So that is a yes, then?

Dr Bowsher: Yes.

Q207 Lord Cunningham of Felling: Thank you, Mr Ryall?

Mr Ryall: Going back to your original question, our relationship with customers, I think it is fair to say we have a pretty strong, constructive, productive relationship with our customers, whether it is MoD in terms of the science, and whether a funding model, perhaps something like if the Public Weather Service Customer Group became the Public Weather and Climate Group, in other words, we could link those two separate areas together. That is something I think we would like to think about.

Q208 Chairman: Specifically to the Met, I understand that some of the operations funded by the MoD have lost their funds; MoD have withdrawn. Is that correct? In which case, how has that impacted on you? It is an example of some of the points you have been making.

Mr Ryall: At the moment it is fair to say that the funding structure for the climate component of the Met Office science is being restructured and changing priorities across government. We are now working with a number of different departments to try and
look at that and how it does get restructured. At the moment those discussions are productive but no final agreement has been reached yet.

Q209 Lord Methuen: Would it be appropriate for a department other than the MoD to be your sponsor? Mr Ryall: That is a very interesting question. I think I would go back to what I said earlier in that our activities and our outputs are relevant to a number of departments across government; therefore, it is very difficult to identify one that is the obvious source. A number of reviews over recent years have looked at that and decided that there is no obvious department, and I think that is possibly the way we feel. MoD has traditionally been it because of our support to defence, and it remains a very strong customer. We also provide a lot of information to DECC and Defra. We provide information to other departments, whether it is Transport, etcetera. Those are more cross-government type discussions, but from my perspective it is not obvious that any one department is better than another. What is more important in this context is how funding flows and enables us to do the research and the underpinning science that is relevant to all departments and to providing that UK capability.

Q210 Lord May of Oxford: The change at the Met Office that I referred to earlier that many in the meteorological community are uneasy about is that here is something that was the first Met Office. For 150 years it led the world and it had an unbroken leadership of people of high academic standing in the discipline so that the management had that at its core. Then ten years ago that changed, first with a civil servant, now with a business person, and moving down to its wonderful new site but breaking up the grouping that the Americans have reconfigured theirs to which used to be in Bracknell. I read a particularly fascinating book recently published by Amanda Goodall, Socrates in the Boardroom, documenting the high correlation between the academic excellence of universities and the intellectual standing of the leader. What is your reaction? Do you think it has made little difference or do you think the worries that the community I relate to have substance? Mr Ryall: As I recall, when we moved down to Exeter five or six years ago there were quite a few concerns. I do not think many of those have been realised. I still think the Met Office takes a pretty leading role in the science. A good illustration of that is recently the appointment of our new Chief Scientist, Julia Slingo, who was previously Director of NCAS. That clearly demonstrates both the pull for the Met Office and the fact that it will enhance over the coming years quite strongly, I think, our relationship with NERC. We have also over recent years recognised how important collaboration is, particularly with NERC, which is why we have set up, as we discussed before, a joint programme to try and make sure strategy is aligned. We can break down some of those barriers to so-called collaboration so that both in terms of management and of the frameworks we are collaborating better. Another example is our new supercomputer, which has just been installed. A significant component of that has been put aside purely for collaborative work, so it is a joint NERC/Met Office supercomputer for joint projects, and again that should really help to facilitate some of those projects.

Lord Crickhowell: My question in a way we have been discussing almost for the half hour, as to how effective is research co-ordination across government. You have all said several times over it could be improved.

The Committee suspended from 5.32pm to 5.38pm for a division in the House

Chairman: We have time for one more question.

Q211 Lord Crickhowell: I took advantage of the division to give our witnesses advance warning of what I wanted to say. We have heard that there are obvious difficulties at the moment in getting co-ordination: there are complaints that you are not funded by research councils, and other obstacles, and the question I asked privately was, can you find common ground, a funding solution which would enable you all to go to the hard taskmasters in the Treasury with some hope of success? Is there an obvious common ground which would be likely to be acceptable to overcome the difficulties that you have identified? My second question is perhaps addressed to Dr Bowsher as much as anyone, where we have been talking a great deal about the importance of the work that you do for industry. Is industry making a big enough contribution? We have been hearing an awful lot about funding coming from the taxpayer. Are we getting enough funding for all of your activities? We heard a little bit about commercial activities, but could some more come from industry? There are two questions—is there a common way forward likely to solve the problem, and should we be getting more from industry for the benefits they are obtaining from it? Dr Bowsher: In terms of the first part, I think there are some ways that we could probably get a more coherent approach, yes. Just within my own company, Serco, we have been looking at bringing together some of the national labs that we manage—NPL, AWE, the National Nuclear Laboratory, our support to the Defence Science and Technology Laboratory—to see how can we do things a little better from within the company. We would then be in a better position to present to government a more
coherent approach that will perhaps allow some of those broader synergies to be properly realised across other public sector research organisations. That is the first part. Answering your second part in terms of industry, in a way much of the work that we do is at such a fundamental level it is difficult to see which industrial partner would pay. For example, where we calibrate all of the hospital radiation machines, do we take a levy off each of those? It does not seem that efficient compared with central funding. Where we are doing the translational research which has maximum impact to industry that, I think, is correctly the part of government. Where it is the more applied end, I think we could probably do more in terms of getting industry support.

Q212 Chairman: Professor Thorns?
Professor Thorns: I think the research councils and the government departments are now working more closely together, which is a good thing, and this, I think, avoids duplication which must benefit us in terms of efficiencies and rationalisation. A good example is that I still think a lot could be done across government departments. I happened to be here when Dr Wadge was talking about campylobacter in chickens, which came across as a Food Standards Agency issue. In fact, it is a cross-government issue. It is a Defra issue, it is a Department of Health issue, and therefore one wonders how much duplication there is on campylobacter research in this country, and indeed across the world, because you wonder whether the various funders are talking to each other in terms of providing co-ordinated research questions and other questions. I do think that across government departments they are beginning to talk, and I think that is great. The money must flow with that though. There must not be a separation of developing a scientific question and leaving the funds in the stove pipes. Somehow there has got to be a coming together of those two.

Q213 Chairman: When you say you wonder if there is duplication, do you really wonder or are you just causing us to wonder?
Professor Thorns: No. I was chair of the European action group for seven years that involved 22 countries, and the number of times I had to listen to virtually the same talk on campylobacter in chickens over six years was amazing.

Q214 Chairman: So you do not really wonder; you know that there is duplication?

Professor Thorns: Yes.

Q215 Lord Cunningham of Felling: My Lord Chairman, it is the same question. I was concerned when Professor Thorns gave the impression that he did not know, but I think the answer is you do know and there is duplication?
Professor Thorns: There is nothing wrong in a certain amount of duplication because you have to test that hypothesis a number of ways, but you can go over the top.
Dr Bowsher: Just one point, if I may, to note that there has been some work with Professor Beddington in terms of how you can match all these capabilities across the national labs for more effective outputs.

Q216 Chairman: Mr Ryall?
Mr Ryall: I agree with some of the comments made before when you talked about not having access to research council funding. Certain types of projects are quite challenging. Personally, I think it would be quite useful if we could explore ways of getting access to RC funding for certain projects, perhaps initially looking at where the Met Office could be seen as the “necessary” partner in terms of being involved because of their scientific expertise or because of the need to pull through that science into some sort of application or exploitation in terms of forecasting or climate prediction. I do think we have to be quite careful though, because what has evolved, as we heard before, is some really quite strong and good relationships with customers, and we have got to be very careful when we change funding mechanisms that we do not throw benefits away. To suddenly have in prospect a much more open system, you feel that there could be risks of it being of a much more complex, less directed nature, so we have to be a little careful that we approach this in a paced, sensible manner, perhaps exploring certain projects more based on outcome needs and therefore who needs to be involved and therefore just some funding for that, rather than a blanket looking at it on a problem-by-problem basis.
Chairman: Thank you very much indeed. We have now run beyond our time, not least because of the division, but we thank you very much. There were one or two other areas we indicated we are interested in your views on, and if you have written comments that would be very helpful. Equally, if, looking at the transcript, there are points you would like to amplify or perhaps clarify, that would be much appreciated also. Thank you very much for your time and for the written evidence that came in before.
Supplementary memorandum by the Met Office

In light of the Chair’s introductory remarks to the oral evidence session on 11 November, it was felt the Committee might welcome further input on the benefits received from UK Government investment in Met Office science and the value for money it provides to the UK taxpayer.

— The Met Office is globally unique. It offers prediction across all timescales (weather and climate) using a single, highly sophisticated computer forecasting model (known as the Unified Model) and drawing from an extensive, shared observations network. This has concrete benefits:
   - access to greater computing resources [with the benefits of pooled capacity, shared IT infrastructure / expertise and efficiencies from economies of scale]
   - ability to look beyond immediate weather variables to describe full range of impacts—on a daily, monthly, seasonal, decadal or century long basis
— An independent review of the Met Office Hadley Centre published in 2007 acknowledged the pioneering nature of its work and its position at the “pinnacle of global climate science”.

Much of this success was attributed to its links with the Met Office National Weather Programme and a commissioning/funding structure that was both stable and focused on producing policy-relevant outputs.

The same report stated that, “no other single body has a comparable breadth of climate change science, data analysis and modelling, or has made the same contribution to global climate science and current knowledge”.

— An independent report commissioned in 2007 concluded that from the £84 million invested each year in the Met Office’s Public Weather Service (PWS) alone over £600m worth of value added benefits were returned to the UK taxpayer (or £10 return against every £1.40 invested). The PWS is but one area of Met Office activity; predicting and helping mitigate against the impacts of severe weather and providing the public with day-to-day weather forecasts. The report also acknowledges how investment in PWS has provided for the development of the Met Office science that underpinned the UK’s response to incidents as diverse as Buncefield and outbreaks of bluetongue among UK livestock.

— The quality of Met Office weather science is internationally recognised; we are consistently rated as the world’s most accurate operational weather forecaster by the World Meteorological Organization, a UN specialised agency.
— Met Office science has a strong operational pull through—demonstrable in a huge variety of ways ranging from battlefield support to the protection of critical national infrastructure at home in the UK. We deploy science to monitor and predict occurrences ranging from atmospheric impacts upon human health conditions such as COPD to the impacts of climate change in developing countries.

With reference to Lord Methuen’s question regarding our current position as an MOD-owned trading fund.

— While our science has a genuinely cross-Government relevance and we have a customer-base that includes DECC, Defra, MoD and others, our current governance is suited to the unique security issues associated with the type of frontline support we provide to the armed services.
— In 2006 The Commons Defence Select Committee concluded that there were “no grounds for recommending any changes of responsibility”
— The latest available financial figures show a net return of £17 million from the Met Office to our own Department

12 November 2009

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3 The Public Weather Service’s contribution to the UK economy—PA Consulting May 2007
1. The role of the Higher Education Funding Council for England (HEFCE) is to allocate funding provided by the government to universities and colleges in England for teaching and research (including support for knowledge transfer).

2. HEFCE funding for research is allocated to enable universities collectively to maintain a research base of world leading quality across the full range of disciplines, creating a sustainable and flexible national baseline capacity which enables the sector to respond strategically to a changing external environment and on which research and other activity funded from other sources can build. Within the dual support system, our funding is allocated as a block grant which the receiving institutions may spend in ways that they consider will best meet these aims, and is distributed selectively by reference to robust indicators of research quality.

3. In particular, our funding supports HEIs undertaking innovative research, including in new fields and opening new lines of enquiry; the potential that it creates for them to make connections across subjects with a technological, business and social focus is particularly important in this context. It also makes a substantial contribution to maintaining a strong and stable physical human environment in which excellent research funded from a variety of sources can be carried out. In our view the operation of the dual support system, under which government funding is channelled through complementary grant systems providing both block grant and project funding, has been a major factor in achieving and maintaining the exceptionally high quality of the UK research base in the face of growing international competition.

4. Research funded by HEFCE achieves positive economic and social impacts in several ways, including through the direct application and exploitation of HE research (supported by our Higher Education Innovation Fund); by underpinning the contribution of all HEIs to creating a highly educated, skilled and flexible workforce; and by contributing to a national culture of innovation. We are currently working to establish stronger and more direct links between our funding and the impacts made by the research activity that it supports.

5. HEFCE’s strategic aim for our research funding is:

   to develop and sustain a dynamic and internationally competitive research sector that makes a major contribution to economic prosperity and national wellbeing and to the expansion and dissemination of knowledge.

6. Our objectives supporting this aim are:

   — To maintain a research sector with a strong position among the world leaders, which can respond flexibly to the changing needs of stakeholders and lead in developing new and innovative fields of enquiry.

   — To work with Government and the sector to develop a system for assessing research which informs funding and demonstrates the power of the national research base, helping institutions to identify and foster excellence.

   — To ensure that research can be supported without prejudice to the sustainability of the sector’s long-term financial, physical and human resources, or the delivery of other activities in the public interest.

   — To develop a funding policy that achieves these objectives.
Funding and assessment

7. In 2009–10 HEFCE will distribute £1,572 million in recurrent research funding. This is made up of the following elements:

- £1,074 million for mainstream QR grant
- £32.3 million for London weighting for mainstream QR
- £202.7 million for the research degree programme (RDP) supervision fund
- £193.6 million for the charity support element
- £62.9 million for the business research element
- £6.5 million for research libraries.

8. Mainstream QR grant is distributed by formula using indicators of research volume, excellence and subject mix derived from the Research Assessment Exercise (RAE). In this way, HEFCE ensures that its funding is distributed selectively to institutions with the highest quality research, and there is a clear contestability supporting accountable and efficient use of public funds.

9. The charity support fund and business research element are distributed with reference to income received from charitable or business sources respectively. The purpose of the charity support fund is to recognise that charities supporting research in higher education are not always able to meet the full economic cost of the work that they support. The business research element provides an incentive for universities and colleges to work with business and commercial organizations.

10. In addition to these formula based allocations the Council allocates funds from time for special initiatives to strengthen the national research base, responding to particular needs that have been identified by the Council, by government, by partner funding bodies or by the universities and colleges themselves. In particular:

- Between 2003 and 2009 the Council allocated some £20 million each year to support building research capability in seven fields where the national base was judged to be less well developed.

- We have co-funded with individual research councils a number of schemes to build capacity in emerging fields (for example, the Science and Innovation awards co-funded with EPSRC) or in fields judged to require support in the national interest (for example, support for quantitative social sciences co-funded with ESRC).

- In allocating mainstream QR grant for 2009—10 following the 2008 RAE we took steps to safeguard our funding for broad areas of research in STEM disciplines which might otherwise have secured a reduced share of grant as their volume of activity rose by less than in other areas.

- We have funded a number of initiatives to build or safeguard research capacity in strategically important fields through collaboration between groups of universities (for example, the South East Physics Network).

11. The UK funding bodies conduct periodic assessments of the quality of research undertaken in universities and colleges across the UK. The most recent of these was the 2008 RAE; similar exercises were conducted previously in 1992, 1996 and 2001. The outcome of RAE is used by the funding bodies to drive grant allocations. It also plays important roles in benchmarking research quality against international standards, in public information and in supporting universities and colleges managing their research activities and improving quality. The 2008 exercise was the last in that form and will be replaced by the Research Excellence Framework, which is currently being developed by HEFCE on behalf of the four UK funding bodies. We issued a consultation paper setting out our proposals for implementing REF on 23 September 2009 (Research excellence framework: second consultation on the assessment and funding of research, HEFCE 2009/38).

12. REF, planned to be conducted as a UK wide exercise for the first time in 2013, will assess research quality through a process of expert review informed by quantitative indicators (“metrics”, including analyses of citation data). A significant new element in the framework is the introduction of a distinct element within the assessment process focussing on the demonstrable economic and social impacts that have been achieved through activity within the submitting institutions that builds on excellent research. This will assess the extent to which a submitted unit of research has built upon its strong record of excellent research to make a positive impact on the economy and society within the assessment period. It will recognise that impact achieved within a recent period may be based in excellent research undertaken some years previously. REF will also pay particular attention to encouraging the mobility of researchers between HE and industry and other spheres of activity.
13. The other main elements will be the assessment of the quality of selected research outputs published within a few years prior to the assessment, and of the quality and sustainability of the submitted unit’s research environment including its contribution to the vitality of the national research base. The process is being designed to be less burdensome for the HE sector than the RAE through increased use of metrics and some streamlining of process.

14. In designing the REF we have been conscious of the strong impact that a process of this kind will have on the behaviour of universities and colleges receiving our funding and of the researchers that they employ. We anticipate that the REF will maintain the pressure applied by the RAE to increase the quality of research in HE, and will be equally effective in ensuring that institutions and researchers recognise and discharge their responsibility to ensure that the potential impacts of their publicly funded research activity are fully and promptly achieved.

RESPONSES TO SELECTED QUESTIONS

What is the overall objective of publicly funded science and technology research?
HEFCE’s aim and objectives for publicly funded research, in the context of government policy, are set out at paragraphs 5 and 6 above. We fully support the principles that publicly funded research should be funded and managed in ways that maximise its benefits to the economy and society; and that continuing to achieve such benefits depends upon the maintenance of a world class research base.

How are public funds for science and technology research allocated? Who is involved at what level and what principles apply? Where appropriate, is the Haldane principle being upheld?
The arrangements for allocating HEFCE funding for research and the principles governing these are set out above. By allocating our funding as a block grant with reference to indicators of quality, HEFCE also upholds the principle that a strong national research base rests in part upon the ability of researchers and managers within HE to set their own priorities within a national policy framework.

Are existing objectives and mechanisms for the allocation of public funds for research appropriate? If not, what changes are necessary?
The new framework for assessment and funding that we are currently developing reflects current national policies and our view of national needs. We intend that it should have the inbuilt flexibility necessary to meet national policy needs within the context of the Council’s role and strategic aims.

What governs the allocation of funding for Government policy-directed research through Government departmental and agency initiatives? Are existing methods appropriate?
Congruence of HEFCE funding and national policy aims is achieved through annual funding allocations determined by the HEFCE Board having regard to our strategic aims and to guidance given by the Secretary of State. As noted above, the Council also allocates funding for special initiatives in response to specific identified needs that are best met in this way.

How are science and technology research priorities co-ordinated across government, and between government and the relevant funding organizations? Who is responsible for ensuring that research gaps to meet policy needs are filled?
HEFCE’s research funding is mainly allocated as block grant, complementing more closely targeted funding allocated by our partners within the dual support system. Thus our primary contribution to meeting priorities and ensuring that gaps are filled is to provide baseline funding sufficient to support a research base in all fields of academic enquiry that may be called upon to meet specific policy needs as these arise. For example, the response of the HE sector to the emergence of China as a major political and economic power has built upon research capacity sustained for many years by the block grant; and the sector’s strong response to the challenges of global warming is built upon an existing very broad base of excellence in a range of scientific and other disciplines. Our funding allocation method has the capacity to respond to national needs in terms of subject priorities, as evidenced by our targeted support for teaching and research in strategically important and vulnerable subjects as well as our decision to safeguard research funding to STEM disciplines in our grant for 2009–10. In designing the REF we are paying particular attention to encouraging and rewarding better interaction between academe and policy makers.
The Council has an established policy of working in partnership with other research funders including:

— through our membership of the UK Research Base Funders’ Forum and the UK Clinical Research Network and regular dialogue with RCUK

— through specific funding partnerships with individual research councils and government departments (including initiatives discussed above)

— through partnership working with the major research charities, as evidenced in our allocation of grant through the charity support element

How is publicly funded science and technology research aligned and co-ordinated with non publicly funded research?

How can industry be encouraged to participate in research efforts to answer societal needs?

The Council works closely with a number of other research funders both at the strategic level and in specific elements of our funding allocations, including the charity support and business research elements in our block grant. The channels through which we work to co-ordinate our funding with activity funded by non-government sources include the UK research base funders’ forum, the UK clinical research collaboration, the Inter-Company Academic Relations Group, and the regular informal dialogue that we maintain with the research charities and the CBI.

September 2009

Examination of Witness

Witness: Mr David Sweeney, Head of Research, Innovation and Skills, Higher Education Funding Council for England, examined.

Q217 Chairman: May I say welcome and thank you very much for your written evidence. I will add now that should there be any points you wish to amplify after the meeting we would be very happy to receive further written comments. The Committee is fairly well down the road now in taking evidence. We will be joined later on, if you are able to stay, by members from the Research Councils and RCUK and it maybe you will have some overlap of interest that would be helpful.

Mr Sweeney: I would be delighted to do that; thank you.

Q218 Chairman: Thank you very much. I would just remind you that this is all on the record, the proceedings will be published. You will receive a transcript to check, usually within about ten days, and then it will be published as part of the evidence, annexed to the report. There are microphones; the acoustics are not great so I hope they are all working well. Can I start by asking you—and this is for the microphone record—simply to identify yourself and your provenance so to speak, where you are from?

Mr Sweeney: My name is David Sweeney; I am the Director of Research, Innovation and Skills for the Higher Education Funding Council for England.

Q219 Chairman: Thank you very much. May I start with a question that will bring some of us up to date who knew a lot about the RAE but now understand you are working with the REF as a way of producing a formula to allocate research funds to the universities. We are interested in the term “impact”—everyone is—how the impacts will be measured and what other criteria will be used and, possibly, the weighting between them. The other thing is that we are, as I say, trying to be fairly swift and prompt to get through all the questions so a concession on my part will now be exercised.

Mr Sweeney: Thank you very much. In taking forward the Research Excellence Framework we are looking at evolution rather than revolution. The response of universities and colleges to RAE 2008 was generally positive; even those who did not have an optimal funding outcome generally supported the process and therefore we wished to build on that in developing the new system that the Government asked of us. After considerable discussion about the role of citation information we retain peer review as the primary method of assessing research outputs but we will be using citation information in the sciences to support that peer review assessment. We were instructed to cut the burden of assessment and therefore we are having fewer larger panels which will also aid consistency across panels in trying to achieve results that carry the confidence of all our academic colleagues. We will also be making some technical changes around the collection of data which will cut the burden. Esteem will not be part of the new system directly, being replaced by an assessment of the contribution that research makes to wider societal benefit, normally called impact as a code. That impact will not be measured, it will be assessed, based on evidence provided by universities of the impact of bodies of research activity, portfolios of work—looking at the impact that has happened during the assessment period but tying that impact back, given the problem of time lags in assessing impact, to excellent research that was carried out for a
substantial period previously. We are not proposing any trade-off between impact and excellence. We will be looking only at impact that arises from excellent research and we will be equally assessing impacts that arrive from all kinds of research, whether those doing it consider it curiosity driven research or consider it applied research. We will be seeking in discussion with our academic colleagues to embrace a wide definition of impact, covering all of the ways in which excellent research can make a difference to the economy, society and national well-being. We have an impact pilot running now across five units of assessment to test these proposals and I should be clear too that all that I am now describing is part of our consultation. That closes very shortly. We expect to receive a large number of responses and we are quite open that we expect some refining of the system based on the consultation responses.

**Q220 Chairman:** Can I ask two very quick supplementary questions, one on the burden? You say you are dealing with this by having fewer larger panels; that may reduce the impact or at least the burden on the number of panels you might have but does it reduce the burden on the universities?

**Mr Sweeney:** I do not think actually that cutting the number of panels will significantly change the burden on the panellists because we expect to involve substantially the same number of colleagues so that we are assessing research at a similarly granular level. We want experts to be looking at the publications. There is, for every discrete submission that a university makes, a fixed cost of developing that supplementary and then Lord May wants to come in.

**Q222 Lord May of Oxford:** I have two quick questions. The first is you said, as you were introducing this, that the reaction of universities has been generally positive. My question would be: who has that reaction come from? Has it come from central academic administration in universities or has it actually come from the faculty? Because if you are going to say it has come from the faculty, then that is grossly disparate with my impression.

**Mr Sweeney:** Certainly I have talked to many universities; I visited in fact every university that perhaps may not have had quite the outcome it had hoped for in the exercise and discussed why and discussed the process.

**Q223 Lord May of Oxford:** When you say you talked to universities, I am asking with whom did you talk? If you talked with central academic administration that is not necessarily isomorphic with the university.

**Mr Sweeney:** That is true, because academics have a range of views, but I have talked to probably thousands of them over the last year in presenting the REF. Actually I detect an enthusiasm to move forward with research assessment. The nervousness that I meet in talking to large groups of academics when visiting a university is around the mechanics of assessing impact rather than around the principle of impact, although I equally know and have been to meetings where there are very strong views that impact is not the best way forward.

**Q224 Lord May of Oxford:** The second question is: you said “we are looking at impact”—who is the “we” that is looking at it? You will be better aware probably than I am, although I have some acquaintance with it, of the ineluctable imperfection of the many studies that try to assess, in economic terms, the benefits of basic research and to quantify the benefit to the country that does it and, more generally, use it as a global tool. I just wonder who is the “we” who is trying to assess the impacts of basic research?

**Mr Sweeney:** We too are aware of the difficulty in quantifying impact; it can sometimes be very helpful in particular areas but that is not the focus of this exercise. We shall be inviting universities to put forward case studies supported by a variety of pieces of evidence; those case studies will be assessed by panels which comprise some academics from the panel of academics looking at outputs but they will be complemented by a similar number of people we characterise as the users of research because we are looking as broadly as possible for those who can play a part in assessing the difference that research has
made to society. This, as a collaborative exercise, will be a considerable strength.

**Q225 Lord Broers**: To what extent are you going to customise the indicators of things like impact? If one is consolidating a number of units then it may be more difficult, may it not? The requirements, for example, in certain aspects of engineering are going to be very different to aspects of mathematics.

**Mr Sweeney**: Yes, but we will have a different panel for engineering than for mathematics and we will be customising the indicators extensively from one panel to another. That, indeed, is one of the tensions that has arisen in our pilot exercise but we will be looking at the case studies which will probably receive the focus of the attention rather than the indicators. The indicators are there to support the expert review being carried out both by academics and by the users of research.

**Q226 Lord Broers**: This customisation will go across all of the three different areas of assessment.

**Mr Sweeney**: That is true; the citation indicators will play a part on some science and engineering sites and not on others and will probably play little or no part in many arts, humanities and social science disciplines. We will customise—we always have done that. The panel guidelines take a general structure and interpret it in a way that is right for the discipline and we shall continue with that.

**Q227 Lord Broers**: One quick question, my Lord Chairman. To follow on from Lord May’s question, have you considered conducting a professional poll of academics, get MORI in or somebody and conduct a poll to see what they think actually without somebody sitting in front of them and asking them questions?

**Mr Sweeney**: As a funder, we act on the basis of advice that is given us from the Secretary of State to carry out an exercise which allows us to selectively fund, based on an assessment of research excellence. That is something that between the Government and us, as funders, we should decide.

**Q228 Lord May of Oxford**: How do you actually determine the allocation of funds to “special initiatives” with the aim of strengthening the research base, for example to “safeguard funding for broad areas of research in science, technology, engineering and mathematics disciplines” (in 2009–10). How much of the total budget is spent on this, who is involved in the process and how does it stand against the fact that in the 2008 RAE things like this saw an interesting divergence of money into quite interestingly different things, but a net reduction in the funds going to many of the premier universities?

**Mr Sweeney**: I am not quite sure there was a net reduction actually going to, for example, the Russell Group.

**Q229 Lord May of Oxford**: The Russell Group would disagree.

**Mr Sweeney**: The facts will be there for you to see. There was no reduction to the Russell Group as a whole; there was an increase actually, though that of course was not true of every institution in the Russell Group.

**Q230 Lord May of Oxford**: I have a quote that says “A number of Russell Group universities saw a decrease of QR funding in cash terms of between 1% and 13%”.

**Mr Sweeney**: A number of them did but across the Russell Group as a whole there was an increase.

**Q231 Lord May of Oxford**: How do you decide what are these special areas that are lots of fun for administrators and maybe are quite often very useful. How do you go about deciding who is involved in that?

**Mr Sweeney**: Over recent years we have allocated funds to strengthen the research base in different ways: through some special initiatives; identifying a budget for specific purposes; and through the decision, which I think you are referring to, allocating the research grant for this current year to safeguard the share of the grant that goes to broad areas of research in STEM disciplines. The decisions were taken by the HEFCE board—that is their responsibility—of course on the advice of officers such as myself. The decision to safeguard STEM disciplines allocated £15 million—that is three per cent of the budget—more to STEM than would otherwise have been the case, and followed the Secretary of State writing to us advising us that we should recognise and respond to the high cost and national importance of STEM subjects. We recognised that, had we not done this, there would have been a net transfer of money from science to social science, arts and humanities. Our board considered that protecting the share was an appropriate response. In addition, the board has set aside £45 million for targeted initiatives to build research capacity over particular periods and, for example, £25 million over nine years for the clinical senior lectureship scheme, both of which come from our general funds. We have also supported capacity building in a number of fields in collaboration with research councils—for example £12 million into language-based areas of studies in partnership with AHRC and ESRC. That followed, obviously, discussion with the research councils but particularly discussion in the funders’ forum which brings us all together on health disciplines. We make targeted...
initiatives and the decision is taken by our board, informed by and supported by the research councils.

Q232 Lord Crickhowell: I have quite a simple question, declaring an interest as being a former President of Cardiff University. You are responsible for providing funds for universities and colleges in England and we have been talking about distribution to the Russell Group universities. I may come back to this again in the later session but could you just explain to me, in simple words, how your work fits in to the UK more generally because there are eminent universities in Scotland, Wales and Northern Ireland. How is it co-ordinated—and I expect to come back later on co-ordination again—in a devolved country, how does it all work?

Mr Sweeney: We are co-ordinated. For example, I attended the meeting of the Welsh Funding Council that did their research allocations and was in frequent contact with my colleague in Scotland who was advising their funding council about their allocations. In the lead-up to our boards or councils taking decisions, we discussed the way in which our allocations might differ slightly: in Wales for example they did not fund very small units whereas in England we chose to fund all units however small; in Scotland they chose to fund work that was at one star level whereas in England we chose not to fund the relatively small amount of work at one star level. We discuss those things but decisions at a fine level of detail, which these are, are for the relevant authorities.

Q233 Lord Crickhowell: You discuss these things but what about the basic sums that you have to allocate between the four countries?

Mr Sweeney: That is not a decision for us.

Q234 Lord Crickhowell: It may not be but you can tell me roughly how is it done, just remind me.

Mr Sweeney: The Scots receive their money through the . . .

Q235 Lord Crickhowell: I know they do, but at some point there must be knowledge of how much money is available to go to top universities in each of the countries. Are the overall total funding allocations of a kind that make it possible to ensure that the funding council arrangements in Wales have the ability to give, say, Cardiff University comparable funding to what you are giving in England?

Mr Sweeney: That is a decision for the Welsh Funding Council to make. There is not total co-ordination. The Scots, for example, have chosen to invest in research pooling; that is a decision they have made out of the total money the Scottish Government makes available to them.

Q236 Lord Crickhowell: I am not sure that is quite an answer to my question.

Mr Sweeney: There is devolution is the simple answer.

Q237 Lord Crickhowell: I am aware there is devolution but I am seeking just to discover where the first basic decisions are taken as to what sums of money are available for the universities in each country before you start allocating.

Mr Sweeney: That is to do with the national governments and the Treasury.

Q238 Lord Haskel: Do you allocate any funds to FE colleges?

Mr Sweeney: The funding council allocates funds to FE colleges but not for research because they choose generally not to enter the research assessment exercise.

Q239 Lord Haskel: You do not get any applications for research from them.

Mr Sweeney: If we do they are very small, my Lord Chairman. I am not aware of any applications from any colleges for research.

Q240 Lord Broers: I would like to broaden this question away from the Russell Group which, after all, is a rather random selection of those of us who happened to dine in the Russell Hotel. Does the board go through a process where they decide, first, how steep the funding curve should be in universities and thereby decide that, in this world where research is getting more and more competitive globally, to try to maintain too broad a spectrum of universities in research really means that almost none of them are capable of being internationally competitive? Having decided, or had that sort of discussion, is there then a discussion that adds in the formula, based on the Research Assessment Exercise (or now the REF), and then the fund is distributed? I have put that clumsily, but I am sure you understand.

Mr Sweeney: The board recognises that there has been a 40 per cent real increase in QR available over the RAE cycle, a very substantial increase, and we made a commitment in the run-up to the exercise that we would identify excellence wherever it was within universities and colleges and we committed beforehand to fund that excellence. The funding outcomes were therefore very much driven by the results of the Research Assessment Exercise. The board did consider broad principles first and accepted the principle, which actually is articulated in the HE framework, that we would fund world-leading work at the highest rate we thought feasible given the results of the exercise. So we considered, in principle, that we would have a very steep slope, a high degree of selectivity, and then most of the rest of the principles that we exercised are exactly those that
we have said before: we build the money up from subject pots, those subject pots are determined by volume, by cost weight and by a very small quality indicator which is not particularly significant here, and then we build up the results for institutions based on the results that they have in each unit of assessment.

Q241 Lord Broers: Do all the committees that look at the units of assessment have international representation?

Mr Sweeney: All of the main panels have international representation and those international members were very active at various points in the process, assuring that the results would be calibrated appropriately.

Q242 Chairman: I wonder if I can push this just a little bit further. In other jurisdictions decisions are sometimes taken just to concentrate on a small number of universities because that is what is affordable and that is what will produce the highest forms of excellence at international level. China is a classic example: university numbers in four figures, down to 100 that they wanted to look at in detail, then to ten and then to three, and there is a very steep curve of funding that goes up that graph. Singapore spectacularly 20 years ago did this for its then one university where they decided they wanted international excellence; Hong Kong—I had some involvement in the decision-making there—has selected two or three universities that will operate at that level. Is such thinking any part of HEFCE’s discussion of these matters?

Mr Sweeney: We do not attempt to artificially control concentration because largely there is no need, the results are very, very concentrated based on the outcomes of the exercise. Research is concentrated in a relatively small number of institutions in this country—90 per cent of the physics money goes to only 20 institutions.

Lord May of Oxford: That is because only half of them teach physics. Only half of what are even called universities even teach physics. So let us keep that in mind, there are not that many physics universities around.

Q243 Chairman: I understand what you are saying and our universities are spectacularly successful in international rankings, and that is great, but this question was focused on the point that some universities claim that the money is being more widely distributed and this will begin to seep in the other direction.

Mr Sweeney: Let me put it like this if I may: we agreed in the run-up to the 2008 exercise that we should fund excellence where it was and that it was unfair to fund, for example, in our top universities, all of the work as if it was world-leading when a portion of the work indeed was rather less than world-leading. What we wanted to avoid was the situation where we were funding relatively less excellent work in some institutions and failing to fund world-leading work in others. The results show that in some institutions they were more than justifying the high level of investment—and you cannot help but notice, for example, that Oxford had a stellar outcome despite the use of profiles and work that was less than excellent and achieving less money. It could be done and we thought that if there were institutions that truly had world-leading work—and that was a decision made fairly consistently across panels, that world-leading work was perhaps slightly more distributed than people accepted in advance—that that work should be recognised and rewarded.

Q244 Lord May of Oxford: My Lord Chairman, in support of what you just said and the study done over ten years ago, if you looked across the conventional units of assessment and then looked at bibliometric studies of the universities in the UK and asked what are the citations per capita in different departments to award a gold, silver or a bronze medal for each subject, you found that something like 26 of the universities got at least one medal and the best of the universities only got medals in 11 of the 21 areas. It is tricky subject to look at, how you evaluate and compare us with the US, but plausible measures suggest that theirs is an even more diverse system than ours and more structurally diverse—there are superb four-year teaching-only colleges which appear to be anathema here. When you try and ask, are we more selective than them in our dispersal of the infrastructure funds and research council money?—the answer is, we appear to be less selective.

Mr Sweeney: But I do think we need to recall that we have got quite a lot of specialist institutions that we are funding. I have read of calls for us to only fund a limited number of institutions in research, perhaps the top 30 or 40. I know that the 51st university in terms of research funding is the University of Aston and that university is doing some excellent research which I would think we should recognise with funding.

Chairman: The question was really whether any of this entered into your thinking? I suspect not; you have decided this is the way you are going—I understand your principles completely. Lord Broers wants to follow up.

Q245 Lord Broers: I have a further point on this. Any social scientist or anybody who has sat around in academic administration knows that committees behave in certain ways and, in effect, committees develop a sort of camaraderie between the members. The international person must feel like that as well
and the international person must find it rather difficult to disagree with the rest when it comes to international judgements and yet they are probably the only person on the committee who is truly objective in that decision. Would it not be worthwhile to have an anonymous testing by inviting external referees to look at some of this? I seem to remember there was an assessment of a couple of subjects going back many years, which is probably irrelevant now, where an entirely international committee came in and assessed certain subject areas and they did not place as many of the units in the international competitive category as the local committee did. 

Mr Sweeney: That is a very reasonable comment. We actually had in our consultation an indication that we will use contextual information about the performance of UK disciplines in guiding panels this time round and that is a rather firmer statement than we made previously. Actually the international members were fairly active and certainly did challenge, but I accept your point that wider information about the performance of disciplines would help panels in coming to decisions. 

Chairman: We had one area that we were going to explore but it has partly been explored through the questions of Lord Crickhowell but I wonder if Lord Methuen wants to add anything. 

Lord Methuen: It has been adequately discussed, we have been through it. 

Chairman: In which case, we should move to the wider session. Thank you very much indeed, but if you would like to stay there and your research council colleagues join you that would be good news indeed.

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**Memorandum by Research Councils UK (RCUK)**

**SUMMARY OF KEY POINTS**

- RCUK’s objective is to support excellent science and research, providing the UK with knowledge and highly trained individuals to drive and safeguard the long term prosperity, health and sustainability of the UK.

- RCUK fully supports the Haldane principle which we see as having a fundamental role in ensuring the independence of the Research Councils and their funding, and we believe it is being upheld. It enables Research Councils and researchers to provide independent advice to Government to support policy-making, which builds and maintains public confidence in this process.

- The Government has responsibility for setting the over-arching strategy and framework for the research base. Within this framework, Research Councils develop their own strategies and priorities through a strong consultative process, involving leading academic researchers and representatives from industry and the public sector recognised for their knowledge of the field.

- All research supported by Research Councils is selected on the basis of research excellence and assessed through detailed peer review. The area of research and the ideas to be investigated are defined by researchers, either by submitting a proposal directly or by informing a Council’s strategic priorities. Both approaches are often in collaboration with partners in other research groups, business, the third sector/NGOs, or the public sector.

- Research Council funding is balanced between supporting and encouraging multidisciplinary research in themes that address major global and societal challenges and safeguarding the health of the entire research base. Investigators are closely involved in developing these themes, and in both cases have considerable freedom and autonomy in putting forward the objectives and scope of their research, and also in modifying the research as it progresses to meet new opportunities. Significant evidence shows that both streams attract the best researchers and have international impact.

- The 10 year Science and Innovation Investment Framework and the continued commitment to this vision have been extraordinarily beneficial to the UK research base. We need to ensure that we maintain investment and confidence in research. This is increasingly important as other nations are enhancing their investment in research.

- The Research Councils engage directly with other funders and users of research to ensure both strategic alignment and collaboration where appropriate. The range of mechanisms employed is diverse and includes sector-specific funding partnerships (for example working closely with major charities), involving research users in strategy development, working closely with the Technology Strategy Board, and co-funding large research investments.
— The Research Councils continually re-focus and refresh their strategies to respond to the grand challenges facing society. Regardless of any pre-conceived focus, we are already funding research in many areas of economic and social importance, delivering impact in its widest sense and have done so for decades.

**INTRODUCTION**

1. The seven UK Research Councils are the largest public funders of research in the UK, investing over £3 billion per annum in research, training and knowledge transfer across a broad spectrum of research areas. The seven Research Councils are:

   — Arts and Humanities Research Council (AHRC)
   — Biotechnology and Biological Sciences Research Council (BBSRC)
   — Economic and Social Research Council (ESRC)
   — Engineering and Physical Sciences Research Council (EPSRC)
   — Medical Research Council (MRC)
   — Natural Environment Research Council (NERC)
   — Science and Technology Facilities Council (STFC)

2. Research Councils have common objectives, which are to:

   — fund the highest quality internationally competitive research;
   — support postgraduate training;
   — advance knowledge and technology, and provide trained researchers and services which meet the needs of users and beneficiaries, thereby contributing to the economic competitiveness of the UK, the effectiveness of public services and policy, health and the quality of life;
   — support public engagement with research.

3. Each Council is an independent Non-Departmental Public Body established by Royal Charter and sponsored by the Department for Business, Innovation, and Skills (BIS). The Councils are funded by BIS with an allocation from the Science Budget. Details of the funding provided for the present Spending Review period (2008–11) are available in the Science Budget Allocations published by BIS.  

4. Each Research Council has a governing Council which acts as a senior decision making body, with members drawn from the Council’s academic, business and user communities. This body is responsible for setting Research Council policy, strategy and priorities. It is also accountable for the stewardship of the Research Council’s budget and the extent to which objectives have been delivered and targets have been met.

5. Each Council is supported by its own structure of high-level advisory boards and groups to identify and prioritise opportunities for research, training and knowledge transfer and to provide external advice on the development of strategies and policies.

6. Research Councils UK (RCUK) is a strategic partnership set up to champion the research, training and knowledge transfer supported by the seven UK Research Councils. RCUK was established in 2002 to enable the Councils to work together more effectively to enhance the overall impact and effectiveness of their research, training and innovation activities, contributing to the delivery of the Government’s objectives for science and innovation. Further details are available at www.rcuk.ac.uk.

7. In this response science and engineering has been interpreted to include all aspects of research, including the physical, biological, engineering, biomedical, natural and social science disciplines, and the arts and humanities. RCUK considers that the whole research spectrum, including the arts and humanities, is relevant to this inquiry.

**Q1. What is the overall objective of publicly-funded science and technology research?**

8. RCUK’s objective is to support excellent science and research, providing the UK with knowledge and highly trained individuals to drive and safeguard the long term prosperity, health and sustainability of the UK.

1 See www.dius.gov.uk/~/media/publications/U/URN07114
Q2. How are public funds for science and technology research allocated? Who is involved at each level and what principles apply? Where appropriate, is the Haldane Principle being upheld?

9. RCUK fully supports the Haldane principle which we see as having a fundamental role in ensuring the independence of the Research Councils and their funding, and we believe it is being upheld. It enables the Research Councils and researchers to provide independent advice to Government to support policy-making, which builds and maintains public confidence in this process.

10. The Government has responsibility for setting the over-arching strategy and framework for the research base. Within this framework, Research Councils develop their own strategies and priorities through a strong consultative process, involving leading academic researchers and representatives from industry and the public sector recognised for their knowledge of the field.

11. All research supported by Research Councils is selected on the basis of research excellence and assessed through detailed peer review. The area of research and the ideas to be investigated are defined by researchers, either by submitting a proposal directly or by informing a Council’s strategic priorities. Both approaches are often in collaboration with partners in other research groups, business, the third sector/NGOs, or the public sector.

12. Research Council funding is balanced between supporting and encouraging multidisciplinary research in themes that address major global and societal challenges and safeguarding the health of the entire research base. Investigators are closely involved in developing these themes, and in both cases have considerable freedom and autonomy in putting forward the objectives and scope of their research, and also in modifying the research as it progresses to meet new opportunities.

13. An overview of the peer review process is provided in Figure 1. An overview of strategy development and the setting of research priorities is provided in Figure 2. These diagrams provide a general overview of both processes and there may be minor variations between Councils. It should be noted that categories in the diagrams are not mutually exclusive—for example, industrialists are represented on advisory panels, and some Council members are also members of Learned Societies.

14. Examples of Peer Review Panels include AHRC’s Medieval and Modern History Committee, MRC’s Molecular and Cellular Medicine Board and STFC’s Astronomy Grants Panel. Examples of Advisory Boards include BBSRC’s Strategy Board, EPSRC’s Technical Opportunities Panel, ESRC’s Strategic Research Board, and NERC’s Science and Innovation Strategy Board.

Figure 1. Overview of the Peer Review Process.

Notes:
1) This step is sometimes omitted in small grants schemes;
2) After rank-ordering of proposals the top percentage are funded based on the available budget;
3) Number of full-time equivalent research-active staff submitted to RAE 2008;
4) This is an approximate figure—some Councils have standing committees, whilst others form ad-hoc panels when required; for the latter, figures were based on the number of panels established over a selected year and the exact number will vary annually.

Figure 2. Overview of Strategy Development and the Setting of Research Priorities.

Notes:

1) Figure includes panels involved in the development of strategy and does not include other sources of advice such as peer review panels;

2) Figure includes Research Council CEOs;

3) Only a selection of the stakeholders/inputs that feed into the synthesis of options are shown.

15. Under the dual support system, the Research Councils provide grants for specific projects and programmes within HEIs and Research Council institutes, as well as support for fellowships and large-scale partnership funding, while the UK’s Funding Councils provide block grant funding to support research facilities and infrastructure. This funding system provides institutions with capacity to undertake research funded by the Research Councils and other sponsors such as the private sector, government departments, charities, the European Union and other international bodies. It also provides funding for very speculative research which is at too early a stage for writing up in a proposal to the Research Councils.

16. There is strong Research Council engagement with the research base, government, business, the third sector and the public that informs our research priorities. This ensures Research Council funded research delivers benefit to society through economic and social impact.

17. The Research Councils play an active role in ensuring that public views have influenced and shaped their own research policies. Three recent and two current examples of where Research Councils have used public dialogue to identify and respond to concerns and aspirations around emerging research opportunities are as follows:

Nanotechnology for Healthcare

The findings from a public dialogue in nanotechnology were used alongside advice from the research and user community in the development of the scope of the nanotechnology for healthcare grand challenge call. Critical to its success was the use of independent facilitators to conduct the dialogue, and the involvement of academic researchers and EPSRC staff throughout the process.
Ageing

Results from the BBSRC/MRC public consultation on ageing research² have helped shape the cross-Council initiative on Lifelong Health and Wellbeing, for example by ensuring that the initiative encompassed prevention research throughout life, an area identified as a priority by the public. In addition members of the MRC’s Public Panel were involved in the review of applications to the Lifelong Health and Wellbeing initiative, ensuring that public concerns and priorities were reflected in decision-making.

Stem Cell Dialogue

The Stem Cell Dialogue project³ was led by BBSRC and MRC and funded by the BIS Sciencewise initiative. The dialogue involved the largest ever public and stakeholder consultation on stem cells in the UK and included the scientific and medical communities, industry, ethics and religious groups. The findings were published in December 2008 and showed conditional support for all avenues of stem cell research, and identified issues around, for example, investment and coordination between public and private sectors, clinical trials, and communication of uncertainties.

Synthetic Biology

On behalf of the Research Councils, BBSRC and EPSRC are leading on a programme to develop effective public engagement around synthetic biology. A public dialogue, part-funded by Sciencewise, is expected to address topics such as regulatory, ethical and others social issues.

Geoengineering

With the support of the Royal Society, which launched the report Geoengineering the Climate⁴ on 1 September 2009, NERC has applied for Sciencewise support to run a public dialogue exercise on the issues of public concern around different geoengineering options and the need for, and direction of, research in this area. EPRSC and ESRC will be engaged in this activity as well as the Royal Society and members of the engineering community.

Q3. Are existing objectives and mechanisms for the allocation of public funds for research appropriate? If not, what changes are necessary?

18. In general terms, RCUK considers that the objectives and mechanisms for the allocation of public funds are appropriate. The current arrangements whereby the science budget is ring-fenced is particularly important for ensuring the long-term continuity of funding, and needs to be maintained.

19. There is however room for improvement in the following areas:

— Ensuring both arms of the dual support system reinforce each other, so that the capabilities offered by HEIs (such as infrastructure and skill sets) and the strategic goals of the Research Councils (such as interdisciplinarity, impact and public engagement) are aligned and encourage the appropriate behaviours at an individual, departmental and HEI level for the UK research system as a whole.

— Planning horizons:

— The 10 year Science and Innovation Investment Framework and the continued commitment to this vision have been extraordinarily beneficial to the UK research base. Universities have had both the funding and confidence to invest in world leading infrastructure, such as the Manchester Interdisciplinary Biocentre, Warwick Digital Lab, and chemistry facilities at the University of Oxford.

— We need to ensure that we maintain investment and confidence in research. This is increasingly important as other nations are enhancing their investment in research. 3-year cycles of funding are too short in all science areas. This has a particular impact on commitment to running costs of large scale capital investments, which are typically over periods of more than 15 years, and on long-term collaborations—for example our ability to bring long term funding to international collaborations with countries such as China, India and the US.

— It is important that the UK is able to articulate its priorities for research very clearly so we can shape the future research agenda in Europe, including future Framework Programmes, the European Research Council, and the European Research Area.

² See www.mrc.ac.uk/Utilities/Documentrecord/index.htm?d = MRC004678
³ See www.sciencewise-erc.org.uk/cms/stem-cell-dialogue/
⁴ See royalsociety.org/displaypagedoc.asp?id = 35110
The formation of the Technology Strategy Board, the Office for Strategic Coordination of Health Research (OSCHR) and the Energy Technologies Institute provides new opportunities for partnerships to ensure important research outcomes are exploited rapidly.

Q4. What governs the allocation of funding for Government policy-directed research through Government departmental and agency initiatives? Are existing mechanisms appropriate? What is the role of Departmental Chief Scientific Advisers?

20. Research Councils are not involved directly with the setting of research priorities by government departments; however we do contribute to this process. Most Research Councils have direct links with government departments and provide input into policy development through a variety of mechanisms, including concordats, representation on advisory bodies, and collaborative funding, as well as secondments to government departments. Specific examples are provided at Annex A.

21. The following Chief Scientific Advisors (CSAs) are members of Councils and Advisory Boards:
   - Professor Bob Watson (Defra CSA) (BBSRC and NERC Council);
   - Professor Dame Sally Davies (DoH CSA) (MRC Council);
   - Professor Brian Collins (BIS, DfT and briefly DECC CSA) (EPSRC Technical Opportunities Panel);
   - Professor Mark Welland (MoD CSA) (EPSRC Council);
   - Professor Julia Slingo (Met Office Chief Scientist) (NERC Council).

22. Research Council involvement in bodies with a cross-departmental remit such as OSCHR also provide effective fora for interactions with Chief Scientists. OSCHR aims to facilitate more efficient translation of health research into health and economic benefits in the UK through better coordination of health research and coherent funding arrangements. The membership of the OSCHR board includes MRC’s CEO Sir Leszek Borysiewicz, Professor Dame Sally Davies, Professor Sir John Savill (Chief Scientist for Scotland) and Professor Mike Harmer (Deputy Chief Medical Officer for Wales).

23. Government policies and allocations of funding for Government policy-directed research should be based on advice and evidence from a wide range of sources, including relevant stakeholders and the general public. Research Councils have access to experts across all research areas, and can provide a useful resource for Government in identifying whom to consult on policy issues. Consultations should be conducted at the outset to ensure they influence policy formulation at the very early stages.

24. Departmental CSAs can play a key role in helping to ensure evidence from research is used in formulating policies and in bringing people together to tackle key issues. The Core Issues Group (CIG), which includes the CSAs of government departments and the Chief Executives of the Research Councils, meets regularly to discuss issues of mutual interest.

Q5. How are science and technology research priorities co-ordinated across Government, and between Government and the relevant funding organisations? Who is responsible for ensuring that research gaps to meet policy needs are filled?

25. Information on Research Council links with government departments is provided at Annex A.

26. The widespread appointment of CSAs has led to some improvements in terms of bringing people together to tackle key issues. Successful partnerships (in addition to CIG) include:
   - The Research Base Funders Forum—allows governmental and non-governmental funders of public good research to consider the collective impact of their strategies on the sustainability, health and outputs on the Research Base.
   - The Energy Research Partnership (ERP)—designed to give strategic direction to UK energy research, development, demonstration and deployment (RDD&D), in the context of the Government’s Energy White Paper and its overall aim to increase the level, coherence and effectiveness of public-private investment in innovation and commercialisation to achieve energy policy goals. It brings together key public and private sector funders of UK energy RDD&D, to promote a coherent approach to addressing UK energy challenges, set within an international context, and increase long-term energy related activity and investments in the UK.
   - The Environment Research Funders’ Forum (ERFF)—a co-ordinating mechanism initiated by NERC between all the public sector funders of environmental research. ERFF aims to improve the way environment research is prioritised, funded, informs policy and delivers return on investment. ERFF has produced a research database which covers research funded by each of its members and is a searchable resource, used to identify any gaps and potential overlaps. The Living with...
Environmental Change (LWEC) partnership was developed through ERFF, and involves collaboration between 20 funders, including Research Councils, government departments and agencies. LWEC funds collaborative research in environmental change, ensuring effective science to policy processes.

— The Joint Climate Research Programme—a joint programme between NERC and the Met Office. The aim of the programme is to ensure that the UK maintains and strengthens its leading international position in climate science, and hence in climate forecasting and provision of advice for climate policy.

— The UK Collaborative on Development Sciences (UKCDS)—brings together key UK funders and stakeholders who provide support for the development sciences research base. It provides a framework for a more coordinated approach to development sciences research, in order to increase its relevance and impact on national and international policies and activities, aimed at improving the lives of the world’s poorest people.

— The UK Clinical Research Collaboration (UKCRC)—established in 2004 with the aim of re-engineering the clinical research environment in the UK, to benefit the public and patients by improving national health and increasing national wealth. The partnership brings together the major stakeholders that influence clinical research in the UK. It includes the main UK research funding bodies; academia; the NHS; regulatory bodies; the bioscience, healthcare and pharmaceutical industries; and patients. The UKCRC represents a new way of working in which complex long-standing issues are tackled by key stakeholders working together.

27. There is still a lack of joined up governance for public sector R&D funding in the UK. The primary criterion for government department funded research, which is largely managed through commissioning, is strategic need rather than excellence as expressed through the peer review system. This can have an impact on the quality of the research, and potentially the impact that can be achieved for the benefit of the UK and more widely.

Q6. Is the balance of Government funding for targeted versus response-mode research appropriate? What mechanisms are required to ensure that an appropriate and flexible balance is achieved? Should the funding of science and technology research be protected within the Research Councils or Government departments? How will the current economic climate change the way that funds are allocated in the future?

28. As highlighted in paragraph 11, all research supported by Research Councils is selected on the basis of research excellence and assessed through detailed peer review. The area of research and the ideas to be investigated are defined by researchers, either by submitting a proposal directly or by informing a Council’s strategic priorities. A more important question is how to ensure the right balance of funding between supporting and encouraging multidisciplinary research around major themes and global challenges and supporting a healthy research base. Significant evidence shows that both streams attract the best researchers and have international impact:

— An independent study by Evidence Ltd\(^5\) demonstrated that EPSRC’s “most successful researchers”\(^6\) do achieve consistently impressive results based on an international comparison of the citation impact of their publications. During 2008–09 this group amounted to around 1,200 principle investigators, and analysis shows that while 68 per cent of them were working in single-discipline fields, an impressive 58 per cent were working in areas defined as multidisciplinary. 25 per cent held multiple grants spanning both single and multi-disciplinary work.

— The NERC citations study 2008,\(^7\) which was also an independent study by Evidence Ltd, evaluated the academic impact of NERC-funded ISI journal papers published between 2003 and 2005. It showed that whilst the rebased citations impact score for UK environmental sciences was 1.25 times world average, NERC-funded science achieved an impact score of 1.66. Within that, a comparison was made of the performances of the NERC funding modes in use at the time (responsive mode, fellowships, directed programmes and core strategic). It showed that responsive mode and directed programmes had comparable impact scores (1.93 and 1.84 respectively). Directed research included the highest proportion of most highly cited papers (those scoring > 8 times world average impact) and fellowships achieved the highest impact score of 2.03 times the world average.

\(^5\) Impact Profiles Study of EPSRC Researchers, Evidence Ltd, 2006  
\(^6\) “Most successful researchers in this context is defined as the approximately 35 per cent of EPSRC-funded researchers who collectively win 80 per cent of all EPSRC research funding.  
\(^7\) See http://www.nerc.ac.uk/about/perform/documents/citations-study-2008.pdf
29. Research Councils develop their funding priorities through a strong consultative process involving leading academic researchers and representatives from industry and the public sector recognised for their knowledge of the field, as highlighted in paragraph 10.

Q7. How is publicly-funded science and technology research aligned and co-ordinated with non-publicly funded research (for example, industrial and charitable research collaborations)? How can industry be encouraged to participate in research efforts seeking to answer societal needs?

30. The Research Councils engage directly with other funders and users of research to ensure both strategic alignment and collaboration where appropriate. The range of mechanisms employed is diverse and includes sector-specific funding partnerships (for example working closely with major charities), involving research users in strategy development, working closely with the Technology Strategy Board, and co-funding large research investments. Examples of these activities are provided at Annex B.

Q8. To what extent should publicly-funded science and technology research be focused on areas of potential economic importance? How should these areas be identified?

31. It is important that consideration is given to both economic and social impact when considering research priorities. Research Councils recognise a wide range of potential impacts, including the impact of skilled people, technology and policy development, wealth creation, and health and quality of life improvements.

32. The Research Councils continually re-focus and refresh their strategies to respond to the grand challenges facing society. Regardless of any pre-conceived focus, we are already funding research in many areas of economic and social importance, delivering impact in its widest sense and have done so for decades. Examples include:

- The existing cross-Council priority themes: Energy; Living with Environmental Change; Global Uncertainties: Security for all in a Changing World; Ageing: Lifelong Health and Wellbeing; Digital Economy; and Nanotechnology through engineering to application;
- Food Security;
- Connected Communities.

33. RCUK is aiming to increase the economic impact of the research we fund over a range of timescales. In the short term we will focus on:

- accelerating the impact from our past investments in research, and maintaining momentum in the development of translational research in readiness for renewed venture capital investment in the economic recovery;
- seizing research opportunities that will underpin the future competitiveness of the economy; and
- ensuring the supply of appropriately skilled people, realising and continuing our sustained investment in the skills of doctoral graduates, and driving forward business performance.

34. In the medium term we will focus on investments into multidisciplinary research and partnerships to address key challenges for society, making sure we continue to invest in a healthy, flexible research base that covers a broad range of disciplines. We will work in partnership to stimulate research and cultivate the essential advanced skills to provide the bedrock for the UK to be a productive, healthy and sustainable society.

35. Our goal is to support research that generates economic growth for the UK and health and wellbeing for our population in a manner that is sustainable for the future. To do this we will focus on research that delivers impact into a focused range of sectors that we believe are central in achieving this goal:  

- Green economy
- Life science sector (including health and food)
- Digital economy
- High-value manufacturing systems and services
- Cultural and creative industries

*Presented at the Research for our Future Event—See http://www.rcuk.ac.uk/research/future.htm*
Q9. How does the UK’s science and technology research funding strategy and spend compare with that in other countries and what lessons can be learned? In this regard, how does England compare with the devolved administrations?

36. The UK has enjoyed continued investment in research over the past two decades and we are currently halfway through the 2004–14 Science and Innovation Investment Framework, with a stated Government commitment to this framework. At the Romanes lecture in Oxford on 27 February 2009, Gordon Brown stated that: “We will meet our 10-year commitment to maintain science spending with investment focusing on pure fundamental science as well as applied science…in meeting our 10-year commitment we will maintain the ring fence we have placed around science funding—protecting money for science from competing demands in the short-term and providing the sustained support the research community needs to deliver world-class results in the medium and long term.”

37. The UK’s response to the current economic climate has differed from some of our key competitors. The US, Germany and Japan have this year announced very significant financial stimulus packages for R&D. The US federal R&D stimulus package is in the order of $21.5 billion, Germany is allocating more than £15 billion of new money for research institutes over the next 10 years and the Japanese have recently announced a £9 billion S&T stimulus for the year 2009–2010. The Indian R&D budget has increased by 17 per cent and the Chinese budget has increased by 25 per cent in 2009, in spite of the economic downturn.

38. Increases in government R&D investment in competitor states may make these countries more attractive destinations for UK researchers in the future; however they will also create new opportunities for stronger interactions and exchange. Given the strength of UK research it is likely that countries with new monies will increasingly want to exploit UK expertise and the UK should be prepared to take advantage of opportunities for further collaboration, and strengthen efforts to address global challenges. Examples of this include the joint EPSRC/National Science Foundation (NSF) sandpit on new directions in synthetic biology and the NERC Rapid and Rapid WATCH programmes delivered with partners including the NSF, The Netherlands Organisation for Scientific Research, the Research Council of Norway and the Max Planck Institute for Meteorology, Germany.

39. Strategic approaches to research funding will vary for each country. The UK and counterpart organisations in the US take an approach that balances researcher-driven and strategic priorities. Countries in Europe use a mix of researcher-driven and strategic priorities, with many having agencies similar to Research Councils which are at arm’s length from Government, but often with more strategic funds being allocated from Ministries (for example, Germany). China and India both favour a top down strategic approach, but India to a much lesser degree.

40. A key strength of the UK is the number of established strategic partnerships which join up the spectrum of research and ensure more effective coordination across research funders and users.

41. The Research Councils are committed to funding excellent research in whichever UK region it is being carried out, and as such the Councils do not allocate funding on a regional basis. This means that the distribution of Research Council funding between England, Northern Ireland, Scotland and Wales varies from year to year depending on the quality of research proposals received. The distribution of funds for research by the seven Research Councils during financial year 2007–08 is provided in Table 1.

### Research Grants

<table>
<thead>
<tr>
<th>£K</th>
<th>AHRC</th>
<th>BBSRC</th>
<th>EPSRC</th>
<th>ESRC</th>
<th>MRC</th>
<th>NERC</th>
<th>STFC</th>
<th>RC Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>England</td>
<td>50,541</td>
<td>151,956</td>
<td>417,615</td>
<td>87,567</td>
<td>180,881</td>
<td>86,418</td>
<td>86,850</td>
<td>1,061,828</td>
<td>83.7</td>
</tr>
<tr>
<td>Scotland</td>
<td>6,486</td>
<td>28,042</td>
<td>67,554</td>
<td>9,318</td>
<td>18,265</td>
<td>16,042</td>
<td>11,761</td>
<td>157,467</td>
<td>12.4</td>
</tr>
<tr>
<td>N. Ireland</td>
<td>1,158</td>
<td>731</td>
<td>7,426</td>
<td>1,293</td>
<td>795</td>
<td>193</td>
<td>770</td>
<td>12,366</td>
<td>1.0</td>
</tr>
<tr>
<td>Wales</td>
<td>1,598</td>
<td>5,956</td>
<td>11,851</td>
<td>6,689</td>
<td>4,755</td>
<td>2,627</td>
<td>4,479</td>
<td>37,054</td>
<td>2.9</td>
</tr>
<tr>
<td>UK total</td>
<td>59,783</td>
<td>185,785</td>
<td>504,446</td>
<td>104,867</td>
<td>204,695</td>
<td>105,280</td>
<td>103,860</td>
<td>1,268,716</td>
<td>100</td>
</tr>
</tbody>
</table>

### Studentships

<table>
<thead>
<tr>
<th>£K</th>
<th>AHRC</th>
<th>BBSRC</th>
<th>EPSRC</th>
<th>ESRC</th>
<th>MRC</th>
<th>NERC</th>
<th>STFC</th>
<th>RC Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>England</td>
<td>36,018</td>
<td>34,460</td>
<td>173,663</td>
<td>46,937</td>
<td>41,711</td>
<td>26,071</td>
<td>12,799</td>
<td>371,659</td>
<td>84.2</td>
</tr>
<tr>
<td>Scotland</td>
<td>2,975</td>
<td>5,760</td>
<td>26,264</td>
<td>6,124</td>
<td>6,955</td>
<td>4,542</td>
<td>1,360</td>
<td>53,980</td>
<td>12.2</td>
</tr>
</tbody>
</table>

9 See http://www.number10.gov.uk/Page18472
10 See http://www.epsrc.ac.uk/CallsForProposals/Archive/JointSyntheticBiology.htm
11 http://www.nerc.ac.uk/research/programmes/rapid/
12 http://www.nerc.ac.uk/research/programmes/rapidwatch/
Table 1. Research Council funding for research grants and studentships over FY2007/08.

<table>
<thead>
<tr>
<th>EK</th>
<th>AHRC</th>
<th>BBSRC</th>
<th>EPSRC</th>
<th>ESRC</th>
<th>MRC</th>
<th>NERC</th>
<th>STFC</th>
<th>RC Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>N. Ireland</td>
<td>598</td>
<td>0</td>
<td>950</td>
<td>88</td>
<td>65</td>
<td>23</td>
<td>1</td>
<td>1,725</td>
<td>0.4</td>
</tr>
<tr>
<td>Wales</td>
<td>1,135</td>
<td>662</td>
<td>5,770</td>
<td>3,200</td>
<td>1,151</td>
<td>1,902</td>
<td>503</td>
<td>14,323</td>
<td>3.2</td>
</tr>
<tr>
<td>UK total</td>
<td>40,726</td>
<td>40,882</td>
<td>206,647</td>
<td>56,349</td>
<td>49,882</td>
<td>32,538</td>
<td>14,663</td>
<td>441,688</td>
<td>100</td>
</tr>
</tbody>
</table>

Notes:
1) EPSRC, figures are gross figures excluding capital;
2) MRC studentships comprises studentships and fellowships; research grants and studentships figures include all relevant grant/student/fellowship costs;
3) STFC research grants include fellowships;
4) For all Councils, figures exclude: Research Council Institutes; overseas grants, studentships and institutes; international subscriptions and central expenditure.

September 2009

Annex A

RESEARCH COUNCIL LINKS WITH GOVERNMENT DEPARTMENTS

RCUK
The Core Issues Group (CIG), which includes the CSAs of government departments and the Chief Executives of the Research Councils, meets regularly to discuss issues of mutual interest.

AHRC
AHRC has links with numerous government departments via projects funded as part of responsive mode funding, strategic programmes and research centres. For example, the Director of the AHRC’s Diasporas, Migration and Identities Programme was commissioned by the Home Office to produce a review of arts and humanities research literature relating to The Roots, Practices and Consequences of Terrorism. The Design Against Crime Research Centre, with some of its projects funded by the AHRC, has provided advice on crime reduction to the Prime Minister’s Strategy Unit. The AHRC also has a Concordat with the Home Office, and several more are being developed with other departments.

BBSRC
BBSRC has working links with all relevant government departments, particularly Defra and, increasingly, DfID. Representatives from the BBSRC senior executive and research community sit on policy advisory bodies, for example the Advisory Committee on Releases to the Environment (ACRE), NPL Advisory Committee and the TSEs funding forum. In addition, Defra commissions a significant amount of policy-focused research from the BBSRC sponsored institutes. BBSRC also works with Defra and the Food Standards Agency to ensure the EU Framework Programme 7 offers appropriate and timely opportunities to the UK research base in relevant areas.

EPSRC
EPSRC has links with several government departments, including working extensively with DfT on joint calls and having a co-funding scheme with MoD (along with other Research Councils). As a specific example, EPSRC has the tools to work with DfT to tailor knowledge to specific policy challenges in sustainable transport. The CSA for DfT and BIS, Brian Collins, is on the EPSRC Technical Opportunities Panel and the MoD CSA, Mark Welland, is on EPSRC Council. EPSRC also works closely with DECC and the Energy Technologies Institute and a DECC representative sits on our Energy Scientific Advisory Group. EPSRC has regular bilaterals with Defra and the Environment Agency.

ESRC
ESRC has concordats with a number of government departments, in which research priorities and strategies are regularly discussed, as well as policy requirements for evidence and other items of mutual interest. Advice is also provided to government departments outside of the usual concordat arrangements. ESRC co-funds a number of research initiatives with government departments; for example, the ESRC and DfID have a joint research funding scheme focused on poverty reduction in developing countries. ESRC also co-funded research on Scottish demography with The Scottish Government. An example of ESRC research investments influencing policy is through the work of the Centre for Economic Performance (established by the ESRC in 1990), which has influenced policies including the Working Families Tax Credit Scheme and the National Minimum Wage. ESRC has also held public policy seminars.
MRC

MRC has links with a number of government departments, the most formal being the relationship with OSCHR, DH and the other UK health departments and the concordat with DFID. Strategic alignment and greater coordination between the MRC and NIHR aims to facilitate the translation of health research and economic benefits within the UK. The MRC’s concordat with DFID has been in effect for over 15 years and provides a framework for the alignment of research strategies and the delivery of research funding. Under the concordat DFID currently allocates about £9 million per annum to the MRC.

NERC

NERC collaborates with relevant government departments both on a bilateral basis and through forums, for example the Environmental Research Funders Forum (ERFF), the cross-Departmental Marine Science Coordinating Committee (MSCC), and the UK Collaborative on Development Sciences (UKCDS). NERC and Defra have a close relationship through regular meetings of the Chief Executive of NERC and the Defra CSA, as well as working level collaborations between Defra and the NERC community; for example many NERC staff have commented on Defra and EA science strategies, have direct working relations with Defra and EA project officers and sit on Defra/EA Theme Advisory Groups. NERC initiated the science-policy partnership programme, Living With Environmental Change (LWEC), which has 18 partners including 6 Research Councils, 11 departments of state, government and agencies and one trading fund (the Met Office). NERC also co-funds a number of research programmes with government partners, for example, the Ecosystems Services and Poverty Alleviation programme with DfID (and ESRC), the Joint Climate Research Programme with the Met Office, and the Sustainable Marine Bioreources programme with Defra and the Scottish and Northern Ireland Governments.

STFC

STFC and NERC have links with government departments through the British National Space Centre partnership. STFC has numerous links with UK government departments as well as working with the Scottish Government and the Welsh Assembly Government. Within the UK it has close relationships with both the Northwest Regional Development Agency and the South East England Development Agency, within whose regions the STFC Science and Innovation Campuses are based. STFC also works extensively with the international scientific community with regard to investments both in the UK and abroad, and this includes working with European Union bodies and institutions as well as with Governments around the world; this is achieved in collaboration with the appropriate UK Government representation and support.

Annex B

EXAMPLES OF ALIGNMENT AND CO-ORDINATION OF PUBLICLY-FUNDED AND NON-PUBLICLY FUNDED RESEARCH

By working with non-public funders of research at both the strategic and project level, the Research Councils encourage funding alignment:

AHRC

Collaboration with users

Working with users to fund research can generate increased turnover. For example, Kingston University and the furniture designers “Naughtone” developed a process which generated new clients, and increased overall sales and contracts.

It can also generate new knowledge and approaches. For example De Montfort University and the Phoenix Arts Centre designed an online new media centre, and developed a series of online classes/workshops, to develop staff skills in website design.
BBSRC

Research and Technology Clubs (RTCs)

RTCs are supported jointly by BBSRC, other funding bodies and consortia of companies, and fund research that addresses priorities in BBSRC’s Technology Strategy. Currently three clubs are running covering bioprocessing research, diet and health research, and integrated biorefining research; two further clubs (in ageing research and crop improvement research) are planned.

Strategic Research Programmes

BBSRC-sponsored research institutes run strategic research programmes which align BBSRC objectives and the objectives of other funders, including industry and other non-public funders; total research income from industry supporting these programmes is currently c£11 million pa.

BBSRC is a founding member of the UK Collaborative on Development Sciences (UKCDS). UKCDS brings together UK funders and stakeholders who provide support for the development sciences research base. Members of UKCDS work together to establish a framework for coordinating development sciences research in the UK. Its aim is to provide sustainable improvements and benefits for the lives of the world’s poorest people.

EPSRC

Some 2,300 user organisations collaborated on EPSRC research grants during 2008–09, and around 1,400 PhD students were engaged on collaborative training projects; over £201 million in resources was committed by business and other users in support of new research grants (a significant increase on the £90 million committed by users in 2007–08). 38 user organisations are involved in strategic partnerships with EPSRC—formal agreements to co-fund research and training.

Energy Technologies Institute

EPSRC is the largest public funder of the Energy Technologies Institute—a partnership between the UK Government and global energy developers, BP, Shell, E.ON, EDF Energy, Caterpillar and Rolls-Royce. This potentially £1 billion partnership funds projects to demonstrate commercial viability of fledgling technologies, sharing the risks involved and accelerating commercial take up. Prof David Delpy, Chief Executive of EPSRC, is a board member of the ETI and EPSRC is working closely with the ETI on the development of programmes in the areas of renewable energy and energy efficient buildings.

SAMULET

The “SAMULET” project launched in July this year is a collaborative programme that aims to accelerate the development and introduction of low carbon aircraft engine technology and to strengthen the supply chain for the UK’s aero-engine industry. It is being led by Rolls-Royce working in a consortium alongside other high profile manufacturers, SMEs and several of the UK’s top universities. EPSRC is investing £11.5 million and the Technology Strategy Board £28.5 million in the programme. Further support is under discussion with regional bodies, and total project value including industry investment is expected to be around £90 million.

ESRC

Strategic Partnerships

The ESRC has strategic partnerships with organisations across all the sectors with which it engages, including the Charity Commission and the Confederation of British Industry.

Collaborative Research Ventures

The ESRC’s Collaborative Research Ventures Scheme was introduced in 2004 to develop funding partnerships with interested parties in business, public and third sectors, to co-fund high quality independent research and develop research capacity. Ventures funded to date include the Third Sector Research Centre and the Centre for Charitable Giving and Philanthropy. The Third Sector Research Centre (TSRC) (co-funded by ESRC, Office of the Third Sector, and Barrow Cadbury Trust) is dedicated to analysing the impact of the sector’s activities and effectiveness. The centre’s work will strengthen the evidence base for the entire third sector (including charities, social enterprises and small community organisations) and will have specific research programmes of direct relevance to third sector policy and practice. Three Capacity Building Clusters will support the work of the TSRC.
The Centre for Charitable Giving and Philanthropy is a partnership of the ESRC, Office of the Third Sector, Scottish Executive, and Carnegie UK Trust. The Centre will support high quality independent research aimed at influencing policy and practice decisions in the UK as well as developing the necessary evidence base to better understand charitable giving and philanthropy issues. It also aims to help third sector organisations, government and business to better understand why and how individuals and businesses can give, helping to increase and target giving to support the public good.

MRC

National Cancer Research Institute (NCRI)

NCRI is a UK-wide partnership between the government, charity and industry which promotes co-operation in cancer research among the 21 member organisations¹³ (including BBSRC, ESRC and MRC) for the benefit of patients, the public and the scientific community. NCRI has the role of maintaining strategic oversight of cancer research in the UK, identifying gaps and opportunities and coordinating the funding activities of the partner organisations.

NCRI undertakes analyses to guide the strategic activities of the partner organisations. Once an area has been identified a Strategic Planning Group is established to develop a coherent approach between NCRI Partners to funding research in specific areas. Examples of priority areas identified by the NCRI partners for which there is on-going joint activity and shared funding include:

- National Prevention Research Initiative (NPRI)
- Supportive and Palliative Care
- Prostate Cancer
- Radiotherapy and associated Radiobiology
- Lung cancer
- Positron Emission Tomography (PET) scanning

NCRI and partner organisations are also developing the national infrastructure underpinning cancer research. This includes an NCRI Informatics Initiative and biosample bank co-ordination.

Further details of the above activities can be found on the NCRI website http://www.ncri.org.uk.

The National Prevention Research Initiative

The National Prevention Research Initiative, managed by MRC, brings together 16 organisations from charity and public sectors¹⁴ to support research on health behaviours associated with significant risks to health—such as poor diet, physical inactivity, smoking and alcohol consumption—and on the environmental factors that influence those behaviours. Research will aim to improve health and prevent chronic, non-communicable diseases or conditions such as certain cancers, heart and circulatory diseases, diabetes, obesity, stroke and dementia.

An important cross-cutting theme of the Initiative, and evident in many of the projects, is risk reduction in communities or social groups with a high incidence of preventable diseases or conditions, and approaches to reduce inequalities in incidence of these diseases or conditions.

The portfolio of 56 NPRI-funded awards is valued at ca. £21 million over 10 years, starting in 2005–06. The MRC contribution is £3.25 million. The projects cover the remit of health behaviours (individually or in combination) and environmental influences, involve both individual-level and population-level interventions and also natural experiments or make use of existing datasets for novel secondary analysis. A number of projects examine particular social or ethnic groups, children through to older age, and/or populations with particular mental health needs.

A full list of awards is available on request.

¹⁴ Alzheimer’s Research Trust; Alzheimer’s Society; Biotechnology and Biological Sciences Research Council; British Heart Foundation; Cancer Research UK; Chief Scientist Office, Scottish Government Health Directorate; Department of Health; Diabetes UK; ESRC; ESPRC; Food Standards Agency; MRC; Research and Development Office for the Northern Ireland Health and Social Services; The Stroke Association; Welsh Assembly Government; and World Cancer Research Fund.
The UK Clinical Research Collaboration

The UK Clinical Research Collaboration (UKCRC) was established in 2004 with the aim of re-engineering the clinical research environment in the UK, to benefit the public and patients by improving national health and increasing national wealth.

The Partnership brings together the major stakeholders that influence clinical research in the UK. It includes the main UK research funding bodies; academia; the NHS; regulatory bodies; the bioscience, healthcare and pharmaceutical industries; and patients.

The UKCRC represents a new way of working in which complex long-standing issues are tackled by key stakeholders working together. Strategic direction and oversight is provided by the UKCRC Board with broad stakeholder input into key issues. The Partnership is supported by a jointly funded, independent Secretariat and has a mixed model of working, where activities are:

- Led and administered by individual Partners on behalf of the Partnership
- Led by individual Partners and administered by the UKCRC Secretariat
- Led and administered by UKCRC Secretariat.

UKCRC is currently chaired by Professor Dame Sally Davies, Director General of Research and Development and Chief Scientific Adviser for the Department of Health and NHS.

NERC

Knowledge Transfer Networks

In 2008–09, NERC worked with the TSB and met with the insurance industry as a precursor to the Financial Services Knowledge Transfer Network (KTN). NERC also worked with the Environmental KTN on interactions with the water industry.

Willis Research Network

Researchers from NERC’s National Centre for Atmospheric Science are working with the world’s largest re-insurance company, Willis Re, to provide predictions and probability analyses of future natural catastrophes like hurricanes, storms and flooding. This is first time climate forecasts have been incorporated into the insurance industry’s catastrophe risk models. The insurance group will use the outputs of this research to advise companies on the financial impacts of future catastrophes, enabling (re)insurance and other risk-related solutions.

The work forms part of the Willis Research Network, the largest collaboration between the academic and financial communities. It brings together a unique group of the world’s leading research centres across the earth sciences, engineering and mathematics to provide comprehensive, practical and consistent risk analyses. It provides Willis Re with a competitive advantage from improved knowledge of environmental risks and hazards.

Ocean Margins (LINK)

This multidisciplinary programme ran from 2000 to 2007 and was jointly funded by NERC, the UK Government and UK industry to encourage collaboration and partnership between the UK science base and industry. The EPSRC also contributed funding to projects within a specific theme. The Programme aimed to improve our geological understanding of ocean margins. The Programme Management Committee included representatives from Statoil (UK) Ltd and BP Oil Exploration Operating Co Ltd. NERC allocated £4.8 million to the programme, which supported 15 NERC studentships, 3 industry studentships and 1 NERC fellowship.

STFC

Science and Innovation Campuses

The STFC has considerable linkages with other research councils, public services and businesses through its both facilities and grants programmes. It aims to increase this interaction over the next 20 years through the development of its Science and Innovation Campus based at Daresbury (DSIC) and at Harwell (HSIC). Both Campuses are public-private sector joint ventures.

HSIC is already home to more than 120 organisations including the STFC Rutherford Appleton Laboratory, Medical Research Council and Health Protection Agency. It has also been announced as the site of the European Space Agency’s UK Centre, building on the Rutherford Appleton Laboratory’s long-standing
position as a world leader in space science and technology. DSIC is supported by the North West Development Agency, Halton Borough Council and the universities of Lancaster, Liverpool and Manchester and is currently seeking a long term private sector partner. The first phase of the Daresbury Science and Innovation Campus has included development of the Cockcroft Institute for Accelerator Science and the Daresbury Innovation Centre for new businesses, which is already over capacity as home to more than 80 new businesses, including a number of STFC spin-outs.

The facilities developed at the Campuses and the work undertaken at the facilities is decided upon collaboratively—using peer review where appropriate—between the Research Councils, the wider scientific community, the Government and other relevant stakeholder groups, nationally and internationally.

STFC Innovations Ltd

STFC Innovations Ltd (formally CLIK) has been launched with the expressed aim of developing further Knowledge Exchange and product development to ensure that ideas originating from STFC laboratories are taken into the UK and global market places. By inviting investment from private individuals and industry, a number of successful spin-out companies covering industries such as health, technology and security have been created.

Memorandum by the Medical Research Council

How do we develop scientific strategy?

1. Introduction

At any point in time, the MRC is taking strategic decisions and decisions based on existing strategy. To a large extent, therefore, strategy development (and implementation) is a rolling process, and this builds on scientific and other opportunities as they arise. However, there are various fixed points, some externally determined and some internally driven.

The former includes Government and the need to present a case for continued/additional funding as part of the CSR process. Our inputs into this are developed from existing strategy, scientific opportunities and our understanding of health needs at the relevant time. The outcome (following the Science Budget settlement) for the MRC—a Delivery Plan for a three-year period—is thus predicated on MRC’s inputs into the process. These are our priorities as accepted by government. The MRC is required to report to Government against the Delivery Plan annually.

The main internally-driven process (though this too is a Government requirement) is a Strategic Plan produced every five years. This is the main opportunity for us to revisit at one point in time our previous strategy and have a fundamental review for the next five years. Strategy does not change, indeed should not normally change, from one year to the next, but every five years is an appropriate time interval to allow for quite radical review. In this way, Strategic Plans are written at a level that assumes a “shelf-life” of at least five years. The Strategic Plan is extremely important as it forms the basis of scientific decision-making over the following five years, as well as for inputs to the CSR process.

The MRC Strategic Plan 2009–14, “Research changes lives”, was launched in June 2009. It is available at: www.mrc.ac.uk/Utilities/Documentrecord/index.htm?d=MRC006090

2. MRC Strategy Board

The MRC has a Strategy Board, which is responsible for developing, coordinating, overseeing implementation of and evaluating the MRC’s strategic plans. The Board takes a leading role in developing the overall strategic scientific plan for the MRC, taking into account research strategies both in the MRC and elsewhere, ensuring that the organisation is responsive to the current and future scientific landscape.

The Strategy Board advises the Chief Executive on the distribution of budgets across the research boards and allocates funding from the Strategic Research Fund and Translational Research Fund, including large and cross-cutting strategic investments. In addition, the Board oversees the MRC’s programme of Strategic Reviews, making recommendations to Council on the outcomes and implementation of strategic decisions.

It was the Strategy Board that had primary responsibility for developing the 2009–14 Strategic Plan (with final approval by MRC Council).

[More information about Strategy Board is at: www.mrc.ac.uk/About/Structure/Strategyboard/Keyfacts/MRC004726].
3. **DEVELOPING THE MRC STRATEGIC PLAN, 2009–14**

As indicated above, in starting to prepare for the Plan, we were not starting from a completely clean slate; nevertheless we encouraged the wide variety of our stakeholders to think radically and to look at the whole spectrum of medical research, not just the parts in which they had a particular interest or expertise. What follows is a summary of a complex and iterative process.

The process was as follows:

1. **Inputs to inform discussions on future strategic directions**

The inputs to inform discussions on future strategic directions were initially presented to Strategy Board (SB) at its meeting in April 2008. The planned inputs (since updated) are summarised in the following table:

<table>
<thead>
<tr>
<th>Input</th>
<th>Time</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Council</td>
<td>July 2008</td>
<td>To identify the high level framework of strategic drivers</td>
</tr>
<tr>
<td>Dinners attended by Council and SB members and key stakeholders</td>
<td>May—June</td>
<td>To understand key stakeholders’ and influencers’ perspectives of research needs and challenges over the coming years</td>
</tr>
<tr>
<td>Health Research Landscape Analysis</td>
<td>May—July</td>
<td>Commissioned analysis of major national and international activities, strategic plans or think pieces</td>
</tr>
<tr>
<td>Health Departments</td>
<td>June</td>
<td>1:1 meetings with CEO to discuss the key drivers and research needs of the departments</td>
</tr>
<tr>
<td>NIHR and OSCHR</td>
<td>Regular updates to SB</td>
<td>Updates on the activities and joint plans with NIHR and OSCHR</td>
</tr>
<tr>
<td>Industry</td>
<td>1st Biannual Pharmaceutical Forum (July)</td>
<td>To identify the key future challenges from an industry perspective</td>
</tr>
<tr>
<td>Research Boards</td>
<td>June/July</td>
<td>To identify challenges that are unlikely to be addressed through response mode funding or Board specific initiatives</td>
</tr>
<tr>
<td>Research Community</td>
<td>Various, ending March 2009</td>
<td>To identify opportunities to feed into strategic development</td>
</tr>
<tr>
<td>Cross Research Council</td>
<td>Various, ending March 2009</td>
<td>To provide latest thinking about cross RC themes and programmes for inclusion in bids for the next spending review.</td>
</tr>
<tr>
<td>Other research funders</td>
<td>Various, ending March 2009</td>
<td>1:1 meetings with CEO to discuss activities of other funders</td>
</tr>
</tbody>
</table>

2. **Inputs from Overview Groups (OG)**

The Overview Groups\(^{15}\) were also asked to have an initial discussion to identify some of the key strategic questions. A number of potential issues and future research challenges which were presented to SB for the overview groups to discuss. These were:

**Research Portfolio and Priorities**

- Is the MRC supporting the “right” areas? Is the portfolio balance appropriate, for example in relation to health needs? How should we examine research tractability?
- What will translation look like in five or 10 years’ time?
- What are the big medical research challenges for the future?

Some “prompts” were taken from some key sources:

- From the SB work plan: Addiction/mental health, global/international, systems medicine, anything arising from the strategic reviews?

\(^{15}\) See: www.mrc.ac.uk/About/Structure/Strategyboard/Overviewgroups/index.htm
— From the Cabinet Office Strategy Unit key challenges: globalisation; economic prosperity; life chances, talent and social mobility; ageing and increasing diversity of population, family life and communities, crime and safety, public services, climate change; constitution and democratic institutions.

— From the Foresight recent/active projects: tackling obesities; The Mental Capital and Wellbeing; Sustainable Energy Management; and the Built Environment.

The Nature of the MRC and its Partnerships
— What are the big, novel sorts of CSR bids we could consider?
— What is the scope to increase leverage in Europe, and should we start to earmark more money for European partnerships?
— What is the distinctive added value of an MRC in 12 years’ time?

UK Basic and Clinical Research Skills, Capacity and Structures
— What are the grand-scale training priorities—what major changes are needed in the balance of skills for the future?
— What is the next phase of development of medical research infrastructure and clinical/academic centres in the UK?

The Overview Groups presented papers to SB which outlined some of the key issues for discussion by SB over the summer/autumn 2008. Each Overview Group met before the September residential meeting of SB to focus on key issues relevant to their specific areas.

A number of key issues were identified by Head Office staff and these topics formed the basis of the agenda for the SB residential meeting. These were:

Methods and resources
— Does the UK have the appropriate methodologies to advance the knowledge base?
— Is there the appropriate guidance, methodological platforms and best practice for the conduct of studies in the particular disciplines, for example experimental medicine?
— What are the relative merits of research facilities at a national, regional and local level?
— What is the rationale for the translation of research areas? Do we understand the needs pull versus the science push?

Collaboration
— Are there potential areas of joint working or opportunities to develop collaborations both nationally and internationally? eg non-communicable diseases
— Does MRC wish to change the level of investment in existing international initiatives—EDCTP, MRC Africa review?
— Who are the partners we need to engage with to enable MRC to deliver the strategy proposed?
— Are there appropriate opportunities for MRC to engage with new partners?

Evaluation and needs
— What level of engagement do the groups need to take balance the relationship between medical research and health care/burden of disease?

Training
— What are the research areas where there are skills shortages?
— What are the academic needs for trainees?
— What is MRC’s role in developing explicit career pathways?
— What are the skill needs for the future? What evidence do we need for prioritising these needs?
Practical issues

What are the practical issues which MRC need to consider?

For example:

- Identification of the appropriate researchers who can facilitate interdisciplinary research to be involved in the relevant MRC governance structures.
- Ensuring appropriate communication and dissemination streams.
- For TSG—enhancing the scientific communities ability to prepare high quality proposals and for MRC peer review system to adequately assess them

Evaluation

- What Key Performance Indicators are needed to monitor delivery?

3. Residential Meeting of Strategy Board (9–10 September 2008)

The aim of the two-day meeting of Strategy Board in September was to undertake a stock-take on the current research landscape and horizon scanning and to develop medium and long term strategic plans for the MRC. Strategy Board was tasked with developing a coherent plan for MRC’s high level strategic directions over the next few years including a refreshed MRC Vision (10+ years) and a four-year Strategic Plan (2009–12). The framework of these two documents were the key outputs of the September residential meeting.

4. Autumn SB and Council Meetings

Over the autumn/winter SB and Council were presented with draft outlines of the Strategic Plan. The strategic themes were developed and framework established.

5. Circulation of the Draft Document

Following constructive feedback and approval of the design concept at the March 2009 meeting of Council, a subsequent draft of the Strategic Plan was circulated to key stakeholders. On 18 March, approximately 450 individuals received the document and an invitation to the launch event. The key stakeholders included:

- Council members
- OSCHR Board members
- CEOs of the Research Councils and Head of RCUK Strategy Unit
- CEOs of the Wellcome Trust, Cancer Research UK, British Heart Foundation and the Association of Medical Research Charities
- Institute, Centre and Unit Directors
- Members of Research Boards, Overview Groups and the DPFS panel
- MRC Programme leaders and senior fellows
- Trustees of the Medical Research Foundation
- Senior Unit Administrators

6. Additional Activities

The draft Strategic Plan was also published on the corporate MRC website, and individuals were offered the opportunity to submit comments. Dr Wendy Ewart (Director of Strategy) presented the Strategic Plan to at the MRC Institute/Unit Directors Conference (31 March), as well as to a number of key stakeholder communities. The Chair, CEO and Director of Strategy of the MRC also met Professor John Beddington (Government Chief Scientific Adviser and Head of the Government Office for Science) and Lord Ara Darzi (then Health Minister) to discuss the aims of the Strategic Plan.

7. Feedback

The Office received 48 comments (11 per cent response rate) from external stakeholders, plus further constructive feedback from senior administrators. Coordinated responses from key stakeholder groups were received from ESRC, NERC, RCUK, MRC Clinical Trials Unit, Imperial College, University College London and Pfizer.
The following quotes summarise the tone of most comments received:

— “The Department of Health is very supportive and we look forward to continuing to work with the MRC over the next five years” Dame Sally Davies (Director General of Research and Development for the Department of Health)

— “An excellent document prepared with refreshing and clever use of themes” Professor Sir John Savill (Chief Scientist at the Scottish Government Health Directorate)

— “I have little doubt that AMRC’s member charities will respond well to the clarity of vision presented and focus of activities as laid out in the document” Dr Simon Denegri (Chief Executive AMRC)

There was a significant support for the approach, lay-out and design of the document. Stakeholders were supportive of the sequential presentation of each strategic aim by using the headings “Aim”, “Objective”, “Now”, “Future”, and “How.”

Feedback included the need for reassurance from stakeholders that MRC would continue to support fundamental research and support science through response-mode funding. These were addressed in a revised draft by inclusion of an explicit statement in the section entitled “Strategic Intent” as well as more continued reference to basic research excellence throughout the document. A number of individuals noted that there was insufficient inclusion of infections research. Several Council members also engaged directly with Head Office regarding the Plan.

An initial summary of the constructive feedback received was presented to Strategy Board (7 April) who endorsed the approach to provide further assurance of MRC’s continued support of fundamental and infection researchers. Strategy Board supported the approach of incorporating constructive comments into the documents where appropriate for endorsement by Council. Council signed off the Strategic Plan in May. The launch event was held at BMA House on 10 June, 2009.

CONCLUSION:

We strongly believe that offering the research community an opportunity to comment on the draft Strategic Plan was a constructive exercise and provided a level of reassurance that the document would be well received. So far all indications are that it has been.

20 August 2009

Examination of Witnesses

Witnesses: Mr David Sweeney, Head of Research, Innovation and Skills, Higher Education Funding Council for England, and Professor Alan Thorpe, Chief Executive, Natural Environment Research Council and Chairman of Research Councils UK, Professor David Delpy, Chief Executive, Engineering and Physical Sciences Research Council, Dr Steven Hill, Head of Strategy Unit, Research Councils UK, Sir Leszek Borysiewicz, Chief Executive, Medical Research Council, examined.

Q246 Chairman: May I welcome the representatives from RCUK and from the research councils. We appreciate the fact that you have dashed from another meeting and that is very welcome from our point of view. Thank you for your written evidence, which we have looked at very carefully, as will come out in the questions I dare say. Just to go through the formalities, this is on the record and a record is taken. A copy of the transcript will be made available to you for comment on any errors that are there and if there are any further points that you want to elaborate on after this session, please feel free to write to us again; that would be much appreciated. That being said may I ask you for the record to identify yourselves with your name and institution?
Sir Leszek Borysiewicz: Leszek Borysiewicz, Chief Executive, Medical Research Council.
Professor Delpy: David Delpy, Chief Executive of the Engineering and Physical Sciences Research Council.

Q247 Chairman: Thank you very much. The other message I gave at the beginning of our earlier session is that we are trying to be concise to make sure that we get a range of questions in, and your co-operation would be appreciated. The first question is really about the dual support system, the strengths and weaknesses from your point of view. I remember battles in the past where the research councils wanted it all and the vice chancellors wanted it all but we have got a dual support system. Would you like to bring us up to date with your thinking on this?
Professor Thorpe: If I could start, we strongly support the dual support system, we think it gives a vibrant research base. Good institutions having that block funding, enabling a really excellent research environment, allied with individual academics able to bid for excellent research projects, seems to be an ideal combination to support the sector and support research, which is after all what we are working to do. Certainly from my point of view, that combination is a really powerful aspect of our system.

Q248 Chairman: As funds get tighter, no pre-emptive raids from the research councils on the universities, as were done in the past I have to say? Is there any other reaction on this?

Sir Leszek Borysiewicz: Having sat and chaired a main panel for the last research assessment exercise, there is one issue that is important as we move, particularly in the health sector, towards more global challenge-based activity. We are asking institutions to get into greater and greater ranges of collaboration across multidisciplinary topics and the big difficulty with allocation of resource through HEFCE—and I know that they are very conscious of this and looking at it—is that the culture of the RAE exercise is one of intense competitiveness between small institutions rather than rewarding and fostering that collaboration that is going to be necessary to maintain international excellence. That is about the only caveat that I would have, but for many disciplines it is hugely important that the dual support system remains because much of the research in arts and humanities departments is obviously conducted with the resources made available through the QR and other such budgets.

Q249 Chairman: Do the research councils see joint proposals coming in from more than one institution regularly?

Professor Thorpe: All the time.

Q250 Chairman: That side of it is working.

Professor Thorpe: Yes.

Q251 Chairman: Are there any other comments on this?

Professor Delpy: I would just echo what Borys has said.

Q252 Lord Broers: Could I just test this one. Do you all philosophically believe that this is a better approach than having what everybody else has, where you bid for research funds, the university charges a given amount of overheads and then it is the university itself that then can decide to take some overheads from perhaps higher margin subjects and support a few lower margin subjects. To a certain extent you could argue that this is a real nanny state way to run the universities, is it not?

Mr Sweeney: We would argue probably that it provides a degree of stability and helps the development of early career researchers, those who are between grants. It also supports the charities who give us substantial funding but yet cannot quite afford to pay the full costs and having a dual support system makes that very easy. It also helps where we are encouraging collaborative work with business again which may generate intangible benefits and perhaps not the full costs of research. If we have the research strategy that we have, then the dual support system is a desirable outcome.

Professor Delpy: I would also emphasise that the flexibility that that additional funding gives to the universities enables them to identify their own local priorities and their own local strategic directions. Although I believe that, through our consultation, the research councils are actually pretty well on top of what may be important at a national level, there are often local drivers that impact maybe just an individual academic with a particular expertise or niche expertise which would be very difficult to fund through the conventional research council route. The flexibility that the VC has through the dual funding enables that element of research to be continued and those that flourish can then come in and apply to us.

Q253 Chairman: Can I ask Mr Sweeney on this one, are there departments in different universities that seek joint assessment under the RAE? I know there is provision, but is it taken up?

Mr Sweeney: Very few departments come together to seek submission and indeed in Scotland, where they have gone rather more consciously for research pooling, they generally did not choose to be assessed collectively.

Sir Leszek Borysiewicz: My Lord Chairman, it is important to remember, particularly for research-intensive universities, that much of QR disappears in supporting the 20 per cent that is missing in relation to full economic costing, cross-supporting the charity money which actually comes in at a much lower level, and if you are fortunate or unfortunate to attract an awful lot of European funding that comes in with a 20 per cent to 60 per cent management cost, so actually maintaining the fabric of the institution gives relatively little freedom for manoeuvre. It is therefore right that whatever freedom for manoeuvre is available to the institution to make the choices where it would like to see new developments, it is very important not to overstate that an enormous amount of freedom for manoeuvre is left—that was particularly my experience in my previous incarnation with regard to resource allocation within Imperial College.
Chairman: I must say, declaring an interest of having been in the position in universities that you describe, there is not much money left, not least if you are successful on charitable funding; that is a huge draw on any QR money. We will move on to Lord Haskel.

Q254 Lord Haskel: Thank you my Lord Chairman. How are the priorities aligned between the two funding streams of the dual support system and do you have any advice as to how you might support each other more effectively?

Professor Thorpe: Perhaps I can pick that up. We are increasingly coming together to work together between, for example, HEFCE and the research councils, and these are areas that cover some of the difficult cultural changes that we want. For example, on public engagement, the research councils and HEFCE (the funding councils) are supporting a significant number of beacons of public engagement in universities, so we are trying where we can to come together to support areas that need stimulation in terms of developing the research environment within the universities. We also come together on work to look at, for example, the evaluation of impact. So we do work increasingly closely together in terms of the practicalities of both how we operate but also in significant new areas where we need to stimulate activity.

Mr Sweeney: Perhaps I could mention that we deal with the EPSRC on science and innovation, the BBSRC and MRC on integrative mammalian biology, the BSRC on causative social sciences and with AHRC and the ESRC on language-based area studies. We are doing a lot of work together and the two sides of dual support are well-tuned.

Chairman: I am pleased to hear that, remembering the battles of former days.

Q255 Lord Haskel: Do you have any advice as to how they might perhaps work together much more effectively?

Mr Sweeney: We have developed closer relations partly through our having a common sponsor department and that is developing well. I do not see the need for significant change; we want to continue to build on excellent relationships.

Sir Leszek Borysiewicz: I would just add that there is a real risk in getting too close an alignment because that is actually going to remove money from the flexibility stream that universities actually have to develop. One of the great things about the UK higher education system is its very diversity and that diversity can only be promoted if a resource is made available to the university. The greater the centralised control, the less is actually going to be available in a finite pot. So I do think we have to be very careful not to overdo the centralised co-ordination. I think we are about right.

Q256 Baroness Neuberger: It is very nice to hear the words “about right” and, Borys, you already said that there was an issue to some extent about collaborative research. Can perhaps all of you tell us what you think the existing mechanisms do to encourage collaborative research amongst different institutions, sectors and disciplines, and actually do they do it to any great extent?

Professor Thorpe: Again perhaps I can start. For me, in terms of being in my job for the last four and a half years, I have seen a tremendous growth in partnership and collaborative working, particularly stimulated, I suppose, around the need for cross-disciplinary and inter-disciplinary work. There has been a really radical increase in collaboration and we all have particular funding schemes, for example, to promote collaboration. My own council, for example, has consortium grants which require separate institutions to make joint proposals in areas of science that require that. We have got, across all the research councils now, programmes of research that again are multidisciplinary—for example on energy, living with environmental change, ageing—which really involve pretty much all of the areas of research. We are closely collaborating as funders and also, in a number of those programmes, collaborating with users and with the people who are going to benefit from that research. For example, on living with environmental change, we have not only the research councils but also the main government departments as partners and some of the business community. There has been a tremendous development of collaborative working across the sector, and with other parts of society and organisations. From my own narrow view, from my own research council, that has tremendous benefits because we can align our funding with funding from other sources, for example government departments and business, and actually lever much more activity by co-design and co-funding of initiatives. It has been a really exciting development.

Q257 Baroness Neuberger: Do you agree?

Professor Delpy: Yes, I would say is in fact if we use the cross-council programmes as exemplars they are a real example of success because, as Borys has mentioned, the RAE in general has driven universities and individual academics to be highly competitive and, prior to the research councils coming together and identifying themes that they as a whole wished to really drive forward as strategically important areas, it was difficult to get universities to work collaboratively on common themes by handling it in a cross-council manner. By avoiding the
complications of inter-disciplinary work through one council taking the ownership and avoiding that double jeopardy, sorting out behind the scenes the complexities of the funding, we clearly, through those programmes, have a success story which we ought to be proud of.

**Q258 Baroness Neuberger:** Can you tell us a bit about the review of the energy research programme, the SUPERGEN programme, and what mechanisms are proposed to encourage more collaborative working in future, given it is one of your babies?

**Professor Delpy:** As you know that was a programme which predated the cross-council programmes and one that was particularly successful because it involved the users, not just the academic researchers, and as you know we have undertaken a review of that. The SUPERGEN programme started off as, in effect, individual EPSRC programmes; now it is rolled within the overall remit of the RCUK energy programme so that not only enables us to bring on board the people who are involved in the other large energy parts of the landscape but also, to be honest, to tension the activities that were currently under way with the, was it 17, SUPERGEN consortia—there were an awful lot of them, I cannot remember the exact number—against some of the other priorities in the energy landscape which came in through the other councils being involved. I would not guarantee that all the SUPERGEN consortia will go forward but I would say that the ones that go forward will actually be stronger and represent a more balanced view of the whole energy landscape within the UK.

**Dr Hill:** The other thing to add to what my colleagues have talked about with the big mission-led programmes is that it is also the case that we have a cross-council funding agreement in place which allows any multidisciplinary research proposal that expands boundaries between councils to be handled in an effective way. So there is then collaboration between councils to ensure appropriate peer review and either sharing of the funding of that proposal or, when the minority partner is small, the funding is just carried by the lead council in order to administer it.

**Q259 Baroness Neuberger:** That is true of responsive-led funding.

**Dr Hill:** It is, yes.

**Q260 Chairman:** Are there any comments from the MRC on that?

**Sir Leszek Borysiewicz:** No, except that we work in collaboration over the health sector, which has been very successful, I would contend, over the last two years. I would also just highlight the importance of collaboration outside national boundaries. For us this is extremely important. Though we may even have to operate outside national boundaries in the UK; it is very helpful to be able to work with devolved administrations by actually understanding the priorities that they place on health in contrast to the priorities in England. There are a variety of programmes therefore that we have in the devolved administrations. It is absolutely possible to do so. The biggest and major difficulty, which we will come on to, is how do you keep that balance of response mode funding for relatively small groups and this much more directed programme, have we got that right? That is a real issue that should be explored. The second is that we must avoid double jeopardy, and every council and every funder that I know of in the UK is absolutely committed, where we are looking at multidisciplinary proposals, at all costs, to avoiding this awfulness of having to go to one and to another and then both having to say yes in order to get the funding. It is death to major collaborative programmes, but we have largely avoided that now.

**Q261 Lord May of Oxford:** May I say as a preamble to this question that I am a very strong supporter of the dual support system—it is absolutely necessary—and that is based on my 11 years as Vice President and Dean for Research at Princeton, which is the university in the States that, after World War II, created the notion of indirect costs in recognition that you have to have money both for central academic administration to start new things, close old things generally, side by side with money competitively granted for basic research. But there is a third leg to that stool, it is not a dual system, it is a tripartite system. The third leg is that sources of funding and encouragement will often go, not necessarily but very often, to different kinds of institutions to carry the new knowledge thus created forward into the marketplace. Trying to confuse the funding of basic research with its prospective social and economic impact seems to me an excellent idea in principle but something that requires not just a high degree of sensitivity, skill and imagination but an almost supernatural degree of prescience. That is the bias that I am coming from as I ask you my question. Could you give with some degree of specificity an answer to this question: what is the mechanism whereby you are going to undertake this (to my mind impossible) task of assessing the social and economic aspects of basic research? How are you going to weigh that weighting, however achieved, against the sheer scientific quality as a piece of basic acquisition of new knowledge, the quality of the investigator and the proposal? How does that confounding of the impact (however you are going prospectively to assess it), relatively weighted against the basic science itself, relate to the mission which I understand to be
the mission of the research councils of supporting basic research?

Professor Delpy: Let me start.

Q262 Lord May of Oxford: You are the bravest!

Professor Delpy: Let me first say that we are talking about the introduction of the impact statement, the impact section, in applications. The impact plan is not—no matter how many times we restate this it does not seem to be believed—asking the academic applicant or the peer reviewers to predict the future benefits. What we are trying to do, what we are intending to do with this, is to get applicants to consider potential benefits and potential pathways to impact of the research that they are undertaking. This is not about changing the research that they are doing.

Q263 Lord May of Oxford: What weight do you give to that?

Professor Delpy: The first thing to say—

Q264 Lord May of Oxford: There is no point in doing it if you do not give it any weight.

Professor Delpy: I disagree with you. The first weighting on peer review is excellence. We have said that unambiguously right from the outset. Let me give you an example—it is always easiest to talk about a specific example. The way that I think EPSRC should consider this is that peer review is a human process, it is imperfect, it has a degree of randomness in it, so there is a bit of uncertainty. I would say that we ask our panels to rank applications on their academic excellence and I would say the top two deciles, the top 20 per cent, we fund automatically anyhow because we have the funding to do that. We then start to move into a boundary where, to be honest, we are going to draw a line, we run out of funding. I do not believe, to be honest, that peer review is sufficiently scientifically accurate to say that this application is better than that one that is just immediately above it, so I think we ought to take into account, as a secondary factor, when we are getting to that boundary as to which ones we should fund and which ones we should not, those that are the most likely to have an impact. We should possibly be funding over and above those that do not because they are of equal excellence and I do not believe that the peer review mechanism—

Q265 Lord May of Oxford: Do you not recognise that the thing that is more outside the box, and thus in that sense, past experience suggests, may in some cases be most likely to have an impact, is going to be disadvantaged by officials trying to judge what is the impact, which is going to be weighted by the present?

Do you not recognise that that could even be counterproductive?

Professor Delpy: I recognise that and all research councils have put in place a variety of different ways of peer review to try and deal with this thing about transformative research and so on. I disagree with your word “officials” making this decision; the people who are making this decision are the academics.

Q266 Lord May of Oxford: Yes, but you have told them to do this.

Professor Delpy: These go out, as you know, to academics for peer review, they come back in, there is a panel of academics who make the decision. It is not the officials who are trying to weight this, it is the academics.

Lord May of Oxford: You have told them to do that, but let me not pursue it.

Chairman: Lord Warner wants to come in and then we will take the views of the others on this.

Q267 Lord Warner: I probably start from a rather different position from my colleague on the other side of the table, you will be pleased to know, as rather pro looking at the impact, but there are two elements to this and I would like your views on this. There are retrospective impacts and there must be an issue about track records of particular institutions in the research they have done having impacts; do you take account of that? The second leg to the question is the whole issue, as I understand what you say, of a kind of ranking system. You start with excellence of the research and peer review but there must be some near misses. What do you do about the people who look as though they are near misses but they have actually got, potentially, something which could be very significant? How do you work with those institutions to get the benefits?

Professor Delpy: There is a potential problem and always has been in peer review, those who are just below the cut-off at a particular panel. Most councils work with this by carrying those applications forward to the next panel because there may be more cash when a different set of applications come in. In respect of the retrospective analysis we are on pretty solid ground because all the research councils do undertake an evaluation of their research investments over time. It takes various forms of review—from internal peer review committees, again of academics or users, all the way up to the international reviews which we undertake on a five-yearly basis of the whole of the field. For that retrospective analysis, we have a pretty robust methodology for handling that. Things at the boundary, the research funding system is inevitably always a bit unfair to those who are at the boundary,
it always has been, and we try to find ways of ensuring that those who we feel were worthy can come back in and compete next time around.

Q268 Lord May of Oxford: This is a central question which I would like to pursue. You have said the way you are going to weight it is in terms of minor weight as a tie-break. I would like to hear what the other three say.

Professor Delpy: That is for EPSRC.

Professor Thorpe: We are all approaching it in a very similar way, but just to say one additional thing and that is that we have had secondary criteria for some time across the councils—risk reward criteria, value for money, whether the research has been managed properly, so it would be wrong to say that we have only ever had one criteria. We have always been clear that the primary criterion before and now is the scientific excellence; but let us be clear that there have been a number of other secondary criteria that panels have taken into account.

Q269 Chairman: Can I just ask for clarification on that? There have been such criteria and you still use them.

Professor Thorpe: And there still are but this is an additional one. A secondary point is that in terms of measuring impact we are getting a lot smarter at being able to do this and realising that actually we have got a hugely successful story to tell on this. You could start at one end of the spectrum, that we measure the citations relative to the international community; that is an impact and we measure that and we do very well on it, but we have plenty of others as well. We have examples of research leading into policy developments, we have lots of statistics on spin-outs, on the relationship between business and research councils and individual researchers; we have information on how much inward investment there is from business because of the excellence of the UK research base; we have got case studies on particular research where, over a ten to 15 year period, we have invested in the training of research students in academic careers, the prizes being won and the application impact being realised which takes that significant time to be developed. We are getting much clearer and much smarter at being able to recognise how successful the UK is at this aspect. So in terms of the retrospective measurement we have a tremendously good story to tell.

Q270 Lord May of Oxford: I find the retrospective one is very interesting, it is a very interesting and good answer, but at the same time much of the citation things would be counts of the excellence of the basic research much more than the economic and social benefits.

Professor Thorpe: Absolutely.

Q271 Lord May of Oxford: But even so.

Professor Thorpe: My point is that impact we do not regard as narrowly as on economic benefit, it is actually on public, on public policy, on other scientists, on business, so it is a very broad concept and we must not lose sight of that.

Q272 Chairman: We will ask the MRC now to come in.

Sir Leszek Borysiewicz: At present we do not have a statement on our grants that requires a comment on economic impact as a separate section. We have for ten years focused on the primary mission of the MRC which is to produce research that will improve health and researchers have always been required to provide a secondary impact in trying to predict how this may impact in this broad area. We will ultimately, because we are going to a joint grant funding system, be involved in this, but we rather focus more on the retrospective analysis, and we are trying to do this in a number of ways. The first of these can be seen in the document that we produced for the Wellcome Trust and the Academy of Medical Sciences where we systematically used economic and Treasury parameters to explore what the economic value of research in both neurosciences and cardiovascular disease is. There are real problems in biomedicine in doing this because what that analysis showed is a phenomenal return. It basically allows you to say to the Chancellor of the Exchequer, “Chancellor, you do not invest in anything in this country which will give you a return of 40p in the pound by Treasury rules in perpetuity as a result of public investment”, because that is what the number is. It is the best value thing that Britain ever does, much more than you would get from a railway or a road. It is an incredibly successful operation. Secondly, we know that industry invests alongside that money between £2.50 and £5.19 for every one pound of public money invested, so that there is a winding factor that industry will go where the public money is going. That is important. Also—and this is the downside—to get the return, to get the real value into practice, it actually takes 17 years. That is what people really forget. If you are going to do retrospective analysis, you really have to go back a long time. The other issue is of course you will say, “this is health.” That is because you do a good trial and the impact of that trial means people live longer so that works well. As I was told by economists, living much beyond 65 you are a liability rather than an economic benefit. The real issue though is that only 9p of that 40p is actually due to extension of life or improvement in life. The rest is down in the benefits of the research industry itself. We can do that type of analysis. I have a
personal belief which is that retrospective analysis should be conducted to ask the scale particularly on economic value. Has the MRC as a whole delivered economic value to the country? I am very worried if we try to define project by project, using economic value to select a project. That is a personal view that I have and I know it is shared by virtually all chief executives. I think all of us have a system within our boards that ensures that that does not become a dominant feature, but is a secondary consideration. What we are now doing is, knowing that we cannot engage in these large-scale exercises all the time, we have abandoned our evaluation system of the outcome grant in terms of final reports. We have introduced over the last four weeks—we now have it live at the present time—a system of evaluation whereby researchers put in all of the information, the collaborations, the industry collaborations are developed and we have collected about 23 per cent of all investigators already in the first two weeks that this has been live. We will have this in real time. Why do we want it? We want it because we have identified that, in the course of an investigation, many new collaborations emerged which were unforeseen and we need to be able to measure what those are. We need to be able to measure the career development of people on those grants and we need to be able to extend the period beyond the end of a grant. Yes, this is an encumbrance on investigators. The deal is we will no longer require a final report. As long as they fill this in, this becomes the MRC record of their achievement. That allows us to conduct now real time analysis against our projected strategic plan and ensure that we are actually investing, without having to wait for that long period of time to elapse as to whether we are getting it right or wrong. We can begin to look at trend lines rather than looking at set points. That is the kind of direction in which we are trying to push so that we can address the economic impact question and we can address the scientific impact. The one we are struggling with, which is hugely important for the MRC, is how do we deal with the societal impact, that third stream of evaluation. I have no answers for that at the present time, but we will be working on it to see how objectively we can get reasonable measures because, hugely for health, that is a very important parameter. That is how we are working but we are working alongside all of the councils to ensure that we learn the best from the evaluation systems that RCUK as a whole is looking to put in. We are putting in information that we are gaining and we are learning from the processes that they have. It is a joined up exercise in trying to get better at what is a very difficult process of evaluation.

**Q273 Chairman:** That is very helpful indeed. I wonder if, in the light of that, the shorter term attempt to measure impact which is now going to become high profile—it may be a mistake in the light of what has just been said—should be fully retrospective like bankers’ bonuses. You look back and see what they have achieved in that university and in that institute. That is the incentive to them to play the thing in the way that you want it played. Despite what Professor Delpy said in reply to Lord May, I think you are still thinking there is a bit of prediction in here because you are estimating what the impact would be.  

**Sir Leszek Borysiewicz:** No.

**Q274 Chairman:** In that case, should it be just completely retrospective?  

**Professor Thorpe:** We should not underestimate the power of researchers thinking about the impact broadly cast, as we have said, right from the start of research, because there are potential opportunities that could be presented if they think about that, rather than just at the end of the research. Our focus on inviting researchers to think about the pathways opens up possibilities for others to get involved in the research as it goes along. It opens up the possibility of even other funders coming on board to support that research. I think it opens up a range of opportunity that will not be there always. If it is only at the end of a project or looking back, you miss out on that. Some of that early thinking is what we are trying to promote and it can be very advantageous.

**Q275 Chairman:** If you want to influence vice-chancellors leaning over the shoulders of their researchers, you promise them there will be money if the results are good. It will have an impact.  

**Professor Delpy:** As part of that impact element, if the descriptor identifies a possible route to impact, if the work pans out and so on, then in fact you can seek in your original application some funding to enable that seamless transfer to happen. You do not have to wait for the end of the grant, then write another grant and wait for the valley of death when your PhD student has left by then. The whole idea is to try to have a seamless transition for those things that do have an impact that arises during the period of the funding and there is a seamless transition to TSB funding or venture capital funding or whatever you have managed to screw out of your VC.

**Q276 Chairman:** It sounds like more of a hope than a prediction.  

**Sir Leszek Borysiewicz:** Whilst we are focusing a lot on retrospective analysis because we think that is probably going to be more robust, we do ask prospectively as a secondary parameter which is an inherent part of our grant application process. It is no different, although we do not ask it formally, from any of the other councils.
Q277  **Lord Broers:** I want to ask Professor Delpy an impossible question, but I think I will ask it anyway. Mr Borysiewicz gave a very elegant answer from the point of view of MRC but your customer base is captive, not global. It is interesting. I was thinking: would anybody bid from overseas for our national health system? I rather doubt it. I cannot see it high on the Chinese order of priorities to take some of their cash and try to buy the British health system. We have flogged just about everything else. We have flogged our airports. Most of our industry has gone. We have a difficult situation in engineering and the applied physical sciences. Is there any element in assessing impact that measures the parochialness, or lack of it, of our research? I know a lot of sectors of American industry, particularly in my field of microelectronics, are really enjoying our research and take it up and use it very rapidly. Do you differentiate?

**Professor Delpy:** Most of my community does not find this impact agenda an alien one. 40 per cent of the research EPSRC funds is collaborative with an end user, not necessarily always a UK company, but 40 per cent of our grants are already involving a user. This idea of getting the output of research through quickly into product or policy is already part of the thinking of this community. Some 2,300 companies are involved in collaborations with EPSRC-funded grants at the moment. We do not specifically look at whether the users are UK or not UK. We have a strategic partnership arrangement with currently, I think, some 31 partnerships and about 37 companies, most of whom are either UK based in terms of having a large research base there or they are multinational who are putting a significant amount of research funding into the UK base. Through that strategic partnership we try to encourage the development of the output of the research we fund within the UK base.

**Lord Broers:** I think that is a good answer. It is good to have it on the record that we think that way, because in fact that is really looking at impact in quite a pragmatic and a financial way. In those subjects, it is appropriate.

**Chairman:** Ask impossible questions and you clearly get good answers.

Q278  **Lord Crickhowell:** I want to move on to another question and then perhaps revert briefly, encouraged by a remark from Sir Leszek earlier, to a question I asked earlier. I think this question is really posed to Dr Hill. In your evidence you say that there is still a lack of joined-up governance for public sector R&D funding in the UK: “The primary criterion for government department funded research, which is largely managed through commissioning, is strategic need rather than excellence as expressed through the peer review system” and so on. What examples can you give of lack of joined-up funding and what remedies would you like to offer the Committee?

**Dr Hill:** It is quite difficult to focus on specific examples but I think the basic idea around the short-term nature of funding for many government departments, the focus sometimes on short-term issues and the potential vulnerability of departmental R&D budgets to other demands within the department, are the sorts of issues that are seen. I think there has been a big change and a big improvement in this over recent years. I think the linkages between the research councils and government departments in defining those strategic research priorities are now at a very sophisticated level through interactions with chief scientific advisers and through big, mission led programmes like *Living with Environmental Change* and *Lifelong Health and Wellbeing*, where the government department partners are fully engaged and fully part of that strategic embedding.

Q279  **Lord Crickhowell:** We have had earlier evidence from Lord Drayson and others of the efforts being made in this direction, but have you any specific add-ons? You have said it is getting better but you have made a criticism. Is there anything further you would like to see particularly done?

**Dr Hill:** I think the steps that have been taken around coordination of research budgets within government, particularly through Lord Drayson’s Cabinet sub-committee which now looks at the budgets across the patch, is a big step forward. I think it is too early to say whether that is working or not because it is a comparatively new initiative. Until we have seen the outcome of that, then I think we should let that initiative run.

**Lord Crickhowell:** Sorry to be boring but as a former Secretary of State I do not need to be told that we have devolution or indeed how it works, but I am quite interested to know what the consequence is of devolution for the university sector in the United Kingdom as a whole. Perhaps with the university, which I once had the privilege for a short time to be head of, now headed by a Nobel Prize-winning research scientist, it is not a bad moment to ask. I am quite interested, and perhaps someone could come back with a note afterwards, to know how the funding differs on scale and so on in the key universities in Scotland and Wales from what is happening in England. I would just like to know whether devolution is working in this field or is not working, or is there a sense in terms of allocation and so on that might make it better. I assume we have devolution. It will continue but we are talking about the science base in the United Kingdom as a whole.
We should not forget that just because we have separate bits of it.

**Lord May of Oxford:** Can I make a factual correction? The research council funding is not a devolved function.

Q280 Lord Crickhowell: No, but we were having evidence earlier as it happens from a body responsible in England.

*Dr Hill:* Research council funding is UK wide and is allocated solely on the basis, as we have already been discussing, of excellence and other criteria. The outcome of that from the point of view of the nations within the United Kingdom is that Scotland wins slightly more funding than it ought to from the size of its academic population.

Q281 Lord May of Oxford: Which of course is why they wanted it not devolved.

*Dr Hill:* Wales wins slightly less and that is the picture that comes out of the competitive process.

Q282 Lord Crickhowell: When we go back to those questions about Russell universities and so on, I still would be quite interested to see if anyone has the sort of numbers available, whether there is some information about how the total funding of the very best Scottish and best Welsh universities perhaps compares with their approximate peers, if there are comparisons that can be made. I think it would be interesting to know whether the UK as a whole, not just on the research councils but the overall funding of the universities, is getting good value for money and a sensible deal.

*Professor Delpy:* Can I quickly come back to the question that was asked at the outset about the lack of joined-up governance between the public sector and the base? One of the key points is this question of timescale. The universities work, and we fund, on a 10 to 50 year timescale and quite often government departments are trying to seek solutions to problems on a shorter timescale. This is exactly why we should be trying to ensure that we are both monitoring the potential impact of the research funding and keeping a track of that over time, because quite often government departments will be wanting to know where there is a solution already there. We are getting much better at monitoring that impact, that output, and having it to hand. We are, through the impact programme that we are putting in place, enabling that disparity in timescales, which is inevitable between our long-term research and the shorter-term priorities of government departments, to be bridged to the benefit of the UK.

*Sir Leszek Borysiewicz:* I have had the privilege of being head of medicine in Wales for over ten years, so I do have first hand experience of this agenda. There are three elements that I would point out. Firstly, there are distinct differences between the funding of universities in Wales, in Scotland and in Northern Ireland compared with HEFCE. They are sovereign countries in some way in their own right and they make their own decisions. Scotland in particular wants to aggregate and group together. It has a completely different structure, particularly around health-related research. Wales takes again a very different perspective as to how it relatively distributes money based on R&D. That is a right that they have and possess under devolution. For the MRC, the real issue is of course that we deal with a situation whereby we have health, which is a devolved matter to the administrations, compared with research, which is not. That requires the MRC to be cognisant of the health priorities which are different in the four different jurisdictions of the four NHSs in the UK and if you sat the four chief medical officers together there would be little agreement as to where the priorities reside. The models of care in Scotland are entirely different. For example, public health is much more centralised and centrally managed. In England it is a devolved structure. We have to manage that particular enterprise. How do we do that? We work with both the Science Minister in Scotland and in Wales and the Health Ministers in both countries. The MRC visits both countries twice a year. We have joint meetings set up to understand the chief scientist office priorities and directions and make sure that they are aligned with where the MRC is. It is exactly the same for Wales and the same for Northern Ireland. We then target the sorts of initiatives that we can bring to bear. For example in Northern Ireland, by getting the Northern Ireland Assembly to work closely with Dublin, we now have a country of sufficient size to start putting in, for example, clinical trial support which on its own Northern Ireland would not be able to do. I count that a real success for joint working. Under the OSCHR agenda, with the devolved administrations coming together, for the first time health investigators in Scotland and in Wales and Northern Ireland have exactly the same position when they come forward for grant support in relationship to the translational aspects of health-related research as they do in England. We have a coordinating mechanism. In that one domain of research I do not believe an investigator should be disadvantaged by working in Wales or Scotland, provided they pass the muster of excellence of the project concerned. It is something every council has to work at. For example, in ten days’ time our main council meeting, an open, public meeting, will be held in Edinburgh and in due course we will also be coming to Cardiff and Belfast because we do want to send the signal that it is our responsibility to work with the priorities that those countries set as much as it is with the priorities that are set in England.
Lord Crickhowell: Thank you very much. That is a very helpful answer.

Q283 Chairman: We have another question that is troubling us a little bit at the moment that it would be unfair to ask you to answer, but I think we should just give notice that we will be asking it of the health authority. It concerns the report in The Times last week that possibly some of the Health Department research budget might be diverted for provision of some of the costs of the care policies that are being developed. It was in a newspaper; it may not be true, but there are two aspects to that. We would be concerned, because it is very much at the centre of some of the questions we are looking at, if that were so; but also whether through the Barnett Formula it would have an impact in Scotland. I do not know if you want to comment.

Sir Leszek Borysiewicz: I could only comment on that and you would have to check the facts of this through with Sally Davies who is in charge of the National Institute of Health Research. I was at a meeting with her when this broke. As I understand it, the situation is the ring-fence has not been breached and the Minister has affirmed that the ring-fence is not breached. The money referred to in research was policy research within the Department of Health. The bit that worried me most of all in that report was that this was described as mediocre research and I know my colleagues in NIHR would not support mediocre research. We were kind of alerted that this was money from a different sector of the Department of Health and we are assured that the ring-fence has not been breached. That was also reported to OSCHR when those questions were asked. I do believe that, for formality, you should seek the response directly from NIHR.

Chairman: I think we certainly will be writing. It was Lord Warner who raised this question. I do not know if there is anything else you want to add?

Lord Warner: No. I do not want to add confusion where there is already confusion.

Q284 Chairman: We will seek clarification from the Minister.

Sir Leszek Borysiewicz: That is my understanding of the position.

Professor Thorpe: Just on the first point, there still are some significant challenges of joining up between departments, particularly on research. I think the Science Minister has been exercised recently about a number of issues. For example, on satellite missions for earth observation. Those data are critical for a number of applications within policy areas, within government departments and where multiple departments are beneficiaries it proves very difficult to get an alignment between departments on those sorts of issues. We have heard of issues associated with the funding of the Hadley Centre for example which is a blue ribbon institution on climate change, which again has suffered from that aspect of perhaps not sufficient joining up of agendas across departments. We had a number of those sorts of concerns in the back of our minds when we raised this. I think we have made progress, but we still have a way to go.

Q285 Lord Broers: It is one of the central topics that people have been discussing for a long time. What are the objectives of responsive mode and directed research? How useful is the current terminology used to differentiate between the different types of research funded by research councils? What changes, if any, do you suggest? The background information we have here is that both CaSE and Imperial College have said they think that more than 50 per cent should be responsive and Imperial has said, “In recent years the balance of Research Council funding has swung too far towards managed programmes at the expense of responsive mode funding”.

Professor Thorpe: Directed research, directed mode, really allows research funders to stimulate activity in certain areas of research. It is defining areas of research and within that applicants, proposers, submit applications for delivering that research. Again, scientific excellence is the criterion. Responsive mode however allows researchers to apply for funding right across the spectrum of research areas, so it is open to that breadth. From that point of view, I think the distinction is clear. The issue of how much responsive mode we support relative to directed mode is a key one. Overall across the research councils, it is approximately two-thirds on responsive mode and a third on directed mode. For a number of councils the trends over recent years in terms of the proportion of responsive mode have been relatively small. From my own council’s point of view, NERC, we have slightly increased the proportion that we put into responsive mode. Across the research councils it has been relatively steady and I know David will want to come in from the point of view of EPSRC where, even over a ten year period, there has been relatively stability in that ratio between the amount being spent on responsive mode and directed mode.

Professor Delpy: I have the data because obviously I was aware of the concerns. As Alan says, over the last ten years there has been very little difference. EPSRC in general has been roughly 50/50 over a ten year period starting from 51 per cent so-called responsive and 49 directed. I personally however find the whole terminology both unhelpful and in fact divisive. Whether it is basic versus pure or pure versus applied or curiosity driven versus something which is not, I
have never known an academic who has put an application in that is not curiosity driven whether it is a specific call or into responsive mode. I think they are very unhelpful distinctions. As Alan said, the key criterion is excellence. We only fund on the basis of peer reviewed excellence. There are however certain areas which we do believe are strategic priorities. We have identified them across council calls and there are one or two in each of the individual councils. Just because we have identified those as priority areas, they then automatically become directed. I have an energy programme. A large number of the applications that come into that are essentially responsive mode calls but they come in to that particular pot of money. They all get grouped as directed. Although I have a ratio of, let us say, 50/50 within EPSRC, I would say that at least a third of what is identified under that directed pot is actually responsive mode. I think it is an unhelpful distinction. The importance is the excellence of the research and we have undertaken an independent review of the outputs of that work, as have NERC, and what it shows is that the citations from what are called responsive mode or what are called directed mode or mission based programmes are virtually identical. In fact, the citations from these research council programmes are higher than the international average anyhow. A recent bit of work from EPSRC showed that programmes which are larger and more ambitious have a statistically higher citation impact than the smaller programmes. The smaller programmes tend to be in responsive mode and the larger, more ambitious programmes tend to be in what we would call directed mode. I would argue it is high quality work. All the evidence is that it has the same international excellence. When we analyse, in terms of EPSRC, the academics who are bidding into the responsive mode pot and those who are bidding into directed mode then it is 75 per cent commonality. It is the same excellent researchers who are doing both.

**Q286 Lord Broers:** Do you have a suggestion for better terminology?

**Professor Delpy:** I would just call it research. What we fund is internationally excellent research. It may be research in the area of energy; it may be research in the area of environmental change or in security.

**Q287 Lord Broers:** You could say you are particularly interested in bids in this area?

**Professor Delpy:** Yes. There are some councils which have almost gone down that route wherever this responsive mode call is issued in an area.

**Professor Thorpe:** It is essentially what our directed mode is. It is saying that in this area we are soliciting proposals in generally quite broad areas rather than across our whole portfolio.

**Q288 Lord Broers:** Why do you not change it?

**Professor Thorpe:** We are giving serious consideration to the terminology because, as David said, the number of words that are being bandied around with different connotations and emphases, if you like, often are used to say that one mode generates better quality, more excellent research. Again, this is why we did the citation analyses to try and test this. It just does not seem to be the case. We do feel we need to change the terminology and we are giving serious thought to that.

**Q289 Chairman:** I think we understand your reservations about the terms, whichever pair you happen to use. If you have statistics that attach to these terms that other people use, as you indicated, they might be very useful to see, if you could send them to us. Secondly, can I just ask whether or not—this is I think one we will be considering—a difference between a strategic priority (I think for example of the MRC, Wellcome and neurodegenerative diseases where you sketch out an area; this is high priority for all sorts of reasons but the excellence of the research is the fundamental thing) as distinct from project driven response mode is helpful.

**Sir Leszek Borysiewicz:** I think language is language and unfortunately the clarity has to be to the community as well. MRC historically has had a different way of funding to most of the other councils. From 1911 onwards, its priority firstly was the intramural research and 40 per cent of the MRC budget is spent on our own scientists working in our own institutes. The LMB and the National Institute for Health Research are examples. We have 29 such units so we directly employ 4,000 scientists working in these areas. Of the remaining calls, we can again provide you with the data but you will have seen from 2005 onwards 90 per cent was in response mode until last year. What changed last year was the response to the Cookeys Report, where we received additional resource in order to begin to develop the translational components. We had 15 specific calls in those areas where gaps were identified. Now if you look at the ratio, it is 62 to 38 per cent in that resource. The value of that pure response mode coming straight to the boards for pure excellence has not changed. It is 140 million, but the value of the directed calls has gone up because we received a specific budget and the increase in our budget was to address this issue of translational research and the gaps that were occurring there in partnership with NIHR and coordinated by OSCHR. That is the position that the
MRC is in. For us, most unhelpful is this divide between blue skies, fundamental, basic and translational. We tend to operate to the Sydney Brenner aphorism that it is either applied research or not yet applied research. It might not be applied for 50 years, but still most life scientists will be working towards a potential application of the research that they are doing. Those are the sorts of numbers and we can provide all of that in more detail to the Committee.

Q290 Lord Warner: To some extent we have dealt with some of the next question. I just want to elaborate it a bit to take account of what has been said. You have already given some indications of the proportion of your research budget that has been allocated to different types of funding. What it would be helpful to know is what criteria you use to allocate proposals between the two. However much you dislike the two pieces of technology, you have to have some basis for allocating money between them. It would be helpful to know what your criteria are. I would also like to probe a bit more this point that the MRC are raising. If you have sat, as I have done, in the seat of the minister dealing with the departmental R&D budget you get a fairly steady flow of letters from people saying, “Why do you not do more research in X, Y, Z?” My guess is that ministers in other departments other than health get the same letters. I think it is quite difficult to understand. In a sense, the MRC gives an example. If you do not have some degree of directed research from time to time, everyone is in responsive mode and there is quite a loss from that. The MRC has flipped from a responsive to a more directed approach. There is a case for the directed mode, however much some of the researchers may dislike the idea. Can you give us some idea of where you think things are going and what are the criteria you use to divide between responsive and directed?

Professor Thorpe: I am sure we will all want to comment but I will start. Perhaps Lord May will forgive me for what I am about to say because we have exchanged conversation about this before. Research councils have strategies and they are based on exactly this sort of question: what should be the proportion of funding that is on grand challenge problems that come from the scientific community providing advice to the council—my council in the case of NERC—on what should be in the strategy? What at the moment should be the grand challenge problems that we should focus our directed funding on and how much in total should we support that relative to responsive mode?

Q291 Lord May of Oxford: I am with you all the way up to this. We just disagree on the number.

Professor Thorpe: The number is simply a judgement call. I cannot speak for the other councils but I know in my own council it is a really hot topic as to how much to vote to the two major streams. I do not say we have special insight into getting that right. All I can say is that it is analysed and thought about, particularly from the point of view of making sure that the disciplines that we need are healthy, because although of course our mantra is multidisciplinary it has to have the core discipline supported. I do not think there is an algorithm that would tell you what that proportion is. I think it is a judgement call. If you look back over the last few years, except for some special cases, there have not been very strong trends in changes of the proportion that we spend on responsive mode and directed. Boris has mentioned a particular example for MRC and across the other research councils there has not been a strong trend. What we focus on in terms of directed mode is driven by our strategy on which are the top priority strategic challenges. I do not think there has been a major shift in the proportion, but in the end it is a judgement call. We rely on our scientific advice from the community which we cull substantially and often in developing and refreshing our strategies. That is what I think one of the major jobs of the research councils is.

Lord May of Oxford: I did say over the last 15 years there have been some instances where it really has gone down markedly, which does not necessarily mean it is wrong, even though I think it is. I could be wrong.

Q292 Lord Warner: The MRC had an external event which came in and changed the way they did business. Have there been external events in your case, if we move to the next research council, an equivalent of the Cooksey Inquiry?

Professor Thorpe: I think the Cooksey Review, certainly in the case of NERC, was much more substantial than any external events for NERC. Obviously there have been changes to research councils that have had similar impacts like, for example, bringing together two councils into one with the Science and Technology Facilities Council.

Professor Delpy: Or the splitting of SERC.

Professor Thorpe: In the last five to ten years probably the MRC and the Cooksey agenda have been in OSCHR really. The setting up of OSCHR has been one of the biggest drivers from the external world.

Dr Hill: This point about the balance between directed and responsive mode funding is the hot question in research policy and there is no one that has a straightforward answer to it. To echo Alan’s point, ultimately it comes down to a judgement call. Really, all you can do is look retrospectively and ask the question: are we hitting the output measures that we want on the basis of the balance of funding that we
have? The UK looks pretty good when you do that. If you look at the citation impact level or at wider impact measures around economic and social benefit, the UK comes out very highly in that, which tends to suggest that at least in the past we have been getting that balance right. Obviously those are very lagging indicators, but there are no more responsive or more short-term indicators for success. I think the judgement call made by councils, supported by the academic community, seems to be a successful way of achieving this balance.

Sir Leszek Borysiewicz: The MRC position is slightly different because of the strong intramural programme that we have. Firstly, you have to understand that we do make decisions that we need to put long-term investment in certain biological sciences to get a result. Obviously I can say the LMB is a great example of how good that result can be, but this goes through unit after unit. We strongly believe in the intramural programme because it allows us to give confidence to scientists to pursue a very difficult question such as Denty’s last work for example on the structure of the ribosome. This is not something you would have undertaken unless you knew you had long term security and you were really going to be able to go for this 24/7. That is really what the unit model structure allows scientists to do. They are often physically associated with universities but they are not part of that university; nor does the university refer to them in the RAE or REF exercises. They are independent scientists taking advantage of that university structure. That is a very strategic decision. The council will decide on those main directions, supported by the strategy board that we have. The Cooksey Review was a very interesting phenomenon. Everybody recalls Cooksey and talks about translational research. They forget the shortest sentence in the Cooksey Report. I think it is paragraph 28. I stand to be corrected, but it actually says that Britain is excellent at basic, biomedical science and its excellence is driven through that basic, biomedical science. When resource was allocated—and I do recall this because this was at the time when I was taking up my position as chief executive—I was absolutely adamant there had to be no cut back on the money that was available for basic, biomedical research. What came in for the translational budget was the extra money that was widely heralded that was coming to the MRC in the last allocation. That money was earmarked towards the translational agenda and therefore nobody was suffering a penalty. That is why I was trying to point out that, whilst the calls have gone down, the amount of money going through response mode has not changed. That is because we were able to sustain that budget based on the fact that there was no reduction. We were never robbing Peter to pay Paul by having a change of direction. We were doing this as an additional activity which was important as a primary rationale for improving the position of the UK in translation. That was dependent on getting the right coordination through OSCHR and the joint working with the devolved administrations and with NIHR. The system is not that different for the MRC, other than this very large intramural programme that we continue to run. We believe that we are doing that successfully and that is achieving the results that would be expected to keep Britain in the forefront of biomedical sciences internationally.

Professor Thorpe: Of course other research councils have research institutes that perform very similar functions.

Q293 Lord Methuen: Concerns have been raised about a reduction in the number of successful applications for research funding. To what do you attribute this reduction? For example, an increase in both quantity and quality, a reduction in quality, a shift in funding from responsive mode towards targeted programmes or other factors?

Professor Delpy: On the basis of the answer we gave to the previous question, there has not been a large shift between responsive mode and directed mode. If we put that to one side, all the evidence that we have is that it is largely due to an increase in the number of people who are applying for funding. I am looking at EPSRC data but I suspect it is not that much different across the rest of the research councils. If you look at the number of independent researchers who have submitted in the RAEs in 1996, 2001, 2008, in the engineering physical sciences area, that has remained roughly constant. There has been a slight increase but a very small amount. If you look at the number of independent researchers who have been funded, there has been a small increase over that same period. If you look at the number of independent applicants for research funding, that has more than doubled over that same period. One could interpret that as being that in 1996 the UK research base had a large number of people in the EPS area, not all of whom were applying for funding and were research active by definition of applying for funding; whereas now virtually everybody who has been returned in the RAE is applying to us for funding. The volume of demand has increased dramatically. There is absolutely no evidence of a fall in quality of applications, but the amount of funding available with that growth in applications means that of course the success rate has dropped.

Sir Leszek Borysiewicz: Just to echo that with some numbers, in 2006–07 the MRC received 1,184 applications. Last year we received 1,924. The scale of the application has gone up. What I believe, certainly in discussion with the charities that we are
seeing in the biomedical sector, is the vice-chancellor effect, which is that in essence because full economic costing comes from the research council this is economically the best grant to get so your best investigators are driven first to the MRC. Then you go to the charities. Then you go to Europe, because the return to the institution is driven. There is institutional behaviour change but we are certainly seeing a big increase. There is no reduction in quality interestingly, which is good news because it does mean we have a lot of investigators. Worryingly, success rates will go down on that level and I believe we are close to the critical figures of around 20 per cent. When we start getting below that, I think all of my colleagues would share the same anxieties that we then will be losing a very substantial amount of high quality, international work. Because of the vagaries of peer review, you do not have that fine discriminator that you can begin to apply and the pressure to apply top down priorities will become greater and greater.

Q294 Lord May of Oxford: I want to comment on one of the causes of this. It is not necessarily a good or a bad thing; it is just a thing. In relation to population size, for every 100 PhDs—at least this was true five years ago—in science, medicine and engineering produced in the USA, we produced 160. We just have more programmes.

Sir Leszek Borysiewicz: We have good talent here.

Q295 Lord Haskel: We just wondered what the effect of the current economic climate has had on you. Has quantitative easing found its way to your resources or are you going to have to find efficiency cuts?

Professor Thorpe: Of course we are in the second year of the Comprehensive Spending Review so we have known what our budget is. Assuming that that holds, which we sincerely hope that it will, for next year, 2010–11, we know our budget. As you know, in the spending review 2007 the research councils received a significant increase in their budgets. From that point of view, we have had some clarity on what our funding is. Of course the economic downturn has provided some serious challenges on our ability to use that money. Perhaps the most well known is that our international subscriptions for activities such as CERN, the European Space Agency etc., have suffered because of exchange rate fluctuations in the wrong direction. That represents serious amounts of money and it represents money that would otherwise be spent on frontline research. It has been a very challenging time for a number of the research councils and we have been working together across all the councils to manage that. It would be wrong to imagine, because we know what our budget is and it was set three years ago, that we have not been affected. I think another factor worth something is that of course we invest heavily in facilities nationally and internationally. Research facilities tend to inflate in their costs of running and production much greater than the RPI. Again, we are always having to manage that provision of those facilities, which tends if we are not careful to eat up more and more of our budget. Those are the sorts of challenges that we have faced up to now. Obviously we are aware that other countries, rather than steady funding, have had a stimulus. Perhaps this is going on to another question but all of us should be aware that we want to have relationships and partnerships with those countries to make sure that the UK research base enables itself to lever and to work with colleagues in those countries. Absolutely there have been some substantial challenges, but perhaps there are even greater challenges that await us shortly.

Q296 Lord Broers: When general things affect all of the research councils, how are those things handled? How do you decide for example, if you are going to have a programme on engineering and medicine, where it is run? Do you all meet as directors with Adrian Smith every now and then? How do you thrash these things out?

Professor Thorpe: We do. Under Research Councils UK we have an executive group that is composed of the chief executives and we meet monthly. Our topics of conversation are exactly those you have articulated about joint activities, sharing best practice, managing the research expenditure across the research councils. Once a quarter, that group meets also with Adrian Smith in what is called the Joint Strategy Group. In fact, we have just come from a meeting of that group to this inquiry. The discussion in that group, as you would imagine, is looking at the science and research budget as a whole and managing that going forward, making the case for sustained investment in research for the spending reviews for example.

Q297 Lord Broers: Do you ever receive pointed advice from the Minister as to how you should all behave?

Professor Thorpe: We receive advice but we do not always accept it of course. We are fully aware of and welcome the Haldane principle. I think my colleagues can answer for themselves but, from my point of view, the Haldane principle is both critically important but also is observed very strongly, whereby research councils can be very robust about the scientific priorities being determined by scientists rather than ministerial control. I think we all have many examples of where we have been able to assert that principle and abide by it very strongly. I think we all
believe very strongly in it. Its application is a very key part of our system.

Professor Delpy: First of all, because of the regular meetings that we have with Adrian, our research directors have a regular monthly meeting where they, at a slightly more detailed level, look at the relative strategic priorities of programmes. Through that, the advice that gets to ministers tends to come as a series of suggestions, to be honest, from the research councils. I have very rarely been in a position where the Minister has asked me a question where I cannot recognise that it was in fact provoked by us feeding information up through the department anyhow. If we did receive such prodding, then like Alan I would be very quick to stand back and quote Haldane. One of the advantages of having committees like yourselves on the parliamentary side is that we and the ministers know that we have to sit in front of you and answer precisely this sort of question.

Chairman: That is why you are always welcome here. May I thank you all very much indeed? It has been a very helpful session. You will see the transcript and if there are points, not least the statistical points that you raise, where you would like to give us further written evidence that would be much appreciated. Thank you very much.

Supplementary memorandum by the Higher Education Funding Council for England

The following responses were received from David Sweeney following a request for supplementary evidence.

Question 1. Following on from David Sweeney’s response to Q220, please can you clarify how the Research Excellence Framework will reduce the burden in terms of time and money on universities, and of administrative processes within HEFCE?

Response: We are seeking to reduce burden in a number of areas. The number of main panels will be reduced from 15 to around four and sub panels from 67 to around 30–40. We will also increase the consistency of the criteria between panels and use generic templates and a common menu of indicators for the impact and environment elements. Together, these changes will reduce the complexity for HEIs of responding to differing criteria, and ease decision-making about which panels to submit to.

The categories of eligible staff will be simplified to ease the selection process and the adjudication of special staff circumstances will be guided by a central equalities panel with clear criteria and guidance, reducing the administrative burden.

We will align the specification for research student and income data with those used by HESA, to avoid duplication of effort within HEIs. We are also working with HESA, Research Councils and other major funders to coordinate our research data requirements; our working principle is that HEIs should be able to collect research data once internally and report this as necessary for various (internal and external) purposes.

Question 2. There have been calls from the research community to reduce the weighting given to impact within the REF, and criticisms that the methodologies for assessing impact are not yet tried and tested and that they will therefore be somewhat subjective. How do you plan to measure impact and over what timescale? Are there plans to amend the current proposals for the REF in light of such comments?

Response: We propose that institutions will submit evidence of impact for assessment by the REF panels. The evidence will take the form of an impact statement (with an overview of the impacts achieved by the unit as a whole), and a number of case studies (illustrating specific examples of impact). Indicators of impact will provide supporting evidence within the impact statements and case studies. The impacts must have been underpinned by high-quality research. The impact must have become evident during the REF assessment period, but the research may have been undertaken earlier—we suggest up to 10–15 years earlier. We are currently running a pilot exercise to test and inform the further development of our approach. The weighting and criteria for assessing impact in the REF will be determined after the conclusion of the impact pilot exercise.

February 2010

Supplementary memorandum by the Research Councils UK (RCUK)

Please find below information requested from Research Councils UK (RCUK) to assist with the current inquiry into the setting of science and technology research funding priorities. This response is organised into sections following each question, to ensure clarity.
1. Please can you provide the Committee with a breakdown of research councils’ expenditure on research for the past five years, showing
   (i) total expenditure
   (ii) the amount, both in figures and as a percentage of the total, allocated to each type of research, with the terminology used, for example responsive mode versus targeted programmes (Q285 and 289).

The information requested above is provided at Annex A. Individual Research Councils’ focus on different areas of research means that each Council collects and records data using the method most effective for their organisation, so there is some variance in the way in which the information is presented. The notes accompanying each table clarify any differences in recording. The terminology each Council uses for its funding which could be described as either “responsive” or “targeted” can be determined by looking at the column headings in the tables.

2. Please can you provide the Committee with
   (i) a copy of your most recent annual Delivery Plan report to the Department for Business, Innovation and Skills;

   The delivery plans of RCUK and individual Research Councils can be accessed at http://www.rcuk.ac.uk/aboutrcuk/deliveryplan
   (ii) your guidelines on impact for researchers;

   The current RCUK guidance for completing the impact summary and impact plans can be found at Annex B. RCUK is also in the process of improving guidance for researchers by developing dedicated web-based support and a comprehensive list of frequently asked questions. The Medical Research Council does not currently use the Je-S (Joint electronic submission) system and therefore provides its own guidelines, which can be found in their Applicant handbook at http://www.mrc.ac.uk/Utilities/Documentrecord/index.htm?d = MRC001873. Key advice is provided in section 3.3 (Research Plans) and information concerning scoring criteria is provided from page 33 onwards.
   (iii) your impact reports to Government

Research Councils submit annually two reports on economic impact to the Department for Business, Innovation and Skills.

The Economic Impact Reporting Frameworks (EIRFs) form a part of the Department for Business, Innovation and Skills (BIS) Performance Management System introduced across all Research Councils in April 2005. The EIRFs replace the previous “Output Frameworks”:

   — http://www.ahrc.ac.uk/About/Policy/Documents/eirf2009.pdf
   — http://www.bbsrc.ac.uk/web/FILES/Publications/pmf_economic_impact_framework_0809.pdf
   — http://www.epsrc.ac.uk/CMSWeb/Downloads/Publications/Corporate/EIRF0809.pdf
   — http://www.esrcsocietytoday.ac.uk/ESRCInfoCentre/Images/ESRC%20EIRF%20Report%202008-09_tcm6-35056.pdf
   — http://www.nerc.ac.uk/about/perform/documents/eirf0809.pdf
   — http://www.stfc.ac.uk/resources/pdf/EIRF09.pdf

Economic Impact Baselines are also submitted, which provide a narrative account of the impact of the Research Councils.

   — http://www.ahrc.ac.uk/About/Policy/Documents/baseline07-08.pdf
   — http://www.epsrc.ac.uk/CMSWeb/Downloads/Publications/Corporate/EconomicImpactBaselineMarch09.pdf
   — http://www.mrc.ac.uk/Utilities/Documentrecord/index.htm?d = MRC006376
   — http://www.nerc.ac.uk/about/perform/documents/eibaseline20072008.pdf
   — http://www.stfc.ac.uk/resources/pdf/delplan_07.pdf
(iv) each research council’s (or RCUK’s) response to the Research Council Economic Impact Group’s 2006 report on increasing the economic impact of research?

In January 2007 RCUK published Increasing the Economic Impact of the Research Councils (http://www.rcuk.ac.uk/cmsweb/downloads/rcuk/publications/ktactionplan.pdf). This set out an action plan to demonstrate and increase the economic impact of the UK Research Councils as recommended in the report of a group chaired by Peter Warry in 2006. It was followed in October 2007 by a report setting out progress on implementing the recommendations of the Warry Report, Excellence with Impact (http://www.rcuk.ac.uk/cmsweb/downloads/rcuk/economicimpact/excellenceimpact.pdf).

3. What effect has the current economic climate had on each research council’s plans for the future within the current comprehensive spending review period and beyond? In particular, what effect have the efficiency cuts outlined in the 2009 budget, and your commitment to focus on five key areas to support research that generates economic growth, had on your current and future programmes of research and on the balance of response-mode and targeted research?

Research Councils work, as is usual, on the basis that they will receive their set allocations for the current spending review period. For projections beyond the current spending review, it is standard practice that Councils decide commitments and investments on the basis of flat cash. The current economic climate has had an effect on certain commitments; fluctuations in exchange rates have affected Councils with international interests and subscriptions, in particular STFC and NERC, who are managing the additional costs incurred with help from the Department for Business, Innovation and Skills.

The £106 million savings announced in 2009’s Budget are part of an ongoing programme of efficiency savings which the Research Councils have been undertaking for several years. These savings are additional to the £243 million already planned over the Spending Review period. No more than 50 per cent of the savings will be met through reprioritisation. Other savings will be met through a number of mechanisms, including, for example, procurement activities undertaken by the RCUK Shared Services Centre; working with the HEI sector to ensure that only the highest quality bids for funding are submitted and thus reducing the burden on peer review; and leveraging funding from partnerships and collaborations.

RCUK understands that decisions concerning the £600 million efficiency savings announced in the pre-budget report will be made following the publication of Lord Browne’s Independent Review of Higher Education Funding and Student Finance in the autumn.

RCUK has six cross-Council priority themes, designed to tackle the grand challenges facing us on a global scale: Energy; Living with Environmental Change; Global Uncertainties; Lifelong Health and Wellbeing; Digital Economy; and Nanoscience through Engineering to Application. Three other areas are currently in development: Food Security; Connected Communities; and Resilient Economy. Five government department priorities are shared with RCUK: Living with Environmental Change; Global Security; A More Resilient Economy; Health & Wellbeing; and Food Security.

The balance of responsive versus directed modes of research remains stable and we have no plans to change the balance. We consider that although funding streams are split into responsive and directed, these are overlapping elements of a spectrum. All RCUK funded research will continue to be selected on the basis of research excellence and assessed through detailed peer review.

4. Please can you provide the Committee with a breakdown of the amount spent, both in figures and as a percentage of the total, by each research council on administration over the past five years?

The information requested above is provided at Annex C.

17 February 2010
## ANNEX A

### BREAKDOWN OF RESEARCH COUNCILS’ EXPENDITURE ON RESEARCH FOR THE PAST FIVE YEARS

#### ARTS AND HUMANITIES RESEARCH COUNCIL (AHRC)

<table>
<thead>
<tr>
<th>AHRC</th>
<th>Responsive (Mode)</th>
<th>Strategic (Initiatives)</th>
<th>Postgraduate Awards</th>
<th>Museums and Galleries Awards</th>
<th>Total expenditure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>£ (k)</td>
<td>%</td>
<td>£ (k)</td>
<td>%</td>
<td>£ (k)</td>
</tr>
<tr>
<td>2004–05</td>
<td>30,436</td>
<td>42.3</td>
<td>1,863</td>
<td>2.6</td>
<td>9,167</td>
</tr>
<tr>
<td>2005–06 (i)</td>
<td>32,717</td>
<td>41.6</td>
<td>2,804</td>
<td>3.6</td>
<td>33,511</td>
</tr>
<tr>
<td>2006–07</td>
<td>40,346</td>
<td>43.8</td>
<td>5,019</td>
<td>5.4</td>
<td>37,060</td>
</tr>
<tr>
<td>2007–08</td>
<td>46,496</td>
<td>41.9</td>
<td>13,406</td>
<td>12.1</td>
<td>40,726</td>
</tr>
<tr>
<td>2008–09</td>
<td>49,626</td>
<td>43.2</td>
<td>13,887</td>
<td>12.1</td>
<td>41,317</td>
</tr>
</tbody>
</table>

**Notes:**
(i) Formerly the Arts and Humanities Research Board, AHRC became a Research Council in 2005–06.

#### BIOTECHNOLOGY AND BIOLOGICAL SCIENCES RESEARCH COUNCIL (BBSRC)

<table>
<thead>
<tr>
<th>BBSRC</th>
<th>Responsive Mode</th>
<th>Managed Mode/Initiatives</th>
<th>Other Spend (i)</th>
<th>Total expenditure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>£ (k)</td>
<td>%</td>
<td>£ (k)</td>
<td>%</td>
</tr>
<tr>
<td>2004–05</td>
<td>109,700</td>
<td>75.86</td>
<td>34,900</td>
<td>24.14</td>
</tr>
<tr>
<td>2005–06</td>
<td>115,400</td>
<td>71.86</td>
<td>45,200</td>
<td>28.14</td>
</tr>
<tr>
<td>2006–07</td>
<td>126,300</td>
<td>70.76</td>
<td>52,200</td>
<td>29.24</td>
</tr>
<tr>
<td>2007–08</td>
<td>143,100</td>
<td>70.18</td>
<td>60,800</td>
<td>29.82</td>
</tr>
<tr>
<td>2008–09</td>
<td>163,700</td>
<td>70.35</td>
<td>69,000</td>
<td>29.65</td>
</tr>
</tbody>
</table>

**Notes:**
(i) The spend on research does NOT include fellowships, studentships, Institute Core Strategic Grants and Institute Programme Grants, equipment and facilities, capital and buildings and the funding for this is included in the end column Other Spend.
Engineering and Physical Sciences Research Council (EPSRC)

<table>
<thead>
<tr>
<th>EPSRC</th>
<th>Responsive</th>
<th>Strategic/directed</th>
<th>Total grant expenditure (i)</th>
<th>Other expenditure (i)</th>
<th>Total Expenditure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>£ (k)</td>
<td>%</td>
<td>£ (k)</td>
<td>%</td>
<td>£ (k)</td>
</tr>
<tr>
<td>2004–05</td>
<td>165,425</td>
<td>53</td>
<td>143,389</td>
<td>46</td>
<td>314,933</td>
</tr>
<tr>
<td>2005–06</td>
<td>172,467</td>
<td>47</td>
<td>148,757</td>
<td>41</td>
<td>366,137</td>
</tr>
<tr>
<td>2008–09</td>
<td>256,218</td>
<td>51</td>
<td>216,406</td>
<td>43</td>
<td>507,343</td>
</tr>
</tbody>
</table>

Notes:
(i) A proportion of EPSRC’s grants is neither responsive nor directed mode, eg fusion research. Other expenditure includes studentships, fellowships, facilities, administration, depreciation, cost of capital.

Economic and Social Research Council (ESRC)

<table>
<thead>
<tr>
<th>ESRC</th>
<th>Responsive</th>
<th>Directed</th>
<th>Total expenditure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>£ (k)</td>
<td>%</td>
<td>£ (k)</td>
</tr>
<tr>
<td>2004–05</td>
<td>21,595</td>
<td>28%</td>
<td>55,399</td>
</tr>
<tr>
<td>2005–06</td>
<td>25,612</td>
<td>30%</td>
<td>60,331</td>
</tr>
<tr>
<td>2006–07</td>
<td>31,307</td>
<td>31%</td>
<td>68,517</td>
</tr>
<tr>
<td>2007–08</td>
<td>40,949</td>
<td>39%</td>
<td>64,883</td>
</tr>
<tr>
<td>2008–09</td>
<td>44,871</td>
<td>38%</td>
<td>73,723</td>
</tr>
</tbody>
</table>

Notes:
(i) ESRC responsive spend calculations include research grants and fellowships.
(ii) ESRC directed spend calculations include the following items of expenditure in addition to research programmes, centres, resources, ventures and other directed initiatives: International Office spend; International Subscriptions; Research Equipment and facilities.
(iii) In addition to the above responsive and directed mode funding, ESRC also funds postgraduate training and knowledge transfer awards, for which expenditure is not provided here.
MEDICAL RESEARCH COUNCIL (MRC)

MRC funding in response and directed mode

All research programmes supported by the MRC might be considered to be response-mode as they are “investigator-led”, the MRC does not commission or tender research. Although for planning purposes the MRC decides on budgets for calls, we only fund the highest quality research and if the quality of applications in response to calls is insufficiently high, the money will be spent instead on other high-quality research, largely “response-mode”. The MRC supports grants, fellowships and studentships which are funded in response-mode and also provides funding for research programmes within the MRC’s own research units and institutes. All MRC research programmes are subject to rigorous peer review.

Extramural/Intramural Spend

<table>
<thead>
<tr>
<th>MRC</th>
<th>Response mode (extramural)</th>
<th>Directed mode (intramural)</th>
<th>Research programme spend</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>£ (k)</td>
<td>%</td>
<td>£ (k)</td>
</tr>
<tr>
<td>2004–05</td>
<td>186,480</td>
<td>44.4</td>
<td>233,167</td>
</tr>
<tr>
<td>2005–06</td>
<td>226,321</td>
<td>46.5</td>
<td>259,955</td>
</tr>
<tr>
<td>2006–07</td>
<td>256,322</td>
<td>53.1</td>
<td>226,563</td>
</tr>
<tr>
<td>2007–08</td>
<td>255,499</td>
<td>51.6</td>
<td>240,121</td>
</tr>
<tr>
<td>2008–09</td>
<td>316,734</td>
<td>55.6</td>
<td>263,146</td>
</tr>
</tbody>
</table>

Notes:
(i) Response mode comprises grants, fellowships and studentships held by universities and other research organisations.
(ii) Directed mode comprises MRC research unit programmes and studentships.
(iii) International subscriptions are not included.
The information requested across MRC programmes is not currently held in such a way that would allow us to report on spend over the five year period requested. The figures below are thus commitment figures and should not be combined with those in the table above, or with other Councils’ spend figures.

Targeted calls provide a strategic framework and guidance on priorities, but the actual research proposals arise from the researchers themselves. In the table below, the MRC has interpreted “directed mode” to relate to specific calls for proposals. In some cases these have been awarded by the research boards in response to highlight notices (i.e. against no planned budget).

It is important to explain the difference between 2007–08 and 2008–09. The amount of funding awarded in response to calls increased significantly as a result of the MRC’s plans for increasing translational research, in line with the OSCHR agenda, in particular between 2007–08 and 2008–09. Between these years, the MRC commitment budget increased substantially, including funding for basic research; some of which falls under “calls”. The 2008–09 figure for calls (£85.1 million) will drop significantly in 2009–10 and beyond as, in many of the areas included, the MRC will move from managed-mode to response-mode.

<table>
<thead>
<tr>
<th>MRC Response mode</th>
<th>Calls</th>
<th>Total award value</th>
</tr>
</thead>
<tbody>
<tr>
<td>£ (k)</td>
<td>%</td>
<td>£ (k)</td>
</tr>
<tr>
<td>2004–05</td>
<td>104,000</td>
<td>79</td>
</tr>
<tr>
<td>2005–06</td>
<td>151,100</td>
<td>90</td>
</tr>
<tr>
<td>2006–07</td>
<td>151,800</td>
<td>88</td>
</tr>
<tr>
<td>2007–08</td>
<td>164,100</td>
<td>86</td>
</tr>
<tr>
<td>2008–09</td>
<td>140,500</td>
<td>62</td>
</tr>
</tbody>
</table>

Notes:
(i) Figures for calls do not include research grants awarded to MRC units and institutes.

NATURAL ENVIRONMENT RESEARCH COUNCIL (NERC)

<table>
<thead>
<tr>
<th>NERC</th>
<th>Responsive Mode</th>
<th>Research Programmes (i)</th>
<th>Capital Expenditure (ii)</th>
<th>Total expenditure (iii)</th>
</tr>
</thead>
<tbody>
<tr>
<td>£ (k)</td>
<td>%</td>
<td>£ (k)</td>
<td>%</td>
<td>£ (k)</td>
</tr>
<tr>
<td>2004–05</td>
<td>47,185</td>
<td>15.4</td>
<td>198,122</td>
<td>64.8</td>
</tr>
<tr>
<td>2005–06</td>
<td>58,333</td>
<td>17.8</td>
<td>201,903</td>
<td>61.6</td>
</tr>
<tr>
<td>2006–07</td>
<td>59,333</td>
<td>17.5</td>
<td>212,661</td>
<td>62.9</td>
</tr>
<tr>
<td>2007–08</td>
<td>74,619</td>
<td>20.5</td>
<td>223,967</td>
<td>61.4</td>
</tr>
<tr>
<td>2008–09</td>
<td>86,414</td>
<td>22.3</td>
<td>237,204</td>
<td>61.1</td>
</tr>
</tbody>
</table>

Notes:
(i) Includes near cash science infrastructure and national capability expenditure.
(ii) Includes both capital grants and direct capital expenditure.
(iii) Total expenditure equals NERC science budget outturn for near cash, capital grants and direct capital. Non cash expenditure has not been included in the total.
### Science and Technology Facilities Council (STFC)

<table>
<thead>
<tr>
<th>STFC</th>
<th>Responsive</th>
<th>Research Programmes</th>
<th>Total expenditure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>£</td>
<td>%</td>
<td>£</td>
</tr>
<tr>
<td>2007–08</td>
<td></td>
<td></td>
<td>£310.524 million spent on research grants, fellowships and international subscriptions. This represented 46 per cent of STFC’s allocation for the year.</td>
</tr>
<tr>
<td>2008–09</td>
<td></td>
<td></td>
<td>£354.997 million spent on research grants, fellowships and international subscriptions. This represented 51 per cent of STFC’s allocation for the year.</td>
</tr>
</tbody>
</table>

Notes:

(i) STFC was formed on 1 April 2007 from the merger of the former Particle Physics and Astronomy Research Council (PPARC) and the Council for the Central Laboratory of the Research Councils (CCLRC). As some functions were transferred to other Research Councils on the creation of STFC, spend on research by CCLRC and PPARC in 2004/05—2006/07 are not comparable and have been omitted.

(ii) The research figures do not include expenditure on major facilities such as ISIS, DLS etc.
EXISTING PATHWAYS TO IMPACT HELPTEXT

https://je-s.rcuk.ac.uk/jesHandbook/jesHelp.aspx?m=s&s=1203

INFORMATION ABOUT THE POTENTIAL IMPACT OF YOUR RESEARCH

The excellent research funded by the UK Research Councils has a huge impact on the wellbeing and economy of the UK. Working together with our wider communities and other partners, we want to ensure that these impacts are effectively demonstrated and supported, throughout the research lifecycle, in order to add value, stimulate interest from wider stakeholders, including the general public, and, where needed, actively highlight the need for continued investment in the research base.

The following principles define, in broad terms, the approach and expectations of the Research Councils:

— Excellent research with high impact is central to Research Council activities.
— The onus rests with research applicants to demonstrate how they would achieve excellence and impact.
— Research Council guidance and assessment procedures aim to:
  — maximise both excellence and impact, and
  — ensure user perspectives are strongly represented.

The Research Councils define impact as the demonstrable contribution that excellent research makes to society and the economy. This definition accords with the Royal Charters of the Councils and with HM Treasury guidance on the appraisal of economic impact. Impact embraces all the extremely diverse ways in which research-related knowledge and skills benefit individuals, organisations and nations by:

— fostering global economic performance, and specifically the economic competitiveness of the United Kingdom;
— increasing the effectiveness of public services and policy, and
— enhancing quality of life, health and creative output.

Impacts from research can

— take many forms,
— become manifest at different stages in the research lifecycle and beyond, and
— be promoted in many different ways.

Research Council assessment processes reflect this diversity and variety.

In presenting your plans to enhance the impacts of research, it is helpful to consider first what is reasonable and/or expected for research of this nature.

The research proposal is your opportunity to present ideas for research to your peers and the Research Council(s). Proposals normally consist of a proposal form, case for support and associated attachments (for example an Impact Plan if required).

The Proposal Form should include an Impact Summary that addresses the following questions:

— Who will benefit from this research?
— How will they benefit from this research?
— What will be done to ensure that they have the opportunity to benefit from this research?

Peer reviewers for research grant proposals will be asked to consider:

— Whether the plans to increase impact are appropriate and justified, given the nature of the proposed research.

Note: The Impact Summary may be published to demonstrate potential impact of Research Council funded research. Please ensure confidential information is not included in this section.

The Case for Support (and/or attached Impact Plan where required) should expand on the information contained in the Impact Summary and describe what will be done to increase the scale or likelihood of impact. In making your case, you should consider and describe any potential impacts of the research on society and the economy.
Please refer to the individual Research Council frequently asked questions (FAQs) for further information on what is required:

**AHRC**: www.ahrc.ac.uk/FundedResearch/Pages/ImpactAssessment.aspx

**BBSRC**: www.bbsrc.ac.uk/funding/apply/economic_impact_faq.pdf

**EPSRC**: <Currently under development>

**ESRC**: www.esrcsocietytoday.ac.uk/esrcexpectations

**NERC**: www.nerc.ac.uk/funding/application/information.asp

**STFC**: www.scitech.ac.uk/EIFAQ

**Impact Summary**:

https://je-s.rcuk.ac.uk/jesHandbook/jesHelp.aspx?m=s&s=1200

The Impact Summary (4,000 characters max) should address the following three questions:

— Who will benefit from this research?
— How will they benefit from this research?
— What will be done to ensure that they have the opportunity to benefit from this research?

**Who will benefit from this research?**

List any beneficiaries from the research, for example those who are likely to be interested in or to benefit from the proposed research—both directly or indirectly. It may be useful to think of beneficiaries as “users” of the research outputs, both immediately, and in the longer term.

Beneficiaries must consist of a wider group than that of the investigators’ immediate professional circle carrying out similar research. For example:

— Are there any beneficiaries within the commercial private sector who will benefit from the research?
— Is there anyone, including policy-makers, within international, national, local or devolved government and government agencies who would benefit from this research?
— Are there any beneficiaries within the public sector, third sector or any others who might use the results to their advantage? Examples include museums, galleries and charities.
— Are there any beneficiaries within the wider public?

**How will they benefit from this research?**

Describe the relevance of the research to these beneficiaries, identifying the potential for impacts arising from the proposed work. Please consider the following when framing your response:

— Explain how the research has the potential to impact on the nation’s health, wealth or culture. For example fostering global economic performance, and specifically the economic competitiveness of the United Kingdom?
— Increasing the effectiveness of public services and policy?
— Enhancing quality of life, health and creative output?
— What will these impacts be, and what is their importance?
— What are the realistic timescales for the benefits to be realised?
— What research and professional skills will staff working on the project develop which they could apply in all employment sectors?

**What will be done to ensure that they benefit from this research?**

Please detail how the proposed research project will be managed to engage users and beneficiaries and increase the likelihood of impacts. This might include:

— Communication and engagement plans;
— collaboration arrangements;
— plans for exploitation, where appropriate; and
— relevant experience and track record.
Note: The Impact Summary may be published to demonstrate potential impact of Research Council funded research. Please ensure confidential information is not included in this Summary.
BREAKDOWN OF THE AMOUNT SPENT, BOTH IN FIGURES AND AS A PERCENTAGE OF THE TOTAL [INDIVIDUAL RESEARCH COUNCIL BUDGET], BY EACH RESEARCH COUNCIL ON ADMINISTRATION OVER THE PAST FIVE YEARS

It should be noted that individual Research Councils employ different criteria to calculate administration, as commitments across RCUK vary depending on the research areas supported by each Council. The figures below cannot therefore be considered as comparable with each other.

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1. The AHRC figures for administration are calculated as the total expenditure on staff and operating costs and are shown as a % of total expenditure.
2. Calculation of ESRC administration spend in the above table includes all staff and operating costs as recorded in the ESRC annual report and accounts, (including award related administration costs not attributable to individual awards), except for the following items of expenditure: Research Evaluation and Information Contracts; Publicity and Distribution; Shared Service Centre Implementation Costs; Depreciation and Amortisation. ESRC expenditure on administration is shown as a percentage of the total ESRC budget, which is defined as grant-in-aid income and external income received.
3. These figures use the standard RCUK definitions, which from 2006–07 included MRC Institutes and units.
4. NERC administration costs are calculated net of external income (pro rata) and as percentage of NERC science budget outturn for near cash, capital grants and direct capital. Non cash expenditure has not been included in the total.
5. STFC was formed on 1 April 2007 from the merger of the former Particle Physics and Astronomy Research Council (PPARC) and the Council for the Central Laboratory of the Research Councils (CCLRC). As some functions were transferred to other Research Councils on the creation of STFC, administrative costs incurred by CCLRC and PPARC in 2005/05—2006/07 are not comparable and have been omitted.
WEDNESDAY 9 DECEMBER 2009

Examination of Witnesses

Witnesses: Professor Sandy Thomas, Head of Foresight, and Professor Chris Gaskell, Chair, Science Advisory Council, Defra, examined.

Q298 Chairman: Welcome. Thank you very much for coming and giving us time. The evidence you have sent in has been very helpful but there are other issues we thought we could pursue. I think you have had notice of what some of these are. There is a full record taken of this session and it will be published as part of the evidence when we publish our report. I am told we are live on web at the moment, so you might wish to bear that in mind as well. For the record, would you simply identify yourselves, to associate a voice with the name, please.

Professor Thomas: Professor Sandy Thomas, Head of Foresight.

Professor Gaskell: Professor Chris Gaskell, Chair of Defra’s Science Advisory Council.

Q299 Chairman: Thank you very much. I want to start with a question for Professor Thomas which picks up two themes. It gives you the opportunity to tell us a little bit about your organisation and then perhaps you could pick up the point we would get to anyway. What role do you think your organisation could play in relation to any eventual realigning of priorities and, dare I say, of cuts that might come through? What would be the contribution that you distinctively might be able to make? Do you think you will be consulted?

Professor Thomas: Perhaps I could begin by explaining very briefly what Foresight is today because its role has changed over the last ten years. If I set that out briefly, it will set the context clearly to answer your other questions. Some of you might recall that Foresight was created in 1994. It was essentially put together coming out of the Realising Our Potential White Paper to help Britain better realise future wealth-creating opportunities in science and technology. That went on for some years, until in 2001 Professor Sir David King, the new Government Chief Scientist, scrapped that particular arrangement, which consisted of standing panels, and created the current model that we now have. The reason he did that was that it was felt that, although there had been some success with the previous Foresight model, it had not sufficiently caught the attention of policymakers and its recommendations were sometimes not having a substantial impact. The new model which is now running has a rolling programme of projects. Some of those have been more concerned with research priorities than others, especially two of the earlier projects. Today we tend to tackle major challenges in which science and technology is one of the major drivers and we look out often at least ten years and often much longer, sometimes out to 2050. We tackle major issues where, as I say, science and technology are major drivers. We have looked at flooding, obesity, mental capital and so on. We have done ten of these big projects. Certainly, we have a translational role. We will bring what we consider to be the best scientific and other evidence from the public sector and the private sector to bear on these complex issues, to create a substantial evidence base. We will bring that together for futures analysis, to make, in essence, strategic recommendations for departments and other stakeholders. Amongst that there will be some pointers to research priorities, but we do recognise that research councils and government departments create their own research priorities and we are one of the inputs to that process. But to try to make sure we are effective in doing that we have built close relations with the research councils and also with the Technology Strategy Board and so on, so that we feed in this information and analysis. Certainly with the research priorities we have some good examples where we have made direct contributions. In terms of realigning, we try to help the Government think more systematically about the future. In doing that, we are thinking about challenges which do have a long-term dimension to them but where there is often a need for short-term action. Whether we are thinking about the long-term impact of flooding or obesity or the future of food and farming, these will translate into priorities for both policy and research that will have an immediate relevance to today. This is what we find, and we work very hard to try to make that happen. In terms of realigning priorities, our contribution is important in thinking very much beyond a narrow focus. We think very much about global challenges,
and many of the challenges that the UK faces today of course are going to be of a global nature. We set the science and technology evidence in a wider context, which we think is very important. We think very hard about the international environment and, also, we look to evidence from the social sciences. We are able to help articulate where our focus should be. In an environment where we are under pressure for resources and where we may have less funds with which to do research, we will be able to articulate how we can strategically position ourselves and to some specifics coming out of our work.

**Q300 Chairman:** Do you think you would be asked for a view on this? If so, or even if not, are you preparing a view on some of these matters of priorities? Today, of all days, everyone is talking of cuts—it will be all over the papers tonight. Are you in proactive mode or are you just waiting to hear?

**Professor Thomas:** The way in which we contribute to that specifically is through our Horizon Scanning Centre. Foresight has a Horizon Scanning Centre that was created in 2005. It has a specific role in that regard. It was asked early on by the Treasury to contribute to setting research priorities. The way in which it did this was with one of its tools something that we call the Sigma Scan. This is over 250 short scans, surveys of important challenges, and 100 of those relate to science and technology. We used those scans, which are updated regularly, to create a digest of what were the science and technology priorities for research. We did this for the Treasury. It went into the 2007 Comprehensive Spending Review. We have been asked recently to refresh those priorities. We have put them down into four clusters—and these are headlines essentially: life sciences and pharma; energy and low carbon technologies; materials and nanotech; and digital and networks. We have done that very quick piece of work for the Treasury. It was submitted recently. We are going to do a longer piece of work which we hope will be useful for government.

The Treasury are keen for us to do this so that it can feed into priority setting for next year. It will be a more thorough piece of work, helping to set these priorities and our longer-term goals within the next decade.

**Q301 Chairman:** This was direct to the Treasury rather than through the Chief Scientist, Director-General, research councils or what-have-you?

**Professor Thomas:** This has been directly with the Treasury. There are many different ways in which this sort of work feeds into government. We do share this widely, we publish it, but the Treasury specifically asked for this piece of work for 2007 and then asked us to update it.

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1 With oversight from the Government Chief Scientist

**Q302 Lord Krebs:** Professor Thomas, perhaps I could briefly follow up on that before I come to ask a question of Professor Gaskell. When you talk about setting priorities or identifying priorities, priorities for whom and on what basis? Are these priorities for areas where the science is burgeoning and therefore creative discoveries are likely to take place, or are these priorities in the sense of areas that might have commercial/other economic or welfare wellbeing relevance to the United Kingdom? Second, to follow up on the Chairman’s question: who is supposed to be acting on the priorities?

**Professor Thomas:** I would say it is more the latter. These are areas that are identified of having real scientific promise. Clearly we are interested also in areas that will have potential economic benefit, but we do not make that a criterion particularly, because that is almost another set of work to identify what the obstacles might be to potential benefits or commercialisation. This, in a sense, is a look at very promising areas of science that may be quite upstream from commercialisation but where a great deal is happening, where there is rapid development, and where there is probably an eye on some future benefit but perhaps no investment in terms of potential commercialisation at this point. This is a sort of untidy classification: a lot of these areas do not fit easily into one category or another. In doing this piece of quite quick work for 2007—in something like six weeks in the autumn for the Treasury: it was a fairly short-term request—we are very conscious that we would like to do a more thorough job and think that we need to be clearer about how we can be more precise, both in the ways in which we identify these priorities and in quite how they fit. We are going to be assisted in this by the Technology Strategy Board, because they do a bit of this sort of work, but we are interested, as they are, in what happens next in terms of what are the barriers to realising some of this potential. In terms of your second question, this work was specifically commissioned by the Treasury. They will use it in a variety of ways, but it would be probably be best to ask them how they do that. Obviously there will be a variety of ways in which they will want to use this information and we do of course also share it more widely with others and disseminate it. We are particularly keen when we do this—what we are calling phase 3—to feed into the 2010 requirements that we work with the Council of Science and Technology and other bodies. We are going to be very consultative, so we can get the best methodology for the purpose.

**Q303 Lord Cunningham of Felling:** Do you keep a record? Do you review how often your identified priorities are taken up or not across government? If you do carry out such a review, do you publish it?
Professor Thomas: I would not say that we have done that for this particular piece of work.

Q304 Lord Cunningham of Felling: I am sorry, I did not mean this piece of work for the Treasury; I mean in general.

Professor Thomas: In general, yes we do. In fact, when I came into Foresight in 2007 I created a follow-up team specifically with two aims in mind. One was to increase the impact of our work in government, which requires a lot of proactive activity, but, also, to be able to map our impact and to be able to be very clear what works. We have a strong record of that. We do one and three reviews of all our major projects and we are evaluated every four years in terms of impact.

Q305 Lord Haskel: Is there an international aspect to this? I remember when I was in business that the Japanese used to do this, in the 1970s and 1980s, and we found their “foresight” views of the areas of business in which we were interested to be very, very useful. Although we are looking at the use that the Government makes of this, do you attempt to use this to provide information to other governments, to the European Union, to the United Nations, to other organisations?

Professor Thomas: In general, right across the Foresight programme there is an international dimension, and we will connect closely with selected stakeholders in the international area. For example, on, say, the obesity project, we will work with the CDC so that we can essentially export our methodologies and approaches, and they are now working on some joint modelling work, for example. In the case of science and technology priorities, which I would want to add is a fairly small piece of work to date—we are going to do this slightly bigger piece of work for next year, as I have referred—certainly in the consultation side of things we have to consult beyond the UK simply because many different things are going to happen in the next ten years in terms of developments in the BRICs elsewhere, and we need to be abreast of that. We are very aware of the international context.

Q306 Lord Haskel: If this is of benefit to the private sector, do you keep it confidential to the Unite Kingdom Government or do you feel that it can be distributed to everybody? We are looking for competitive advantage here.

Professor Thomas: We are identifying, in the narrow piece of work I have described, a fairly high-level approach. We will be looking at these clusters of technology, identifying them as priorities, and there will be a number of subsets under those where we will look at specific areas. All of this is available to government. We have not had a decision yet on how widely we will share this particular refresh of the work. The previous work was published by the Government and available to all because, in many ways, I would say a lot of what was there would not contain a lot of surprises to somebody who was familiar with scientific developments in many countries.

Q307 Lord Krebs: Professor Gaskell, perhaps I could ask you the equivalent questions about the Defra Science Advisory Council. I notice in the Annual Report summary that I have here that part of your role is to provide expert independent scientific advice on policy and strategy but, also, on the strategic direction for departmental science. I wonder if you could describe for us how that works and what the impact of your advice is.

Professor Gaskell: I will preface that with an introduction to the council, how long it has been around and what its general remit is. The council has been in existence since 2004. It was the second SAC set up within government after the Ministry of Defence. We have about 14 members. Our remit, as you have said, is to provide independent advice and challenge to the ministry through the CSA. I say that carefully because we do report through the CSA. It was set up, indeed, by Howard Dalton when he was first CSA, when he recognised, the remit of Defra being very broad, that he wanted to have access to independent advice across that broad remit. He also at that stage, I think, wanted to help Defra—and we do see this as part of our remit—in a sense to rehabilitate some of their scientific reputation which had taken a bit of a knock in the earlier 2000s. Our role there is to advise and challenge, and we do that in a number of ways by working with the CSA. The CSA may well come to us and say, “I would value some independent advice in this area” or we may say to the CSA, “We feel from our perspective that you could do with some advice and challenge in this particular area,” and so there are the two components to it. The agenda is set, in a sense, by both the CSA and by the Science Advisory Council. It is also worth making the point that the Science Advisory Council is a committee of experts and not an expert committee. It is not a committee focused on one particular issue asked particular questions by the ministry through the CSA; it is a broad church. In that context, a lot of our specific work we do through subgroups, which may have and will have members and their chair from the council but which will call in other independent external expertise. Everything we do is published on the web and we hold public meetings, so there is that clear focus on independence. Just to pick up one part of your question, a matter that you picked up just now with Professor Thomas, we do follow up our recommendations to see whether they have been accepted or not by the ministry and by the CSA. Of
the some 150 recommendations that we have made over the years, about 75 per cent have been formally and fully been accepted, and we require the CSA to come back to us within six months with his response to our recommendations. Our role is advice and challenge. Our role is not to do the ministry’s work for it. That is, I think, an important point. We have on occasions come close to being, in a sense, part of the ministry and doing things that they have asked us to do—and I could provide you with an example if you need it—but we have always held against that. We are there, though, to advise and to challenge the CSA and the department on their strategy. Indeed, that has been a significant part of our work recently. Bob Watson, as still the relatively new CSA, has taken the opportunity of looking right the way across the department, looking at the priorities and the research commitments of each of those areas, trying to bring them together and to provide some more strategic coherence and oversight to that. We have been involved in that, both informally and as part of wider discussions that he has had with the community and also more formally as he presents that strategy to the SAC.

Q308 Lord Krebs: Defra, as you say, has a very broad span of research interest. Some areas clearly overlap with other government departments—say, in relation to climate change, both mitigation and adaptation. I wonder how the SAC then, through its advice, interfaces with other government departments that may or may not have advisory councils.

Professor Gaskell: The formal answer is that we do not in a formal way interact with other departments. We do challenge and we have challenged the CSA about whether there is sufficient connectivity. The obvious one to talk about is DECC, since the Government took the responsibility for mitigation away from Defra, leaving, nonetheless, Defra with a significant role in adaptation. We have said repeatedly to the CSA: “Is there enough connectivity?” I think the connectivity is significantly better than it used to be, not least because John Beddington as Chief Scientific Adviser now brings the CSAs from the different departments together. Of course all departments do now have a CSA, with the perhaps notable exception of the Treasury. John Beddington brings those together regularly to discuss areas of overlap. We challenge Bob Watson on that issue: “Are you content that there is sufficient connectivity and that the left hand does know what the right hand is doing?” It is also important, not just in the context of government departments but specifically with other publicly-funded areas of research, and probably worth noting that on SAC, at all of our meetings, we have representation from the research councils, usually at CEO level, and also from the devolved administrations, so we try to produce a degree of connectivity through our meetings.

Q309 Lord Warner: Professor Thomas, you have told us a little bit about how you do Sigma Scanning and you get some sort of sense of the range of activities in which you might get involved. Would you tell us a bit more about the detail of the processes in which you get down to some of the individual studies, and, in particular, the sorts of criteria and principles you use. To what extent are outside people like research councils, like industry, other stakeholders, involved in that process of getting down to, say, the kind of studies you are going to do in the next year or the next two years?

Professor Thomas: In terms of selecting our projects, we have a number of methods and I am happy to describe briefly what those are. First of all, we will have what we might call a cold consultation, where the Government’s Chief Scientist will write to a very wide group of stakeholders, right from permanent secretaries through to learned societies, other academics and so on, to ask for suggestions for topics. That is one approach. We did that two years ago under Professor Beddington. Sir David King also used a hot-house approach, where he would bring together a group of leading people to come up with a long list of ideas for new topics that were felt to be important. These would then, in consultation with research councils, departments, and a select group, be whittled down to a shorter selection. We have also had topics, even large Foresight topics like obesity, which have really come as direct suggestions from departments, and if they meet our criteria they will do that. There are specific criteria for a Foresight project, so we have many different stakeholders feeding into this. The projects must look ahead at least ten years in areas where outcomes are uncertain. They must involve science and technology as the main drivers of change or sources of solutions; they must have outcomes that can be influenced for either the economy, society or the environment, or all three; they must not duplicate work elsewhere; they require an interdisciplinary approach. We are very focused on multidisciplinarity, depending on which way you look at it, and working across departments. Many of these issues will involve several departments. The selection of the topic must command the support of groups who are most likely to be able to influence the future, so we will have very senior stakeholders on a high level board. It must be owned by at least one or more government department, so we will have a sponsoring minister or two owning that project, in essence. That is the process by which we will select the topics. Where we do horizon scanning work, which is where we have a smaller group of people doing shorter-term projects, that is a more client-led work steam, and so quite often we will have specific groups
within government or departments coming to us to ask for particular pieces of work and we will decide. That is much more about looking at strategic futures work. It is also related to training sometimes, and we assess that against a group of criteria, but we do not consult as widely, because we are there in horizon scanning to provide a service to government and its agencies. I hope that answers the question.

Q310 Lord Warner: That is very helpful. To move to the other end of the process: you have said a little bit about the follow up and the issue of your three-year reviews and so forth, but can you give us some idea of the extent to which you have a kind of success rating of the impact of these on determining research priorities in particular, in the sense that people have looked at a Foresight study and have thought that that should be shaping some of their research programmes? Would you give us some feel of your successes and some of your failures perhaps?

Professor Thomas: In the last three years we have dedicated the resource to achieving impact, and we have learned that if we work hard after work is completed then we are much more likely to get impact. That is something that we have been able to do in the last three years. Before that, we did not do it as much, and I think that may have been a factor in some of the very earlier pieces of work not having as much impact as they might. The very two early pieces of work when Foresight was first recast were done around 2002–04: the electromagnetic spectrum project—quite a short programme—and also one on cognitive sciences. These were early pieces of work. It was felt that the impact of the electromagnetic spectrum project, while it was felt to be reasonably successful, was not as great as had been hoped. If we look at the review of that project, it will say that the kinds of priorities that came out of that project would have probably been recognised by others, so it was not a unique piece of work. When we look at the cognitive sciences project which followed—again a very early project around 2003–04—I would say that that project, which was looking quite uniquely at the time at the interface between neuroscience and computing, did elicit a new research councils’ recognition of the importance of mental wellbeing and we have worked very hard with the MRC, with our experts, to do that. I could lay out, but obviously there is not time, a number of specific examples like that. One final example I might mention is the surveillance strategy on obesity coming out of the Department of Health. That has worked specifically with the output from the Foresight project to set up its surveillance strategy.

Q311 Lord Cunningham of Felling: Professor Gaskell, how are you consulted by Defra, if you are, indeed, regularly consulted by them? At what point in the process does this consultation or request for advice or guidance take place?

Professor Gaskell: Our consultation with Defra and our interactions with Defra are through the Chief Scientific Adviser and we maintain that protocol. I think it is useful to know what the lines of communication are. There have been examples over the years where the Chief Scientific Adviser has said to us, “I think this is an issue that I need help on,” and they have ranged very much in type; for example, Howard Dalton in the early days was concerned about the disparity across the department in terms of quality assurance and peer review of the science, a rather “process” side of things, but, none the less, we were able to review that across the department and provide him with very considerable assistance in terms of getting a greater uniformity of approach in that area. We have also been consulted and asked for advice in areas such as social science. That was a quite helpful mixture of the department probably thinking they needed some help but us pushing them to suggest that they did need some, and we produced what I think was a very effective report which has raised the profile of social science within Defra. It made them recognise that they were not intelligent customers for this and that it needed to be a significant part of their evidence base. That was very useful too. We were also asked specifically for advice in the area of epidemic diseases, particularly contingency plans. We had a very useful impact and produced a very useful set of advice, initially around
foot-and-mouth disease but subsequently in avian influenza, which allowed the department to develop not only the contingency plans themselves but a degree of comfort and confirmation that they had had independent advice and validity on what was for them a very difficult and contentious area. There have been a number of areas. On bovine TB Howard Dalton asked us specifically for advice in that area, particularly to look at a body of scientific evidence on which he needed assistance and independent evaluation to confirm to him that it was fit for purpose.

Q312 Lord Cunningham of Felling: You say in the submission that you have given us and you have said again this morning that you advise and challenge the department on strategy. What do you do if you think they have made a wrong call?
Professor Gaskell: We say so.

Q313 Lord Cunningham of Felling: To?
Professor Gaskell: To the CSA. It may be a commentary on the robustness of us or the relationship we have with the CSA but there have been relatively few occasions when we have come to a point where we have made a recommendation or a commentary and the CSA has said, “I hear what you say, but . . . .”. As I have said, the figures demonstrate that most of them have been accepted. A couple have been accepted “in principle,” which is sometimes a euphemism for no. There have been some minor examples where they have said no for reasons—and we ask them to explain, if they do not. This goes back to the whole question which I am sure you will debate in another place about the role of advice and policy in science in government. There have been relatively few occasions where we have met anything like a brick wall. Quite recently, with one of the different components of the department, looking at whether there are degrees of reorganisation within the department, a degree of comfort and confirmation that they had achieved towards the greatest strategic objectives of the department created from sections from other government departments and almost inevitably there were differences in culture between those and different priorities and different approaches and different agendas. Initially the department found it difficult to bring those together. There has been quite a degree of reorganisation within the department, and Bob Watson, as I have said the fairly recently appointed Chief Scientific Adviser, has spent a lot of time and has involved SACs in this, in looking at all the research in the different components of the department, looking at whether there are degrees of co-ordination or the removal of overlap that could be achieved towards the greatest strategic objectives of the department. Whilst these are early days, I think the direction of travel is very positive within the department. As I said earlier, I am not so clear about the linkages with other government departments. It may be an area that we should challenge the CSA more about, but I am personally, and I think the council is, reassured by the moves that the Government Chief Scientific Adviser has made to bring the CSAs together so that they know collectively what their priorities are and can share their individual agendas. Clearly it is vitally important with areas such as DECC and Defra.

Q314 Lord Cunningham of Felling: This was not foot-and-mouth disease!
Professor Gaskell: No, his feet did not get that high. He was just rocking.

Q315 Lord Cunningham of Felling: Do you ever meet the Secretary of State?
Professor Gaskell: Yes, I have met the Secretary of State.

Q316 Lord Cunningham of Felling: I do not mean socially.
Professor Gaskell: No, no. When I was first appointed as chair I had a specific session with him. We regularly invite the Permanent Secretary and one or other of the Ministers of State to the dinner we have before every meeting. They have taken those up. The Secretary of State has not been for dinner but the Permanent Secretary quite regularly comes.

Q317 Lord Methuen: Professor Gaskell, to what extent is the research co-ordinated strategically across the department, and, I would have thought, with DECC, and what changes, if any, would you suggest Defra’s research funding allocation processes?
Professor Gaskell: As I alluded to earlier, I think there have been significant advances made in just the last year about the co-ordination across the department. As most of you will know better than I, Defra was a department created from sections from other government departments and almost inevitably there were differences in culture between those and different priorities and different approaches and different agendas. Initially the department found it difficult to bring those together. There has been quite a degree of reorganisation within the department, and Bob Watson, as I have said the fairly recently appointed Chief Scientific Adviser, has spent a lot of time and has involved SACs in this, in looking at all the research in the different components of the department, looking at whether there are degrees of co-ordination or the removal of overlap that could be achieved towards the greatest strategic objectives of the department. Whilst these are early days, I think the direction of travel is very positive within the department. As I said earlier, I am not so clear about the linkages with other government departments. It may be an area that we should challenge the CSA more about, but I am personally, and I think the council is, reassured by the moves that the Government Chief Scientific Adviser has made to bring the CSAs together so that they know collectively what their priorities are and can share their individual agendas. Clearly it is vitally important with areas such as DECC and Defra.

Q318 Lord Colwyn: In the Science Advisory Council report published in June which we have, you describe a number of ongoing initiatives aimed at improving the way scientific advice is provided across government. To what extent did government departments collaborate and co-ordinate their research activities?
Professor Gaskell: I am not sure that I am best placed or have any particular knowledge of that. The appointment of CSAs in all departments of course is a relatively recent phenomenon, and the appointment
of SACs. We had a meeting just ten days ago, under John Beddington’s chairmanship, of the chairs of advisory councils and committees within government—some 70 were invited and about 40 could make the date—and one of the issues raised there was this issue of co-ordination and collaboration. We felt it would be useful and important—indeed it is minuted now and this will be published shortly, and I know John Beddington is keen for this to happen—for the chairs of government department SACs to meet more regularly, so that they as well as the CSAs have some understanding of the potential for and the reality of collaboration across the departments. I do not know personally of mechanisms that would ensure the degree of collaboration that you are obviously hinting would be helpful and that would indeed be helpful.

**Q319 Lord Colwyn:** How often do you think they will meet? What will be regularly?
**Professor Gaskell:** That is to be decided, but I would have thought we would have needed to meet at least twice a year. We laughingly suggested there would be an element of group therapy in our meeting. This meeting of course was prompted by the little local difficulty around advice on drugs and the Home Office and the position of science advisory councils in that, but out of that has come the very positive view, as I say, that we should meet regularly to share best practice and to make sure that the agendas that we are each following are complementary rather than overlapping, and if there are lacunae that we need to worry about, that we address those.

**Q320 Lord Colwyn:** At the moment they might in fact not meet every year.
**Professor Gaskell:** Apart from one social gathering a year, we do not, as chairs of SACs, meet in a formal sense to share our experiences and best practice, but I know John Beddington has that in hand.

**Q321 Baroness Perry of Southwark:** My question is for both of you, although perhaps mainly for Professor Thomas. We know there is a tension between the long-term horizon planning and government’s urgent short-term policy priorities. How do you ensure that the priorities for research long term are considered and how much do you feel that that is co-ordinated across government departments?
**Professor Thomas:** You are quite right, Lady Perry, there is this tension, and Foresight is squarely in that territory. Clearly we think it is important that government is encouraged to think longer term—and by longer term we would mean at least five years out and preferably longer. As I have already observed, a number of our projects will look out over several decades. This is particularly important where we are thinking about issues that take quite a long time either to have impact or to be mitigated by solutions, so whether we are thinking about turning around what some call the obesity epidemic, which is likely to take the best part of 30 years it has been predicted, or whether we are talking about making buildings more energy efficient, and, clearly, a lot of the buildings we have now will be here in 2050, a lot of these things are necessarily very long term. Clearly, to get what I might call support or buy-in from government departments for this work that we do, it has to feel to them that it has sufficient priority and relevance to be able to compete with resource that is dedicated to more short-term considerations. In selecting projects, we have tried to recognise that getting departments really supporting our work is vital if we are going to influence the outcome, because otherwise there is always a risk that the work we might do could be ignored, and, clearly, that is something we want to avoid. Getting a strong pull for departments for Foresight work is the market we are creating and we feel that is there. We also feel that there is greater recognition across government in the last few years that there is a need to look longer term. If one looks across now, as opposed to, say, five years ago, a number of departments have small groups of people dedicated to horizon scanning. Defra is a good example. The MoD has had such a facility in place for a long time—it has a dedicated team at DSTL, its agency—and the Home Office is setting up horizon scanning. First of all, I think the climate for this is changing. Second, we try to use approaches which create this market for our work to get government interested in the longer term. This is easier to do in some areas than others. For example, there has been real recognition of the need to make buildings energy efficient, to have a greater mix of energy generation, and we had good support, for example, from CLG and good recognition of the need for a longer-term approach for the particular project we did on sustainable energy in the built environment. That coincidence of their needs and our expertise in dealing with that whole area was very well received. Similarly, I would draw on the example of the future of food and farming, where the volatility in food prices 18 months to two years ago really caught governments’ attention around the world. I would say that that has created a real appetite for an understanding of what the longer term issues are and what the trends are and what we can help do to combat the uncertainty in terms of action now. Although we are saying that our job is to help the Government think systematically about the future, it is really so that they can take effective action now. It is not about just something to contemplate. I think this message has got across, and we have tried. I think successfully, to establish our reputation as being a
source of high quality evidence-based strategic analysis that has helped departments plan. In terms of how that is co-ordinated across government, that is harder to answer in a straightforward way because many departments have their own arrangements and some departments have more recent experience at this than others. I would not claim that Foresight is the only part of government that is thinking longer term: as I say, the MoD has a long history here, of which you will be aware, in their strategic trends work. It is quite variable but I would say that Foresight is setting a good example by bringing departments together. Increasingly with our projects we are able to do that. There is one project on the future of land use in the UK, due to be published in January, which has both Defra and CLG as co-sponsors, and our mental capital project had three departments. I see in other spheres of government, examples where boards are either created or take on collaborative cross-departmental longer-term looks at things, and we dedicate quite a lot of our follow-up resources to inputting and supporting those efforts. I hope that has answered your question.

Professor Gaskell: This tension, this issue of how much of increasingly scarce departmental resources to commit to short or long-term policy supporting evidence generation, is something we have discussed in Defra. Certainly the present CSA is of the view that if there has been an imbalance, it has been too much short-term and not enough long-term research within the department. We have discussed this overtly at SAC with him as part of his developing evidence strategy for the department. We have also been and are being directly helpful in horizon scanning. There is, as you say, a horizon scanning group within Defra. We have some expertise on the SAC and we have formed a subgroup to work with this section of the department. This is a modus operandi where we are not overtly advising and challenging and then going away but we are seeking to work with the people within Defra—without going native and having complete ownership of the outcome, because that is the department’s work, but we are being helpful as they develop. I get a sense that horizon scanning is being developed in a range of departments across government. Whether the level of expertise and understanding of the methodologies and concepts of horizon scanning are equally well distributed I am not the person to ask, but we get a sense that there is quite a steep learning curve in some areas about the methodology of horizon scanning, and that is something we were seeking to address by helping. The issue, of course, for Defra is that it requires evidence for policy formulation. It made a policy decision itself some years ago that it would move away from applied industry-supporting research and focus its R&D effort on policy. That has led it to a number of decisions, and I think has probably taken it towards more short-termism. There are a number of issues there which we could debate. One is about the almost knee-jerk requirement to spend money on an area because it is a current policy issue, and it may almost be done in order to be seen to be done, where it may not be appropriate and there may be long-term consequences of that. The other thing on which we have pressed the CSA and Defra is where it seeks to develop evidence for policy, but particularly where it is a new policy area, it should make sure that it has a full understanding of the evidence that is already available. There is an awful temptation to rediscover wheels because you feel you need to be doing something when a new policy question arises.

Q322 Baroness Perry of Southwark: There have been, have there not, some glaring examples where a long-term problem, like, for instance, the security of energy supply has been hanging around but because it was such a long way off it was possible for the government departments to keep pushing it away and not take urgent action until very recently. I do not know whether either of you has had experience of issues like that but they do exist, do they not?

Professor Gaskell: You are absolutely right. Of course some of the major issues of concern to us at the moment, particularly around sustainable food supply and climate change, are in that awkward policy area where it is unlikely to be an immediate problem on my watch, as it were, but it is going to be within the timescale where something needs to be done on my watch in order to stop it happening on somebody else’s watch. Those are often really quite difficult policy issues to grasp. A number of those fall slap bang in the middle of Defra’s responsibilities and it is something we have and will continue to discuss.

Chairman: I am not sure if it is difficult to grasp. Perhaps more it is difficult to act on, which is rather different.

Q323 Lord Warner: Just to pursue this briefly, there are some long-term issues which you are going to be studying. If they are serious issues, you probably have to start doing something about them now, quite quickly, which then does pose this problem. I have heard quite a lot about how you interrelate with departments, I have heard how you relate to Permanent Secretaries and Chief Scientific Advisers, but how do you market your idea with ministers? How do you get ministers to take seriously some of the recommendations? From both sides, Foresight and advisory councils, what is your interaction?

Professor Thomas: On the big Foresight projects, I think it varies. We will sometimes have more than one minister during the duration of a project. Clearly with ministers there is a certain turnover, and so that varies. For example, in the obesity projects we had ministerial sponsorship from both Caroline Flint and
Dawn Primarolo. We had what I would describe was excellent engagement from both Ministers, who were very well briefed on this. They were very concerned about how we could tackle obesity better. With their support we were able to create a very influential position as regards the new obesity strategy that was published in January 2008. The support of ministers in that particular example was really crucial, but I think I could point to several other examples where we are able to brief ministers regularly about how projects are developing. They will be present at launches, and we will work hard with them to follow up projects. For example, John Denham became a sponsoring Minister for our mental capital project, and even though he has moved to CLG now, he has specifically asked to remain sponsor and has authorised some funds to help us try to get a more cross-departmental strategy understood in government. I have had a very positive experience on the whole in my three years and I think that extends further back.

Professor Gaskell: As I said earlier, our connectivity with the department is not directly with the Minister; it is through the CSA. The way in which we seek to make our advice stick, if you like, with the CSA is by making sure that it is robust and well thought through. We also tend, I have to say, to work on a relatively “no surprises” basis, so we do not ambush the CSA with information or advice that he was not expecting. That worked particularly well with our recommendations around social science. We did not wake up one morning and say, “You’re not very good at this”. We accumulated the evidence and we let them know that this was the developing view. The other thing to say is that although as the Science Advisory Council we take our remit broadly, in that we are not, for example, just natural scientists but we do have social scientists, and we talk a lot about risk and uncertainty and we advise in all those areas, we have to recognise that the advice we are offering is one component of the advice that goes towards the formulation of policy. There may be other advice and other information and other things weighing on a minister’s mind in making a decision, so it is our role to present the advice as we see it and to talk to the Minister through the CSA about the uncertainties and certainties of that advice, but it is for the minister to decide.

Chairman: So they keep telling us.

Q324 Lord Crickhowell: You have had a number of questions about co-ordination across government. Do either of your organisations have any relationship with the devolved administrations? Throughout this inquiry I am quite interested to know whether the increasing role of the devolved administrations and the semi break-up in that sense of the United Kingdom is having an impact on science and research. Do you have any comments on that particular aspect?

Professor Gaskell: We do involve the devolved administrations. We have, as I have said earlier, representatives on SAC, attending members of SAC, from the devolved administrations. Wherever possible when there are issues that are of direct relevance to the devolved administrations, they may form part of a sub-group looking particularly at that issue. It is important for Defra because Defra’s responsibilities for some things are for the UK and for others they are just for England. It becomes particularly difficult in areas such as infectious diseases of animals, where the approaches of the different devolved administrations may be different. It is also true to say that the research resources and agenda, although they may be smaller in the devolved administrations than they may be in core UK, in England, that is not always by any means the case, and there is certainly a body of research in Scotland relevant to Defra’s work, and we make sure that we have access to that and take that into consideration. You are absolutely right, it is important that Defra and the SAC are fully cognisant, as I think they are, of the devolved administrations.

Professor Thomas: We have found working with the DAs to be quite fruitful in Foresight. We have involved them particularly in follow-up, because they cannot always be involved in the projects and spare the time to come down to high level stakeholder meetings, but we will make sure that we involve them in the projects. For example, in the land use project we have specifically involved both Wales and Scotland in the evidence gathering and so on. We will work quite hard with the Scottish Executive in following up some of the work. They were very interested in the obesity project and, also, the mental capital project has been a particular focus for Wales. We will bring them in both during and after projects in a way that has really been fruitful.

Chairman: May I thank you both warmly. Our time has been very fully used. It has been a very helpful session. If on reflection there are any points that you would like to amplify or additional points you feel you wanted to make but did not have the opportunity to make, we would be very happy to have a written piece from you. We thank you for your written evidence and this amplification. You will see a transcript of the session within about ten days probably. Thank you very much.
SETTING RESEARCH AND FUNDING PRIORITIES: EVIDENCE

WEDNESDAY 9 DECEMBER 2009

Present
Colwyn, L
Crickhowell, L
Cunningham of Felling, L
Haskel, L
Krebs, L

Methuen, L
Neuberger, B
Perry of Southwark, B
Sutherland of Houndwood, L (Chairman)
Warner, L

Memorandum by Campaign for Science and Engineering (CaSE)

INTRODUCTION
1. The Campaign for Science & Engineering (CaSE) is a policy advocate for science and engineering in the UK. We are supported by individuals and organisations spanning all areas of science, technology, engineering and mathematics with representation from universities, industry, learned societies and charities.

OBJECTIVE OF PUBLICLY-FUNDED SCIENCE AND TECHNOLOGY RESEARCH
2. The objective of research is to advance knowledge; the purpose of doing so will vary from project to project. The Government’s overall objective with respect to science and technology is to increase the UK’s knowledge intensity (measured in percentage of GDP spent on R&D).

3. There are many reasons why advancing scientific and technical knowledge is in the public interest. New knowledge contributes to the creation of economic opportunities, it also helps us identify and respond to societal challenges, and it contributes to our cultural advancement. Research is critical to informing policy decisions with evidence. Highly-skilled scientists, technologists, engineers and mathematicians are an extremely important outcome of publicly funded-research.

PORTFOLIO OF INVESTMENT
4. The Science and Innovation Investment Framework 2004–14 set to raise the level of investment in the Science Budget, whilst only aiming to maintain departmental funding levels. Over the last decade investment in the dual support system (Research Councils and HEFCs) has increased, whilst overall government departmental investment has remained relatively constant in real terms. The increased investment in the Science Budget was and still is needed. However, the implications of the shift in the balance of investment need to be considered as the consequences have not yet been fully explored. The government needs to ensure that strategic research in priority areas is performed. If the current funding trend is maintained then it is important to examine the mechanisms by which government can direct funding to priority areas.

5. When considering public expenditure on science and technology it is worth noting that funds are also distributed via other means, including the Regional Development Agencies, the Technology Strategy Board and the European Framework Programme. The Government also supports industrial investment in research through the R&D tax credit. Funding streams should not be viewed in isolation as there are different mechanisms for supporting different elements of R&D in the UK. They should continue to have distinct purposes.

DUAL SUPPORT SYSTEM
6. The Government allocates funds for the research base (universities and institutes) via the dual support system (Research Councils and HEFCs). The overriding principle for both funding streams is and should remain excellence. Without a focus on funding excellent research, the UK will risk its international standing. The dual support system needs to support research across all disciplines to ensure a broad research base.

7. The dual support system is partially devolved. Research Councils should remain focused on funding the highest quality research across the UK. Devolved HEFCs mean that there will be different decisions on both the level of funding and the principles guiding the distribution of Quality Related (QR) research across the UK.
Research Councils

8. The Science Budget which is mainly distributed by the Research Councils needs to be “ring-fenced” from the other spending commitments of the department that is responsible for its allocation and oversight so that it is not cut during a spending period. There should be a long-term framework for investment to give clarity, and hopefully confidence, to the research community, corporate and charitable research funders about the level of support for research.

9. The allocation of the Science Budget to the Research Councils is where the government has the greatest influence in shaping their research priorities. The last Allocation of the Science Budget focused Research Council funding on cross-cutting programmes that reflected the Treasury’s key policy challenges. In the run-up to the next spending round the Director General for Science and Research has said that he will consult selected bodies in shaping both the departmental submission and allocation of funding to Research Councils. It is important that the process is done transparently.

10. It is extremely difficult to determine if the Government is upholding the Haldane Principle, as it does not regularly publish the guidance it gives to Research Councils. Greater transparency is needed about the role of government in setting Research Council funding priorities in order to improve accountability. Greater clarity and consensus is needed on what level of guidance government should be giving Research Councils, this is particularly important in the development of their strategic plans.

11. The balance between directed and responsive mode research should not be a static figure, nor should it be the same figure across Research Councils. However, there is a strong rationale to support the Ten Year Framework’s position that responsive mode funding should form the larger part. The reason is twofold. First, responsive mode funding gives flexibility to the funding system. Second, it is a highly competitive form of distributing project funding which can raise standards.

12. An ongoing research policy issue is whether there should be greater focus on priority areas. Any move in this direction should not risk the breadth of the UK’s research base. Narrowing the science and engineering research base would risk the UK’s ability to absorb research that other countries are carrying out and areas that industry can invest in. The UK needs to be part of a global system of knowledge production, and it is extremely difficult to know what areas of research will have the greatest impact or where the UK can lead the world. Furthermore narrowing the research base could put student of studying science, engineering and mathematics if they do not see support for their areas of interest.

13. Research Councils UK should publish annual data on the distribution of funding by each Research Council. There needs to be consistency in how terminology, like responsive and directed, is applied across Research Councils. This information would help to inform debates about research funding.

Higher Education Funding Council for England

14. Funding from Higher Education Funding Councils provides the baseline investment needed to support research in higher education institutions. Allocation of the Quality Related (QR) block grant will be informed in the future by the outcome of the Research Excellence Framework (REF). In order to ensure the confidence of the research community in the process, it needs to be managed by expert panels. QR funding should be focused on supporting internationally excellent science and engineering research within universities.

Organisational issues

15. As Lord Mandelson has proposed reviewing the Department for Business, Innovation and Skills’ non-departmental public bodies, including the Research Councils and HEFCE, it is timely for the Committee to consider the mechanisms for allocating public funds to research. Although there are issues to consider within each funding agency there is no compelling reason to change the institutional setup at this time. Any changes would have significant costs. Tradeoffs should be evaluated when considering different funding systems.

Government Departmental R&D

16. Departments need to invest in R&D to develop the evidence-base to inform policy decisions and to improve the delivery of services. Although departmental expenditure has increased considerably over the last 10 years R&D budgets have not kept pace. Greater scrutiny of departmental R&D budgets is needed to assess if they are effectively deployed. Each department should have a scientific advisory committee to do this.

17. As the Government is pursuing industrial activism, greater consideration needs to be given to how departmental R&D budgets could support innovation in priority sectors. The other alternative is to give greater support to the Technology Strategy Board to support R&D investments in strategic areas.
18. Government departments are largely responsible for setting the level of their R&D budget and their research priorities. This has meant that there has been little progress in developing a more robust mechanism to protect departmental R&D budgets as the Sainsbury Review recommended. In the near future overall public expenditure is set to be cut, it is important that departments make use of their research budgets to ensure that their policy and delivery functions are efficient and effective. A Treasury Chief Scientific Adviser should be appointed to develop the evidence base to help inform government expenditure and evaluate different forms of support for R&D.

19. The Government Chief Scientific Adviser and the Government Office for Science provide an oversight role, but there needs to be clearer responsibilities about how research priorities are coordinated across government. Since the Office of Science and Technology was split, there seems to be less ability to look at the science and technology research capacity across government.

20. The Government Office for Science should have a stronger role in coordinating government departmental R&D expenditure. It should also be responsible for ensuring that research gaps to meet policy needs are filed. For the most part this will be done by working with relevant departments. However, serious consideration should be given to allocating the Government Office for Science with its own research budget in the next spending round for research that falls between departmental portfolios.

21. The Office of Science and Technology used to produce *The Forward Look*, which included high-level priorities and spending plans across government funded science, engineering & technology. The last one was produced in 2003. A similar review of public funding should be re-started in order to communicate to various audiences the funding commitments and priorities of the government’s portfolio of investments in science, engineering and technology.

**Setting and Coordinating Research Priorities**

22. The Government has numerous institutional mechanisms for discussing science and research policy, the Cabinet sub-Committee on Science and Innovation, and the Chief Scientific Advisers Committee. Greater clarity is needed on what issues are being considered by both groups.

23. In terms of coordination with non-governmental funders there is the Research Base Funders’ Forum. The UK Science Forum comprised of leaders from research-intensive companies and was meant to give advice on improving the UK’s business R&D and innovation performance. It is unclear what impact the Forum has had on informing research priorities. Again it is important that all government supported forums on research policy produce public records of their deliberations and advice.

24. The Technology Strategy Board is starting to play an important role in funding research in selected areas. However it needs to have a much clearer funding stream, which is outside of the Science Budget, if it is going to live up to the ambitions for it. It has the most scope for supporting emerging technologies.

25. The Council for Science and Technology should be reconstituted to have a much clearer role in looking across the portfolio of public investment in science and technology and advising on strategic cross-cutting issues. As the funding and policy landscape is diffuse there needs to be a body with the capacity to look across the research funding landscape. A reconstituted CST would need to have greater resources to analyse funding trends and prospective policy options.

**Response to the Economic Crisis**

26. The economic crisis led to a short-term growth in public expenditure, which will most likely be followed by medium-term cuts. Unlike many other OECD countries the UK has not made support for science and innovation central to its short-term response. It is critical that the medium-term cuts to public expenditure do not constrain the UK’s long-term economic future. A pro-science and pro-engineering response to the crisis is needed if the government is going to deliver upon its aim of having a more balanced economy in the future. Other countries, notably the US, Finland and Korea, have at different times used economic crisis to increase funding of science and technology.

**International Comparison of Strategy and Funding of Publicly Funded R&D**

27. The UK’s 10 Year Framework compares well against other countries’ strategies. It is comprehensive in the policy issues covered and has resulted in sustained increased investment in the research base. Not all targets have been achieved, but it has focused government departments on key strategic issues, including science and mathematics education. The Ten Year Framework should be seen through until 2014. The process to develop a new medium-term framework should start following the next spending round. There needs to be a robust evidence-base and consultation to inform the development of a long-term strategy.
28. Many other OECD countries have long-term strategies, which have increasing levels of investment in science and technology as their objective (see the OECD Science, Technology and Industry Outlook reports). The UK still lags behind our international competitors in terms of investment and aspiration in increasing the knowledge intensity of our economy. The target of 2.5 per cent of GDP being spent on R&D should not be abandoned.

September 2009

Memorandum by the Royal Society of Edinburgh

SUMMARY

— Science and technology in the UK is currently at a pivotal moment in determining its future. While our science base is at present second only to that of the USA in scope and output, major investments and structural changes by other countries mean that significant changes are required to maintain the UK’s position.

— There is a strong economic case to be made for Government support in science funding. The development of “knowledge capital” is the only major competitive advantage for nations such as the UK and its maintenance and development will be an imperative for a strong and dynamic economy. Further, analyses show that long-term returns on investment in research are higher than most other forms of public investment.

— However the role of the science base in preparing for an unknown future, and the developing possibilities and ideas to address future challenges to the human ecosystem, must also be recognised as vitally important. Scientific research is also an area where the UK has shown itself able to make a major contribution to humanity’s understanding of the world and itself, and as such is an important attribute of national identity.

— It must be recognised that fundamental research, targeted programmes and translational activities form a research continuum. To divert funds away from fundamental research in favour of targeted programmes now will mean that the continuum will not be fed by either ideas or creative skills for the future.

— There are three basic functional roles in stimulating and funding a creative and useful science base: a body that funds highly creative research, maintaining excellence and diversity; a means of maintaining thematic research priorities to address key challenges and develop pre-competitive research; and means whereby government is able to make clear long term commitment to particular technology areas in order to stimulate investment from private companies.

— Research Councils should redirect their efforts towards their fundamental mission of stimulating and funding the highest levels of creativity. This is currently being undermined by the increasing pressure on Councils to deliver short-term benefits.

— The role of Government is twofold: to ensure that there are intermediary processes able to deliver thematic programmes of research that deliver on specific policy objectives; and to create intermediary functions to stimulate the take up of pre-commercial opportunities created by fundamental research.

— The Government also has a role to play in stimulating private investment, by demonstrating sustained commitment through setting long term national priorities, such as targets for energy and green technologies, while allowing flexibility in how these are achieved. This approach should lead to more effective integration of all parts of the research continuum.

— We have been impressed by the American model of the National Academies, which can call on a vast range of expertise to advise government on science and suggest that consideration should be given to formally utilising the strengths of UK academies.

— It is important that the UK engages effectively with the European dimension to make maximum use of the opportunities the EU offers and the leverage it provides to have a greater impact on the global stage.

INTRODUCTION

1. The Royal Society of Edinburgh (RSE), Scotland’s National Academy, is well placed to respond to the invitation from the House of Lords Science and Technology Committee to inform its inquiry on setting science and technology research funding priorities. It has distinguished Fellows involved in a wide variety of areas of scientific research, including medicine, physics, chemistry, biological sciences, engineering and technology.
2. In this response we address what we believe to be the key high level issues that must be considered by the UK Government when setting research funding priorities for science and technology. We are also sending a copy of the Society’s report *Picking Winners or Responding to Demand*, which was a response to a recent call for evidence from the Innovation, Universities, Science & Skills (IUSS) Committee, and which also addresses issues relevant to the House of Lords Committee’s inquiry.

**THE PRESENT DILEMMA**

3. The present is likely to prove a pivotal moment for UK science and technology. The global competition for excellence in science and technology, as the key economic and social driver for the future, is becoming more intense (Box 1) and the current financial crisis has created overwhelming pressure to make severe funding choices. The UK is fortunate at this juncture in having made significant increases in science funding in recent years. This has complemented the development in recent decades of highly competitive processes that have fostered an ethos of excellence that has made our science base the most productive and cost-effective in Europe and, globally, second only to that of the USA in its scope and impact. However, given the relatively low proportion of GDP that the UK invests in science, and the major investments and structural changes being made by other countries, it would be dangerously naive to suppose that these achievements can be maintained without significant changes.

**Box 1.**

Fast developing economies such as India and China have been investing heavily in science, producing a rapid expansion of research output. The Obama administration in the USA has provided a short-term injection of major funds for science programmes and the US Congress has written (June 2009) to the US Academies of Science and Engineering and the Institute of Medicine requesting that they collaborate to identify the actions that the US should take in maintaining the excellence in science and education that will be required to meet national goals in the 21st century. Both Germany and France are instituting structural changes designed to improve the efficiency of their science bases and Korea and Singapore continue to increase investment in their technologically specialist research bases.

**THE RATIONALE FOR GOVERNMENT SUPPORT**

*The economic case*

4. The immediate, most persuasive rationale for science and technology funding in Government eyes is the economic one. In a global economy, the only major competitive advantage for a country where labour rates are high by international standards is through the availability of “knowledge capital” of ideas. The vital source of many such ideas comes from research, particularly in science, engineering and technology, and through the capacity of those undertaking research at the international cutting edge to rapidly anticipate and import new ideas no matter where they originate.

5. Should business primarily fund this research? International evidence is very clear on this. It will not. A publicly funded science base, and in particular the people whose development it supports, is a key element of the national intellectual infrastructure on which business depends. If it is not provided by the state at a high level that is excellent by international standards, business will simply go elsewhere to find it.

6. There have been numerous analyses that show the returns on investment in research to be high. One such recent analysis suggests that research into cardiovascular sciences produces a return of 39 per cent per annum over 30 years. It is important to note however that such returns are not immediate. In cases such as that above, the time-to-benefit was an average of 17 years. The seeds of current benefit were generally sown many years before, and the precise route to benefit was not clear when the seeds were sown. If Government prioritises research where the lead time to benefit is predictable and short, by implication ones where market applications are obvious and returns relatively low, it risks jeopardising the harvest of greater returns from scientific discoveries that unexpectedly open up new and powerful possibilities. This does not mean to say that we should sit idly by waiting for the economic fruits of basic research to reveal themselves. Mechanisms that scan the output of basic research for application are crucial, but we should not measure its utility on too short a time frame.

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3. Academy of Medical Sciences “Medical research: what’s it worth?” (November 2008).
setting research and funding priorities: evidence

Box 2.

Fundamental work on the biochemistry and cell biology of protein kinases was of no commercial interest for 25 years. Now, one in three targets being pursued by the pharmaceutical industry is a protein kinase and drugs like Gleevec have revolutionised the treatment of chronic myeloid leukaemia.

7. Although it is not credible that there are policies for the science base that would help in lifting the economy from recession in the short term, we argue that there is a longer term imperative to rebuild the manufacturing capacity of the UK economy. In a context of increasing scientific and technological excellence in many countries, and an increasing shift by them to policies for high value, knowledge-based production, maintaining or increasing funding for the science base and improving the structures through which it operates must be important priorities.

Preparing for the future

8. Another fundamental role of the science base that is not adequately recognised is to create the possibilities and ideas, and the scientists and citizens who embody them, that an unknown future may need. Thirty years ago, scientists who studied climate change were regarded as harmless but irrelevant. However, serendipitous investment in their work revealed processes that we now recognise as threatening the future of the planet and their successors are playing a crucial role in assessing how we need to adapt.

9. In this regard, it is important to recognise that the planetary-scale challenges to the human ecosystem that are coming into focus may make demands on science and technology that far exceed the challenges of economic growth. At the same time we must not assume that we necessarily know what all those challenges will be. Energy, agricultural production, water supply and infectious disease are already on the list, but many others could join them. It is vital that the science base retains the diversity and vitality needed to address novel issues as they arise. It must not have objectives defined only in terms of short-term economic benefit.

The cultural rationale

10. Finally, we do not apologise for arguing that the urge to understand nature and our place in it is profoundly human and that Britain’s sense of identity is partly conditioned by the many towering scientific contributions it has made to that understanding. A nation’s sense of what it has and continues to contribute to human understanding is crucial to its social and political vitality. We should not underestimate it.

The Research Continuum

11. As pressures on resources grow, the long running debate on the balance of funding between targeted research, to address immediate concerns, and fundamental research, to maintain long term scientific vitality, intensifies. In reality, research is a continuum that cannot be easily subdivided according to whether it has short- or long-term goals. Fundamental research, targeted programmes and translational mechanisms for pre-commercial and commercial research are parts of a continuum in which fundamental research finds its way into application, though on highly varying timescales.

12. The public expectation for government policies to produce tangible results through targeted research in the short term is understandable. Responding to this demand by diverting funds away from fundamental research in favour of targeted programmes that depend on earlier fundamental research, ensures that the continuum pipeline will not be fed, either by ideas and concepts or the highly transferable and creative skills that come from doing fundamental research. A farmer does not forego planting next year’s seed because of his enthusiasm to sell this year’s crop. Moreover, major innovations that create new possibilities, new markets and new solutions often arise from quite unexpected sources (eg Box 2). We are profoundly concerned that the Research Councils’ decisions to require applicants to identify potential economic value in their work will lead proposers systematically to skew their objectives in favour of the short term, perversely undermining the creativity of the research base. We cannot afford to undermine the long-term creativity of the research base. We will go on to suggest (paragraphs 16–19) that the Research Councils’ dilemma in balancing funding for fundamental understanding against short term economic benefit should be addressed by institutional changes.
KEY FUNCTIONAL ROLES

13. We suggest that there are three basic functional roles in stimulating and funding a creative and useful science base:

(a) A body that funds highly creative research, irrespective of the position of that research in the continuum in paragraph 11. Its purpose is to maintain the excellence, diversity and creativity of research and to ensure that the UK remains a major attractor for international researchers.

(b) A means of setting thematic research priorities on issues of current importance such as for example energy technologies or meso-scale climate forecasting.

(c) A means whereby government commits itself to sustained, long term objectives for a particular economic sector (such as renewable energy, pharmaceuticals or aerospace) or public function (such as the renewal of national infrastructure) that gives private companies the confidence to invest in the expectation of long term financial returns and the incentive to pull strongly on the research base.

14. In practice such functions interact strongly. Those actors in domain (a) will be influenced in their proposals by priorities in (b) and (c), whilst investors in domain (c) will be influenced by the level of excellence in domain (a), and so on.

15. In an economic climate in which it will be imperative for the UK Government to make most effective use of its budgets, it must ensure that the structure of responsibility is clear, that the responsible bodies have attributes that are well-designed to discharge their function and that modes of operation are efficient in supporting the research continuum. We now consider how this might be better achieved in the UK setting.

STIMULATING AND FUNDING CREATIVE RESEARCH—THE ROLE OF RESEARCH COUNCILS

16. Research Councils have been increasingly expected to play both their traditional role of stimulating and funding research excellence and in addition promoting the exploitation of research findings. They are expected to stimulate contributions to wealth generation by combining both “push” from the science base and somehow to simulate “pull” from markets. At the same time, as research budgets for government departments have fallen, Research Councils are expected to deliver targeted research to address governmental priorities.4

17. As a consequence, the Research Councils now sprawl across the different functions in paragraph 13 in a confusing and inefficient fashion. By presenting a mixed message to applicants, of excellence on the one hand and short-term applicability on the other, we believe that they fall short in their principal role of stimulating and funding the highest levels of creativity, whilst being inappropriate proxies for market “pull”.

18. We suggest that Research Councils should be re-directed towards their fundamental mission, of stimulating and funding the most creative science at the highest international levels of excellence. Highly creative scientists in an internationally competitive science base are the bedrock upon which the benefits summarised in paragraphs 4–9 are based.

19. We also suggest that the current plethora of Research Councils and other funding organisations leads to complexity that hampers the ability of research organisations to drive forward their activities effectively. This can be particularly damaging where cross-disciplinary responses across the research continuum are required to meet some of the major challenges (see Box 3).

Box 3

While the MRC is the main funder of medical research, there is significant cross over with the BBSRC. However the BBSRC continues its policy of excluding applications related to disease and therapeutic research. This causes important and highly translatable opportunities to fall between two stools. Almost all science operates by perturbing the equilibrium and observing outcome, in human biology this generally equates to studying mechanisms of disease. The best way to understand health is to study disease.

Similarly, the artificial demarcation between BBSRC and MRC frequently separates research from its natural test-beds and partnerships. For example, chemoinformatics, bioinformatics and network biology are vital core technologies for drug design and discovery yet these are not typically funded by the MRC as they are seen as “too fundamental” and as “big-data platform technologies” that belong to the BBSRC camp. Thus, these technologies are impeded from properly articulating with some of their most practical beneficiaries (the Biotech and Pharma industries).

4 For example, the proposed 2010–15 BBSRC strategic plan lists Bioenergy/Biorenewables and Food Security as two of their three priorities. These appear to be driven by Central Government thinking rather than scientific thinking.
THE ROLE OF GOVERNMENT

Intermediary bodies

20. We see the direct responsibilities of Government as twofold. Firstly to ensure that there are “intermediary” processes able to drive thematic programmes of research that deliver on specific policy objectives. Much of this was undertaken through Departmental research and through Research Institutes such as the Hadley Centre, although we believe that this world-leading facility has been recently under threat because of cuts in the research budget of the sponsoring Department. Government needs seriously to consider how policy-related research can be better stimulated and exploited. It has recently suggested that the advice capacity of universities should be much better used but slicker mechanisms to define and procure policy advice are necessary to replace current ad hoc and inefficient contracting processes.

21. Secondly we need intermediary functions to stimulate the take up of pre-commercial opportunities that have been created through fundamental research. There is no substantial equivalent in the UK of bodies to drive pre-commercial opportunities derived from fundamental research, although Research Councils attempt to cover this role. In Germany it is a role undertaken by Frauenhofer Institutes and in the USA by bodies such as the National Institute of Health. It represents a serious deficit in the UK’s capacity to capitalise on the excellence of its science base. One option to fill this gap would be to expand and re-define the role of the Technology Strategy Board.

“Placing bets”: the role of Government in stimulating private investment

22. The so-called “valley of death” in UK research policy has historically been the relative weakness in translating scientific and technological discovery into profitable application. With notable exceptions, such as pharmaceuticals and aerospace, there has been a lack of “pull” from industry on the science base. Attempts to replace this by “push” from the science base, though laudable, cannot be of a scale adequate to make up for the deficit. We suggest that some of the answers lie in the Government’s own hands.

23. We suggest that sustained commitment by Government to develop business strengths that build on science and technology capacity and that are well-aligned to national needs is the way forward. It should do so by setting out high level priorities that give private companies the confidence to invest for the long term. Long term objectives and targets for energy and green technologies are obvious examples of the potential for such market signals. Other tools to stimulate activity include the use of public procurement (where the US SBIR scheme is an obvious model), taxation policies and regulation, including planning regulations.

24. Such a context then defines the role for “mission-driven research” in which Government sets a very high level direction but allows flexibility in how this is achieved. There are numerous examples of where such an approach has brought great success, such as the space industry in France, wind technology in Denmark and IT in the USA.

25. As referenced in our response to the IUSS Committee in April 2009, the Council for Science and Technology has suggested a process through which technology “bets” could be placed. They should be in areas where the UK has world-leading capacity; which have large actual or potential growing global markets (in excess of £100 billion); where the UK has the businesses, structures and people able to take developments to market; where there are strong, positive societal benefits; where technology risks are low and where government is able to intervene, not merely or necessarily through funding, but also through regulation.

MAKING CHOICES?

26. In the model we have set out above, choices are not made at the fundamental science end of the research continuum (other than through the excellence of the research proposal), where they risk vacating areas that might become crucial because of unexpected future discoveries (we believe that in a modern multi-disciplinary world, “critical diversity” is as important as “critical mass”). They are made at the applications end of the continuum through the identification of major priorities as in paragraphs 22–25 above.

27. Such an approach is also one in which it is in companies’ interests to engage with the science base, as happens for instance with Rolls-Royce Aerospace through their University Technology Centres. That engagement is crucially important if greater and more diversely articulated links are to be created between industry and the science base, and because it is in the self-interest of industry to create them, they are likely to be much more effective than those driven from the science base and from Research Councils.

28. It is also important to recognise that scientists’ decisions about what to study are not only questions of scientific tractability but also related to the perceived “importance” of an issue. Given the potential of the environment that we have attempted to sketch out, there is likely to be considerable convergence between the

ideas of priority at both ends of the research continuum. Indeed, evidence from the Netherlands indicates that the fields of “blue skies” applications usually overlap strongly with the thrust of directed research programmes, except that the former tend to be more creative in their approach, in not being so constrained by prior assumptions.

29. A further advantage of this suggested approach is that it has the potential to move away from the “zero-sum game” which assumes that the balance between basic and applied research must be struck or changed within Research Council funding to adapt to new political realities. Incentivisation by Government of private investment provides a crucial additional element of funding.

30. We also see no reason to revisit the widely misunderstood “Haldane Principle”, that the science community, rather than government or administrators, should choose what research should be funded on the basis of excellence, whilst another, neglected aspect of Haldane’s recommendations should be observed, that Government has the responsibility to identify high level priorities. In our model this translates into a means of ensuring interaction between the two ends of the research continuum.

A NATIONAL ACADEMY FUNCTION?

31. We have been impressed by the functioning of the US National Academies that were chartered by Congress in 1863 to advise Government on matters of science and technology. Whereas UK Government and Devolved Administrations have their science strategy bodies (e.g. CST for UK Government; SSAC for the Scottish Government) these bodies cannot call on the vast range of expertise that are available to UK academies (the Royal Society, the Royal Academy of Engineering, the Academy of Medical Sciences, the Royal Society of Edinburgh). The House of Lords Committee might consider whether there are ways of more formally utilising the strengths of these bodies on major strategic issues.

THE ROLE OF CHARITIES

32. Major charities have traditionally provided the lion’s share of funding in several strategic areas, for example on infection and immunity (the Wellcome Trust), cancer research (Cancer UK) and cardiovascular research (British Heart Foundation). In these areas charities’ contributions have been significantly bigger than that of the MRC. The current financial downturn has significantly affected charities and we are already facing major funding crises in areas of strategic importance for national wealth creation. This must be taken into account by policymakers when considering government funding priorities.

UK IN EUROPE

33. An element that has been missing from debates on policy for science is that of Europe. In the last few years there have been serious attempts to reinvigorate the concept of a “European Research Area”, which could provide a platform from which national research efforts could exert greater leverage. It is important that the UK engages more effectively with the European dimension to maximise the benefits that it has the potential to offer member states.

Additional Information

In responding to this consultation the Society would like to draw attention to the following Royal Society of Edinburgh responses which are relevant to this subject:

— The Royal Society of Edinburgh’s submission to the House of Commons Science and Technology Committee’s Inquiry into UK Science and Europe: Value for Money (January 2003)
— The Royal Society of Edinburgh’s submission to the House of Commons Science and Technology Committee’s Inquiry into the international policies and activities of the Research Councils (April 2007)
— The Royal Society of Edinburgh’s submission to the UK Parliament’s IUSS Committee, Putting Science and Engineering at the Heart of Government Policy (January 2009)

Any enquiries about this submission and others should be addressed to the RSE’s Consultations Officer, Ms Susan Bishop (Email: evidenceadvice@royalsoced.org.uk).

Responses are published on the RSE website (www.royalsoced.org.uk).

September 2009
INTRODUCTION

1. The British Academy, the UK’s national academy for the humanities and social sciences, is pleased to respond to the Committee’s inquiry, Setting Funding Priorities for Scientific and Technological Research. This inquiry is both timely and important, as the current pressure on public finances makes it highly likely that difficult decisions are going to have to be taken about what is and is not funded.

2. We are also pleased that the inquiry will cover all aspects of science and technology, which we take to mean “science” in its broad sense, including the humanities and social sciences (HSS), as well as science, technology, engineering and medicine (STEM). The Committee may also be interested in the way the Department for Business, Innovation and Skills (BIS) has defined “science”:

   “By ‘science’ we mean all-encompassing knowledge based on scholarship and research undertaken in the physical, biological, engineering, medical, natural and social disciplines, including the arts and humanities, which is underpinned by methodologies that build up and test understanding about our world and beyond.” (BIS website, “Science and Society”)

3. As indicated below, the British Academy, along with the Royal Society and the Royal Academy of Engineering, supports an interdisciplinary approach to research aimed at addressing a resilient economic recovery. In her oral evidence to the IUSS Select Committee on 25 February 2009, Baroness O’Neill, the then President of the British Academy, outlined the ways in which HSS research was important to economic, cultural, social and political well-being. This view we know is shared by others, notably, Universities UK. For example, at a recent UUK conference, UUK President, Professor Steve Smith argued that “universities are fundamental for social and economic progress, and establishing the kind of country that can compete and proper in the future”. We also support UUK’s commitment to promote the case for funding for humanities and social science research.

4. In this submission, we focus on three issues raised in the inquiry’s call for evidence:

   — How decisions are made to meet societal needs
   — The balance of funding between targeted and curiosity-driven research
   — How research is commissioned in Government Departments

SUMMARY

5. The British Academy makes the following key points:

   — STEM and HSS are both the proper subjects of an inquiry such as this one being conducted by the House of Lords Science and Technology Committee.
   — With both STEM and HSS subjects, the identification in advance of particular research areas that are likely to be of economic importance can be valuable but is inherently difficult, and risky as a basis for setting priorities for funding.
   — HSS research makes direct and indirect contributions to economic growth, including the critically important and fast-growing UK cultural industry sector.
   — There should be an appropriate balance between targeted and curiosity-driven research.
   — Government Department policymaking should draw fully on all that the humanities and social sciences have to offer.
   — Government Departments should ensure that they have appropriate quality controls in place in their commissioning and evaluation processes, including peer review etc.

HOW DECISIONS ARE MADE TO MEET SOCIETAL NEEDS

To what extent should publicly-funded science and technology research be focused on areas of economic importance? How should these areas be identified?

6. Any policy to focus research funding on areas of perceived economic importance would mean that funds would have to be taken from areas that are seen as less important. This would be at the expense of the many other valuable benefits flowing from the research base, which tend to have indirect economic impact and often provide the essential infrastructure to enable the economy to prosper.
7. The identification in advance of “areas of economic importance” in research can be extremely valuable but also inherently difficult. It is not surprising therefore that the government’s track record of “picking winners” is not good.

8. In some research areas, including some in HSS, areas likely to deliver economic benefits can be identified in a meaningful and robust way; for example, research for a major publication (a dictionary could be an example) may be reliably expected to lead to major sales both in the UK and internationally; archaeological research on certain sites may be expected to attract tourists; and research on connections between drink and motor accidents may be expected to help reduce government expenditure on police and health services. However, there are major risks in applying a rigid rule that all research must be evaluated in respect of its contribution to economic performance. One risk would be that a policy on these lines would only identify areas of possible short-term economic impacts (which may not come to fruition) at the expense of other important and longer-term impacts. Another risk is that, rigidly applied, it would undermine the idea of the pursuit of knowledge for its own sake—an idea that is widely seen (in the UK and internationally) as important, and constitutes part of the attraction of universities. Both in STEM and HSS subjects key advances of great significance (including in economic terms) have often begun with disinterested research not aimed at any specific economic impact. This is not to suggest it is improper to examine the impact of research; but it is to point to the dangers of funding on this basis alone.

9. A number of forms of measurement suggest that HSS research is an important source of direct economic value. For example, these disciplines are a prime source of economic value to the cultural industries and service sector. The UK cultural sector is considered by the OECD to be relatively more important (at just under 6 per cent of GDP) than its equivalent sectors in the US, Canada, France and Australia. UNESCO estimates indicate that the UK is the world’s biggest exporter of “cultural goods”, surpassing even the US. Earlier this year, Lord Carter, then the Government’s Communication Minister, predicted that: “In five years’ time, the creative industries [in the UK] could be as powerful as the financial services industry has been for the last 10 or 15 years.”

10. The indirect economic value of HSS research is just as important (if not more important) than its more direct contributions. For example, while health services are obviously based on the life sciences, they also depend upon psychological, social and ethical foundations to ensure that medical care is effective. HSS researchers provide advice and expertise on issues such as: the social, economic and environmental factors affecting health; medical ethics; the spread of disease; genomics; efficient management structures. Mental health and psychological well-being are also becoming an increasingly important element in healthcare agendas. The psychological effects of unemployment can also have serious implications for longer-term economic performance. HSS research enables these problems to be better understood and inform the development of effective policy interventions.

11. Technological advances cannot be effective unless there is more intelligent legislation, regulation, accounting and audit standards, commitment to more sustainable business models, which all rely heavily on the insights of the HSS research base. Technologies cannot be considered in isolation of their ethical, social, legal, and cultural implications. Similarly, the development of low carbon technologies, energy efficiency measures, and “cleaner” transportation will need to draw on the full range of expertise within the research base, ranging from science, engineering, economics and the social sciences. The move to a low-carbon economy will not be achieved without addressing the socio-economic and psychological dimensions.

12. Much HSS research is of great importance in terms of diplomacy, trade and other forms of contact worldwide. Knowledge of other languages is obviously important here, as is informed understanding of local culture in all its dimensions (including tradition, religion, value systems). So too is policy as the basis for working on relationships at economic, political, social, educational and other dimensions. This has some direct economic impact, but also some indirect economic benefit.

13. While HSS research is an important source of economic value, it is essential that its many other important (often longer-term) contributions to our social, political and cultural well-being (which also have indirect economic impact) are not overlooked. A narrow focus solely on the possible direct economic benefits flowing from the research base would be damaging to the UK, as it would ignore many of the other important benefits of HSS research, including its contribution to our understanding of the world, our responses to the opportunities and dangers it presents, and to our quality of life.

14. Furthermore, supporting some subject areas at the expense of others may make it more difficult for the UK to respond to the unexpected in the future. Once centres of research expertise and excellence are lost to the UK, it can take many years for the UK to rebuild this capacity and make up the ground lost to its overseas competitors. In the joint academies’ letter to Lord Drayson of 27 March 2009, the British Academy, the Royal Academy of Engineering, and the Royal Society wrote: “The identification in advance of “areas of economic importance” in research can be extremely valuable but also inherently difficult. It is not surprising therefore that the government’s track record of “picking winners” is not good. As quoted in The Observer, 1 February 2009.
Society and the Royal Academy of Engineering outlined the action that we believed was necessary to foster economic recovery, and made the following points:

“We believe that a mix of targeted measures is required to generate short term gains while ensuring a long-term resilient recovery. A compelling recovery narrative must have science, engineering and research innovation at its heart. It must be closely aligned with efforts to build a low-carbon economy. And it must draw effectively on the full range of disciplines and expertise within the UK’s research base.

We applaud the Government’s commitment to building a strong research and skills base over the past 12 years. And we welcome recent assurances from the Prime Minister that investments will be maintained across the board, in line with the 10-Year Framework.”

The Haldane Principle

15. The Committee asks for comments on the Haldane principle. The principle remains fundamental: funding decisions by arm’s length bodies based on peer review are a defence of quality and independence. Dual support is also the vital dimension of the research funding system. One comment we would add is to observe the virtue of non-monopolistic funding: the availability of public research funding through funding councils, research councils and national academies, as well as private sources from industry and foundations, provides a plurality of funding opportunities and thus a greater chance that an excellent proposal will secure a source of funding.

The Balance of Funding BetweenTargeted and Curiosity-Driven Research

Is the balance of Government funding between targeted and curiosity-driven, response-mode research appropriate?

16. The Government currently sets (in consultation with the research community) broad, overarching strategic themes for research. But it also in the Government’s interests to ensure that there is an appropriate balance between targeted and curiosity-driven, response-mode research: response-mode research can lead to unforeseen benefits, including unexpected business and commercial applications. The Government should also accept that it would be unwise and counterproductive to seek to micromanage the research endeavour. The outcomes of original research cannot always be anticipated in advance, so any efforts to plan the totality of research will fail and risk distorting research priorities.

How Research is Commissioned in Government Departments

17. We welcome the fact that the Committee has included in the scope of its inquiry questions about the research and development budgets of Government Departments. As the Committee will be well aware, these budgets are considerable but have also been under pressure in recent years. It is therefore helpful that the Committee has broadened the scope of its inquiry to consider Government research policy as a whole, including the areas (ie the R and D budgets of Government Departments) that Government Departments obviously control directly.

18. An Academy report published last year, Punching our Weight, included a number of recommendations addressed to Government Departments on the way in which research should be commissioned, including the importance of:

— thinking ahead about the evidence that needs to be obtained;
— allowing sufficient time to review the existing evidence base;
— identifying the best sources of expertise;
— ensuring that they draw fully on all that the humanities and social sciences can offer. The Academy is concerned in particular that the insights and expertise of humanities researchers are very often not being exploited by policymakers.
— looking at how they communicate their departmental research needs to those who might be able to advise on its feasibility or do it.
— establishing better networks with appropriate researchers;
— ensuring that there are appropriate quality control measures in place. The Academy believes that Departments need to introduce a greater degree of peer review into their commissioning and evaluation processes. They should not rely on work that has only had to satisfy the demands of research tender. This can lead to policy based evidence not evidence based policy. Where peer review is not used, Government Departments need to explain openly that the work has not been subject to peer review.
19. In addition, *Punching our Weight* drew attention to the Academy’s concerns about the fragmentation of social science research in Government Departments. There are currently separate professional groups and structures for science, social research, economics, statistics and operational research. We also note that the current Government Chief Social Scientist (Professor Paul Wiles) is due to step down from this position by the end of the year. In view of the importance of the social sciences to effective public policy, we consider it essential that the good work that Professor Wiles has put in train should be continued, and that steps to appoint a successor to this important position should be put in place as soon as possible.

*September 2009*

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**Examination of Witnesses**

Witnesses: Mr Nick Dusic, Director, Campaign for Science and Engineering (CaSE), Professor Geoffrey Boulton, General Secretary, Royal Society of Edinburgh, and Professor Roger Kain, Honorary Treasurer (and ex-officio Vice-President), British Academy, examined.

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**Q325 Chairman:** Welcome. Thank you very much for giving us your time and, also, for the written evidence that your organisations have already submitted, which will be part of the background to our discussion, I have no doubt. Can I remind you that a record is taken of this discussion and will be published as part of the evidence. You will see a transcript of that, probably within about ten days, to check, but we do publish the evidence. Finally, I understand that we are live on the web; doubtless you will want to take that into account when you raise the answers. Thank you very much. Can I start with, really, quite a broad question, but it is very central to what we are thinking about at the moment, which is how, within the UK, do we go about setting research priorities? That is the fundamental issue. It is given an extra edge—and one of the reasons we are conducting an inquiry now to follow up previous work we have done—because at 12.30 we will be hearing about cuts and more cuts, and we will hear a lot about that over the coming year, which will become a reality. We want to see how robust the system is, and we would value it, as a first question, if you would to tell us how robust you think it is at the moment. The other thing you have to do is give us your name, to be identified for the record that we are recording. If you give us your name and particular institution.

**Professor Kain:** I am Roger Kain, Vice-President of the British Academy.

**Professor Boulton:** I am Geoffrey Boulton, General Secretary of the Royal Society of Edinburgh.

**Mr Dusic:** Nick Dusic, Director of the Campaign for Science and Engineering.

**Q326 Chairman:** Who would like to start?

**Professor Boulton:** Let me have a go, just to soften this up a little bit. I think we have quite a strong view that the place not to prioritise is what we, in our submission, called the “upstream” end; in other words, you do not make choices about the sorts of thing you study. The reason for that, of course, is what we geologists call crypto-gensis; that is to say, you never know what the future might hold, you do not know where the important innovations in the future might come from—very often they come from the most unexpected areas. On the other hand, prioritisation is important, and we would argue that you prioritise the downstream end. Our submission very much directed itself towards the economic agenda, but I could generalise that for you, in a sense, to the whole agenda of research use. Our argument is that there are ways whereby Government, in particular, and the agencies in government, can make choices about economic and technological opportunities; and it should do so and send strong signals out to markets, to potential investors, in the hope that (and I think there are many examples which demonstrate that this is a realistic hope) that will attract investment from companies simply because they realise that there is a long-term potential for benefit in that state because of the long-term commitment to change. Once that begins to happen and you get investment at the downstream end, inevitably, that pulls on upstream activity, and many of us would argue that one of the problems that we have had in the UK is that the pull on the research base has been weak, both in the business domain and, also, in the policy domain. If one looks at the capacity of UK research, the mantra which we repeat to ourselves, that we are excellent by international terms, in my view, we do not use enough. On the other hand, I think we have to recognise how best to use it. One of the implicit assumptions that underlies some of the things, the research councils and funding councils are doing at the moment for example, is that it is technologies we are looking for; but I would say that, actually, what we need is talent more than technology. We really ought to be focusing on two fundamental processes: one of them is stimulating creativity amongst, particularly, young researchers and ensuring that we are able to attract some of the best talents of each generation into research and then, when they get into the research process, we are able to support them, give them responsibility and the like; and the other side of the coin, much more difficult one, I think, is how do we create processes which draw powerfully on the research base? I could go on but I will stop there.
Q327 Chairman: Not a supplementary for now but, maybe, you could drop us a line. You mentioned examples of where there had been economic and industrial business benefit from having a proper draw-through. If you could provide one or two things that would be very helpful, in fact.

Mr Dusic: Following on from that. I would like to move us to think a bit broader about the research funding portfolio the Government invests in. The research base is the strength in that system. It has been consistently invested in over the last ten years through the ten-year Science and Innovation Investment Framework, which is supposed to last till 2014. However, the Government does not just invest in the research base, it also invests through its own departments; it invests through the RDAs; it invests through the Technology Strategy Board; through Europe, through the R&D Tax Credits, and if you look over the last ten years—or even going back further, 20 years—there has been a real decrease in government department R&D spending; even over the last few years there has been a decrease of 28 per cent between 2004 and 2007 in departmental R&D spend. So we are already seeing cuts to part of the UK’s research funding system. Going forward, we need to look at the broad portfolio in much more clarity, more analysis of how we are expecting certain strengths to come through from different parts of the funding system. So the big weakness is that when we look at this portfolio there is not anyone, really, looking across the board. The Treasury is the one who decides how much people get, both within the research base and within departments and through R&D Tax Credits, but within the Treasury there is not a decision-making process to look at that broad portfolio and the balance between, and the return we get on, each of those investments.

Professor Kain: If I may, at the outset, just very much welcome, on behalf of the British Academy, your Lordships’ investigation of the whole breadth of the research base, including the humanities and the social sciences. You will see in the Academy’s submission (I think it is paragraphs 9 to 13) that we identify some of the key contributions that the humanities and social sciences can make to UK society summarised—the building of cultural capital, the informing of public policy-making, underpinning the wellbeing and quality of life of society, providing a basis for attracting international business by ensuring the cultural capital that the kinds of people working in those domains—business leaders, tourists and, of course, international students—demand. Further to that, I think we would see research as a multidisciplinary endeavour that there are few of the grand challenges that have been identified by the research councils or other agencies that do not require a multidisciplinary approach taking account of the humanities and the social sciences. The prime example that I would cite of that is climate change. If we are to mitigate climate change, we need to take account of the behavioural, the political, the cultural and the social components that underpin that. That said, I would see, from the Academy’s viewpoint, that the real strengths of the UK funding system as at present constituted are the plurality of the funding opportunities that are offered—funding councils with the block grants and the universities, research councils, the national academies and, of course, private philanthropic agencies. There is this plurality, providing multiple decision points and ensuring that an excellent piece of proposed work is highly likely to be funded. We, in the UK, in terms of the non-government funding, apply peer review so that all ideas for investment are reviewed by academics. The best research gets funded and I think the evidence is, and there is a lot of evidence—for example, a very recent report published by Universities UK and the Funding Council for England—showing that the highest quality research base generates the highest quality impact. The complementary nature of the dual support system (finally in this introduction) is a vital component, and one which should be retained. The ten-year Science and Innovation Investment Framework, and investment before that, has delivered huge benefits to the research base. The committed vision of that kind of length of planning enables strategic decisions to be made by universities over something like two decades, and we very much welcome hearing Gordon Brown saying in February 2009 that he pledges the support of the ring-fence.

Q328 Chairman: Thank you. I wonder if I could put two supplementaries: one very specifically to Nick Dusic and then a broader one? The broader one, so the others can be thinking if they want to comment, is whether or not there are any international comparisons. Are other countries doing this better than us? The one to Nick Dusic is that he pledges the support of the ring-fence. If you look over the last ten years—or even going back further, 20 years—there has been a real decrease in government department R&D spending; even over the last few years there has been a decrease of 28 per cent between 2004 and 2007 in departmental R&D spend. So we are already seeing cuts to part of the UK’s research funding system. Going forward, we need to look at the broad portfolio in much more clarity, more analysis of how we are expecting certain strengths to come through from different parts of the funding system. So the big weakness is that when we look at this portfolio there is not anyone, really, looking across the board. The Treasury is the one who decides how much people get, both within the research base and within departments and through R&D Tax Credits, but within the Treasury there is not a decision-making process to look at that broad portfolio and the balance between, and the return we get on, each of those investments.

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Mr Dusic: On that issue, we think there should be a chief scientific adviser within the Treasury department. This has been an idea that has been floated previously, including by the Government Chief Scientific Adviser, but it is not something that has been seen through yet.

Q329 Chairman: Would you support that?
Mr Dusic: I would definitely support that. Looking at this broad portfolio of investment, not just the research-based investment but the whole portfolio of public support for science and technology research, it needs advice on: one, the impact agenda; two, what the different streams are trying to do and how they complement each other; and three, the evidence of how the portfolio has been managed and been performing. I think a chief scientific adviser in the Treasury is definitely something that should be done. I also think there need to be stronger mechanisms—maybe, through the Government Office for Science—for looking across the board at the portfolio as well.

Chairman: Thank you very much. I know Lord Krebs wants to come in with a supplementary. Is it on this or should we take it after the international point?
Lord Krebs: After the international point.

Q330 Chairman: Do you want to comment on the international situation?
Mr Dusic: Briefly. Science and technology research is an international endeavour, and we need to be looking to what other countries are doing. Other countries are increasing their investment at this time in science and technology research, and we cannot fall behind. In terms of the different comparisons, one of the issues that this committee is looking at is strategic, mission-oriented research. In the States, departments play a much stronger role in this area, especially the Department of Energy in energy research (now the Department of Energy and Climate Change), and it does seem appropriate that they should be playing a much stronger role in energy research in this country. I think that is something that can be looked at.

Professor Kain: I think your Lordships have, in the very good submission from the Department for Business, Innovation and Skills, an analysis of the public service agreement metrics and how the UK shapes up, and indicates, broadly, of course, that we are punching well above our weight with a low level of investment in research in comparison with our competitors—1.8 per cent of GDP by comparison with 2.7, or thereabouts, in the US, and so on. The more immediate concern is, of course, that a number of our international research competitors have initiated stimulus packages in the recession: the US, in particular, but, also, Japan, Germany, India and China. Our research funding system is, by its outputs, a very efficient and a very effective one, but, with a lower proportion of funding going in than our competitors, that position must be fragile. If we wish to hold our position of second in the world, and the benefits that that brings in terms of the flows of international students and other research-based activities to the United Kingdom, then I can see a peril over the next two or three years.

Q331 Chairman: In fact, I was wanting to focus more on the systems in other countries rather than the volume. However much cash there is, does anyone do it better than us?
Professor Boulton: If we take two parts of this whole process—what I called the “upstream” end, which is basically the research that is done, and the “downstream” end, where it is used—I would take the view (and we are making generalisations at this stage, so I will make some), that at the upstream end we do very well, extremely well, and I do not think we have, frankly, a great deal to learn, except at second order, from many others. It does not mean, of course, that we should sit on our haunches, and if we are going to be able to respond to the investments that have been made elsewhere then we have to think structurally about how we improve an already good research base to make it even better. I think the real problems lie at the downstream end, and I would say there are two principal actors in the two broad areas of demand. One is in public policy and the other one is in, if you like, the economy. The actors are different actors: in public policy, it is largely government; in the economy, it is largely private industry and private business. They have different habits and different ways of behaving, so one has to separate those two, I think. What I will do is just talk a little bit about the economic end and the way others do it. One thing that differentiates us from a number of countries that, I think, are very effective in utilising their science base is that we do not have a business or industrial policy in this country. If you are in the States, the federal Government takes the view that it is not particularly interested in being seen to be a paragon of liberal capitalism, it wants to screw the market in order to bring benefit to the USA, and it does so by, at the Federal level, determining that there are certain sectors which it believes are going to be important in the future and it is going to make sure the research is done and make sure that companies get the signals they need. Other bodies, like the National Institute of Health (the Department of Energy has already been referred to), play a very similar role, and it is very much a process whereby they drive the downstream end of the system to give companies the confidence to invest. In Singapore, they have been systematically investing in biotech, although my sense is they are not doing this as well as they might. In Taiwan, years ago now, they decided that communications was going to be their central activity and they have been
immensely successful, for a relatively small country. In Germany it has been chemicals and the automotive industry. So that external companies—investors—know where to go when they are looking both for the research, on the one hand, and the translational activity that takes that research into utility. So if you want to find out how you should be designing electric cars, you do not go to Birmingham any more, you go to Voitsberg. I think that is one of the key things we have got to understand a little more about: the way in which others have used government capacity to be able to structure the downstream end of their enterprise. One of the questions I think we need to ask ourselves is: we divested ourselves of many research institutes through the 1970s, 1980s and 1990s, which played an important strategic role, do we need to reinvent them to create a function which is similar to the function of, let us say, Fraunhofer Institutes in Germany, which in a sense take the raw, basic research that is created within the universities and institutes and ensure that is pulled towards application, where industry can see that there are possibilities that they can seize upon readily and invest on a substantial scale without frightening their investors away. I think there is a lot to be learnt, particularly at the downstream end.

Q332 Lord Krebs: This is a question, really, for Professor Kain, following on the earlier comments he made. I wondered whether you, in the British Academy, have a view about what the research priorities in the humanities and social sciences should be. Or are you neutral on that question?

Professor Kain: I think that we would want the research priorities to be the result of a deep conversation between the various stakeholders who are involved. There is the academic constituency in the learned societies; there are the research councils and there is government. The British Academy is broadly content with the pattern of research priorities as have been established as between directed mode and responsive mode, though I think we feel that that kind of dichotomy is not always the most useful one. Where we feel that there is more attention needed is the way in which academics in the social sciences, in particular, but also the humanities, are involved in the policy making domain. Our criticism of the funding system as of now would be that government departments, which commission a huge amount of research, do it in a very different way to other areas of public research funding. There is much greater dependence on consultants, of hustling up experts at short notice, by comparison with the kind of peer review process which ensures fundamental excellence. So our concern is that some research evidence is policy-rated evidence rather than evidence-supported policy. I think you will find in the submission from Paul Wiles, the Government Social Scientist, that there is a need for a much more rigorous and more robust process for commissioning research and evaluating research in government departments. That would be where, I think, we would see that there needs to be some priority attention.

Q333 Lord Haskel: We have had quite a lot of discussion about the many funding streams and about the plurality of them. Indeed, you have listed some of them for us—for example, government departments, the research councils, Higher Education Funding Councils, the Technology Strategy Board and the Regional Development Agencies. Would you like to say on what different principles, or on what different criteria, each one should base its setting of priorities? What should it base its research principles on?

Professor Kain: If I may start with a comment on the Technology Strategy Board, the Academy has a concern that despite the importance of the creative and the cultural industries to the United Kingdom—and their fast increasing contribution to the United Kingdom economy—the Technology Strategy Board does not have a particularly significant face towards those areas. We do feel that there is something being lost there. Otherwise, in the public funding sphere, the Haldane principle is absolutely vital. The ability of the universities, with their block grant, to take a punt on risky research, to build the careers of the future research stars on the basis of the block grant by paying their salaries, the ability of the academies, by having their small funding streams, as the British Academy, to focus and build the careers of early career researchers—they are playing, all of these funders, a complementary role. I think the complementarity is as important as the plurality. It is no good having plurality if there is a lot of overlap, but our funding system, as placed at the moment, does have plurality with complementarity.

Mr Nick Dusic: I guess you can break it down in a number of areas. The research base, so the research councils and the Higher Education Funding Councils, need to be funding the highest quality research. Breaking the research council components down, you have responsive mode and directed programmes. The responsive mode side is extremely important, because many of the areas that science will bring for the future are ones that we have not thought about yet, and that is why the Foresight activities and other activities to try to pick those areas have been quite unsuccessful in seeing where science will lead us in the future. On the directed programme side, we have seen a change to these more large-scale, cross-council programmes, looking at big challenges, both to society but, also, to policymakers. The thing that we would like to see is, when there is guidance from government to the research councils, that the guidance is made transparently and made public, supporting the
Haldane principle. There is guidance that is given from government departments to research councils and that needs to be made public. The Regional Development Agencies are there to support collaborations between the university sector and the local economy, and those will be based on different criteria, as well the Technology Strategy Board supporting emerging areas of technology. I think there are a number of different funding streams, but for the research base it is the quality of the research that is important.

Professor Boulton: I think, first of all, one has to start by thinking of the functions that are required to maintain a healthy research base, and then think of the institutions—whether the institutions we have are addressing the right functions. For me, the functions are, first of all, to stimulate creativity in research across the whole spectrum, particularly ensuring that younger people are attracted into research. Secondly, I think we need to ensure that we can stimulate cross-disciplinary work, which is partly about structures, and often those structures are in our universities. One thinks of the potential of universities; they are unique institutions insofar as they embrace the whole diversity of human understanding, and yet, internally, they are often like little universities themselves—the university of physics, the university of social science—and, actually, the universities, I think, need to think very deeply about how they drive their activity. Of course, the drivers for the universities are external funding streams, with metrics attached to them. Unless you have intelligent metrics, and that is an extremely difficult thing to do, then you will not get intelligent behaviour or the behaviour one is seeking to achieve. Other issues, I think, are key strategic areas where, let us say, a new area of science or social science or the humanities suddenly begins to flower and blossom, and you really want to put resource behind that area. I think that is a key function. Another key function, of course, is maintaining skills and capabilities. Where does that lie? Who decides whether we have enough engineers? Many of us believe the next era will be another heroic era of engineering; the question is where are we going to get the engineers from, because they are not coming through the system at the moment? So one thinks of a set of functions of those sorts, and then says: “What institutions do we have and are they doing the right job?” I would say that the universities are not doing a particularly good job in the cross-disciplinary domain at the moment and we need to think deeply about how we make it easier for them to respond to the challenge. I think they are not doing a particularly good job in another domain, and that is that I think the great danger in Britain (and it is a danger which I think has already shown signs of some pathologies in the universities) is that research becomes the enemy of teaching and education rather than its necessary complement. If you ask what are the drivers, in the behaviour of my young colleagues, who are admirable in every respect, the key drivers that are passed down from vice-chancellors and deans and heads of department are actually: “When is your next paper coming out in Nature?” There is nothing analogous to that on the teaching side. So I think that it is very important not to divorce a consideration of the UK research base, much of which is in the universities, from the influence that has on the education we give our kids in the universities. I think the research councils try to do far too much, and I also think that in many ways they have an erroneous model of the way in which the world works. If one looks at the sorts of things that they are doing at the moment—they have a concern for interdisciplinary, they think that is important, they are concerned to support what we call blue skies research, but they are also concerned to try to push innovation out from the universities by start-ups and spin-outs and all those things, and my sense is that that is not a particularly efficient way of working. I would far prefer them to be concentrating on really stimulating a strong, powerful and, indeed, ambitious research base and recognise that no one made too much money in the national economy by simply trying to push start-ups or spin-outs from universities. It does not work like that. I think, if you look at the things they are doing in relation to impact, my view is it is based on a quite erroneous premise and it is beginning. I think, to have some quite damaging consequences. I would like to see the whole system thought through much more carefully. In our submission we argue that the TSB could potentially have a very important role, because if one takes the view that government ought to be more aggressive in, if you like, placing bets on future technologies or future sectors, then it needs to have an agent as well. The role of the TSB could be a significant agent. Then, of course, the research councils say: “Surely you don’t mean you are going to give them some of our money, do you?” The answer is, probably, “Yes”. At the moment, the research councils have this terrible decision; they believe—and I think erroneously—that they have to make a decision about pure and applied research and that it is a zero-sum game; if you expand one you have to diminish the other. Actually, if we can bring in greater investment at the downstream end it does not become a zero-sum game any more and applied research, I think, has the potential for stimulus that, at the moment, we are not capturing.

Q334 Lord Haskel: You seem to think that the RDAs and the TSB seem to be in touch with business for better or for worse and other sectors are dealing with, as you put it, stimulating creativity. Do our
other witnesses agree with that? Do you feel that is a correct apportionment?

Professor Kain: I do not want to disagree but I just offer an alternative view, which is that the Regional Development Agenecies have a key role to play. They play it across the country in very different ways; they are very different organisms from one to another. One of the potentials that they have, and which some of them realise, is to bring universities together in a collaborative sense. One of the issues, as we go forward, is going to be building scale and critical mass to retain international competitiveness. Even the biggest science department is going to need to get bigger, and one of the ways in which you can build capacity is to collaborate. If I might just draw your attention to an example from south-west England, the South West England Regional Development Agency, working with HEFCE and my university at Exeter, and Bath and Bristol, has produced a vehicle called Great Western Research, which brings together the research capability and capacity of the three universities plus the other higher education institutes in south-west England across a number of areas of activity which are of critical importance to the south west of England. Sustainability is one of them, and the creative and cultural industries is another. Together, that collaborative weight means that there is a real international competitiveness. One of the disappointments in the RAEs of the past, and by the looks of things the Research Excellence Framework of the future, is a lack of obvious incentivising or facilitating for those kinds of collaborations. When it comes down to it, universities are autonomous institutions, competitive in one sense, one with another. However, for the better organisation of research they need to be more collaborative, and anything that can be done to encourage collaboration like that, to build critical mass, is to be welcomed. My feeling is that the Regional Development Agencies have a considerable role to play in that.

Q335 Lord Krebs: A very brief follow-up to Professor Boulton. If I understood correctly, you were saying (and perhaps I am over-interpreting it) that the research councils should restrict themselves, largely or even entirely, to responsive mode funding and not try to have managed and directed programmes and set priorities. Is that what you are saying?

Professor Boulton: No. I was saying that I think that their responsibility ought, primarily, to be to support the creativity and the strength of the research base. I think there are several things that one needs to do there; obviously, the responsive mode is crucially important, and all research councils agree in that regard. I think they also, collectively, have a responsibility to ensure that funding is available for major cross-disciplinary issues. They have moved very substantially in recent years in that direction. I think that one of the responsibilities they have, in the directed mode, is to identify areas where certain opportunities arise within the research base within the United Kingdom and, for a number of years at least, whether it is worth putting strategic funds to support those activities. I have a question in my mind, actually, about where responsibility for ensuring that we have the manpower required comes from. I think that is an interesting issue, and I am not sure where it lies. Can I, if I may, just refer back to Lord Haskel and, if I dare, correct him? You said I seemed to think that the RDAs and the TSB did this. Actually, no, I think the RDAs and the TSB should do it this way. Thinking about their function is very important; they are there, and my view is how do we evolve them? Some of the RDAs, I think, are beginning to do really effective jobs and some of them, I think, have got a rather confused idea of their function.

Q336 Baroness Neuberger: We have already got partly into this subject. Professor Boulton, I think you have been very clear about where you think the research councils should be; Mr Dusic, I think, you feel strongly that the government departments have a greater role to play in some of the direction and, Professor Kain, I think you feel strongly about the social science bit, but who should be responsible for doing the co-ordinating and, indeed, the funding of both the fundamental, curiosity-driven research or the research to support specific policy objectives, and then you could add the mission-oriented or grand challenge research for societal benefit? Who is responsible for that? What are the mechanisms and the criteria you will use? You have done some of that, I think, particularly Professor Boulton, in your discussion with the research councils. Which of you would like to start on that?

Professor Kain: I would just come back, Lady Neuberger, to my initial points that the strength is in the plurality, and that I am not sure that there should be a super-arching decision-making group which is setting out the priorities for the various components.

Q337 Baroness Neuberger: I completely see that, but what about pulling it together and co-ordinating it, and seeing what is going on? I completely accept your argument, saying that you do not necessarily want somebody saying: “only do that”, but what about pulling it together and seeing where things are being duplicated and where, actually, some people should be working together who are not? How do you do that?

Professor Kain: I think that there are vehicles for that within the funders’ forum and around the table of Research Councils UK, and in the discussions which
the national academies have. Every discussion of that kind that I am involved with, or hear of, is premised on ensuring that there is not competitiveness but there is complementarity. I think that that has worked; that where there is overlap, the mechanisms for setting priorities through the delivery plans of the national academies and the research councils, for example, provide the opportunity, at that point, for that overlap to be dealt with and to ensure that there are not gaps. The gaps, I think, are there and, if they are, they are, again, a result of a productive discussion. If I think of my domain where we have the two research councils, AHRC and the ERSC, there are very careful protocols that have been established to ensure that a piece of high-quality work does not fall down the crack and not get funded simply because it does not seem to fit.

Q338 Baroness Neuberger: So you think the co-ordination is actually happening? Professor Kain: I think the co-ordination is happening, and it is happening in a kind of competitive basis that no one wants to be doing something which they are not getting the best value from because someone else is doing it but doing it better or at a bigger scale.

Professor Boulton: Let me give a couple of principles first, and then a couple of examples, one good, one bad. I think the principles would be that if one thinks in functional terms, different bodies should have different functions, but some duplication is a virtue. We need, in a sense, to see this mosaic of science and its research and utility in Britain, understand what we want of it as a society, and ensure that the building blocks—the mosaic tiles—fit together reasonably. I am not going to give you a prescription (you can probably guess what I would say). I think that is a key issue, and it seems to me, at the moment, we have become rather muddled because the amount of duplication, I think, is excessive. If you ask the question: if we are doing something large that requires all these capacities to be drawn on, how do we go about doing it? Let me give you a bad example: one was the BP bio-fuels institute where the UK was one of three bidders and we hopefully failed to get our act together. The implications of that were enormous: $1 billion of investment. It could have been a tremendous fillip to energy research and, of course, the important social science policy elements of safety were there too, and we totally failed simply because we had no means—and probably no track record—of getting our act together in a sensible way. Although we were one of three bidders, we were never going to win.

Q339 Baroness Neuberger: Okay, so we should be able to do that then.

Professor Boulton: We should be able to do that.

Q340 Baroness Neuberger: We will do that how? Professor Boulton: Reference has already been made to a funders’ forum. I am not suggesting that should be the place where it should be done, but a forum of that sort which brings quasi-independent entities together to have a clear view of their role—that they are able to shake the system down so that, at least, it produces the goods, I think, is a key issue. Let me give you, though, one good example, and again it is in the energy domain: I think that the collaboration between research councils and the Government Office of Science and others in government, in relation to energy, has actually created collaboration which has broken down university walls across the UK, and even though the total investment is nowhere near as big as, in principle, it ought to be, my view is that we are doing extremely well in that domain. What I would like to see is a much stronger sort of demand from industry, and I think there are ways in which government could create demand which would permit the Energy Institute and its various connections to work even better than it currently does.

Mr Dusic: I just agree with Professor Boulton’s point on the need for better understanding of the mosaic of research funding; I totally support that call. Around curiosity-driven research, we have the UK funding system, research councils and the Higher Education Funding Councils, but there is also the European Research Council who works in this space, and it works in a different way and it funds just on the basis of the highest quality research criteria. It is worth remembering the European component when discussing the mosaic. Government departments are the only people who will fund policy-driven research; the only ones who know what the policy research needs are, and so it is critical that they retain their departmental R&D budgets for that purpose. Around the mission-driven research needs, I spoke briefly about the cross-council research programmes, and those are an attempt to move the research councils in that direction. Some of those do have policy relevance to them so that the government departments should be spending a bit more money in making those proper collaborations work, which was the hope for a number of them when they were first set up. There is also a European dimension here, with the framework programmes, which is meant to, in the future, go towards a grand challenge-led approach, possibly, in the next framework. So that is worth remembering. On bringing co-ordination around industry, the TSB is there to bring co-ordination around sectoral needs, so I think we should make the best use of it and keep seeing how it progresses, but supporting it as it goes along.
Chairman: We are beginning to run out of time. I think Lord Warner has a quick supplementary, which means a quick answer, basically, and then Lord Cunningham, I think, has a point.

Lord Warner: We are very good at actually creating new bodies to co-ordinate in this country on public policy. Do I take away from this session (though you have not said it overtly) that you actually think there are too many actors on the stage?

Q341 Chairman: I see one head nodding. Would you like to put it in words through the microphone, please?
Professor Boulton: The answer is yes.

Q342 Chairman: Thank you—that is a good, short answer.
Professor Kain: My answer would be no, because I believe in the plurality.

Mr Dusic: I think we would need a bit more understanding at the Treasury about the plurality of research funding, and that is the right focus.

Q343 Lord Cunningham of Felling: Can I direct this question to Professor Boulton, if I may, please? Was I right to conclude from what you said earlier, when you referred to the United States of America and the Federal Government, that you think there is a dislocation in the UK between our basic fundamental research and where we should be directing national efforts economically and industrially?

Professor Boulton: Yes, I think there is. We have been hounded, in a sense, by a common agreement that picking winners is a bad thing. I think, in general, that is right; you pick winners—and certainly when I go to the races once a year, I pick winners and I always lose. I think placing bets, in a sense, is another way of thinking about it. In other words, we ought to have some bets out there about what the future might hold. Some are pretty sure-fired bets: we need to think seriously about how we are going to accommodate our technologies, our industries and our society to climate change—that is a given. However, I think recently the Council for Science and Technology (and I was a member of the group that did some work on this) produced a paper, which I certainly recommend to you, which was about how government goes about making choices, and we were asked by the Treasury to look at something like 125 different technology priorities that had come from government departments and bring them down to five that had the potential to bring a return on a decadal timescale.

The way we did that, we developed a method which said that we should prioritise those areas where the UK is amongst the world leaders (if not the world leader); where there are very large markets (and “large” meant in excess of 100 billion globally); where we have the companies with the capacity to take things to market; where levers of regulation or even funding were in government hands and could be manoeuvred; and where there are unlikely to be major public objections to the development of a technology or a particular area. So we identified on that basis. So I think the answer to your question, coming back to it, is yes.

Q344 Lord Cunningham of Felling: What needs to be done to bring an end to that dislocation, other than appointing you to Whitehall?

Professor Boulton: I have a nice old boat on the west coast of Scotland and could not possibly spare the time! You must not tempt me to suggest changes in mechanisms of government—I do not think that is my role. Lodged within government, my view is that there needs to be a strategy—an industrial business strategy, if you like. Given that the present government has already indicated very clearly that it would like to see not so much a shift away from financial services but, actually, a re-emphasis on manufacturing, for example, my view is that the way to do that is to think very seriously in exactly the domains I have talked about. If I were to identify someone, I understand we have a government minister who is the Lord High of Everything Else, and maybe he should think about it.

Q345 Chairman: That would be one way of doing it. Thank you very much for your presence. We have not been able to cover all the topics that we indicated we would like to cover, but could I invite you, if you have comments on some of the ones we pointed to, to give us a written response? That would be very helpful indeed. Thank you for your time; it has been an interesting session and the transcript will be available within ten days, I think. Thank you.

Professor Kain: Thank you all very much.
Memorandum by the Association of Medical Research Charities

The Association of Medical Research Charities (AMRC) welcomes the opportunity to submit written evidence to the inquiry.

AMRC

AMRC is a membership organisation of the leading medical and health research charities in the UK. Working with our member charities and partners, we aim to support the sector’s effectiveness and advance medical research by developing best practice, providing information and guidance, improving public dialogue about research and science, and influencing government.

Established in 1987, AMRC now has 120 member charities that contributed over £935 million to research in 2008–09 aimed at tackling diseases such as heart disease, cancer and diabetes, as well as rarer conditions like cystic fibrosis and motor neurone disease. Over the past six years AMRC charities have spent over £4 billion on research in the UK, contributing significantly to our knowledge and understanding in the life sciences, medicine and health.

Our evidence is based on the views and opinions expressed by member charities in response to an AMRC survey conducted in September 2009. Comments from members in response to the survey have been included in text boxes in our submission where relevant.

We are aware that many of our members have also submitted written evidence to the Committee. These naturally reflect concerns specific to their field. Nonetheless we believe consistent themes emerge which we hope the Committee will note in the course of its inquiry.

What is the overall objective of publicly-funded science and technology research?

With respect to medical and health research AMRC believes that the overall objective of publicly-funded science and technology research is to improve health and wellbeing, prevent and cure disease where possible, and diagnose, treat and ameliorate where not.

How does the UK’s science and technology research funding strategy and spend compare with that in other countries and what lessons can be learned? In this regard, how does England compare with the devolved administrations? How will the current economic climate change the way that funds are allocated in the future?

The UK has a diverse and vibrant medical research charity sector which contributes approximately one third of all public funds to research in the UK. Of the £935 million of spent by our members on research in 2008–09, approximately 83 per cent was spent in England, 14 per cent in Scotland, 2 per cent in Wales and 1 per cent in Northern Ireland. This pattern of expenditure has remained consistent in recent years and we do not anticipate significant changes in the foreseeable future.

AMRC data shows that the UK charity sector is second only to the US in terms of its expenditure on medical and health research and far exceeds the contribution to research by NGOs in Canada and Europe. The UK sector is also a global leader in terms of its expenditure as expressed as a proportion of all public funding on research.

1 Based on AMRC subscription data collected 2008–09
2 Online survey conducted by AMRC in September 2009 to which 26 member charities responded in full.
3 op cit
More over, the uniqueness of the research charity sector in the UK is even better defined by a number of other factors: a commitment to funding research of the highest quality according to a common set of principles; a unity of purpose on key issues such as the necessity of animal research; a dedication to working alongside other partners in the UK research enterprise and, of course; the huge public support on which its work is founded.\(^4\)

A dominant theme for research charities currently, as for other funders, is the impact of the economic downturn. Although AMRC’s evidence\(^5\) points to the sector’s expenditure being down by only 4 per cent overall this year, this hides wide variations within our membership with smaller research charities—and by their nature those funding research into less common disorders—being particularly hard hit. Our forecast is that 2010–11 will likely be more difficult still as our members are impacted by the consequences of public service cuts and the drawing of funds away from research for other initiatives.

Nonetheless our survey of members about the recession in March 2009 demonstrated that research charities are committed to developing strategies that will enable them to maintain their commitment to science through this period—for instance, almost two thirds (63.9 per cent) of members who responded to our survey at that time said they were looking at co-funding opportunities.\(^6\)

**How are public funds for science and technology research allocated?**

Overall, AMRC believes that the UK now has a more robust strategy for medical and health research since the establishment of the Office for Strategic Co-ordination for Health Research (OSCHR) in December 2006. This has included a sensible prioritisation of cross-cutting themes such as e-Health, translational research and public health research. It has also been supported by significant Government investment. We would also affirm that these initiatives have done well to target and focus on specific areas of concern while maintaining an appropriate balance in funding: basic v applied etc.

“We believe that OSCHR has been tackling the right questions over its first two years, although it is still far from clarifying and optimising the routes through which translational research is funded.”

Although it remains early days for OSCHR, the results of its work are beginning to influence the strategic thinking of the wider funding community including medical research charities. In our survey, just over two fifths of charities (42 per cent) who responded said that the establishment of OSCHR, the National Institute of Health Research (NIHR) and associated reforms to improve clinical and translational research had influenced their research funding strategy either a great deal or to some extent.

“The creation of OSCHR has improved transparency in the way clinical and healthcare research funding is allocated and has encouraged us to investigate the possibility of developing funding partnerships as part of our strategy to provide more people with the opportunity to participate in clinical research.”

But the overall impact is patchy; continuing opaqueness in decision-making processes plus a lack of concerted effort to engage the charity sector in general is undoubtedly preventing many other AMRC members from seizing opportunities—and this despite OSCHR prioritising such engagement activity in its first progress report in 2008.\(^7\)

When asked, 88 per cent of the members who took part in our survey felt that the way in which public funds are allocated to science and technology research could be more open and transparent to them as research funders. Comments from our members included the following:

“It is very difficult to find details on what is being spent in a specific research area. For example it is currently impossible to determine what funds are going towards gene therapy. It is important to know what support is being given to inform charity decisions.”

“Our status as a patient-representative charity which also funds research seems to vary from one funding stream to another—and in some cases, there is no opportunity at all to partner with academia or industry in initiatives of core importance to us.”

“At present, high level policy decisions on how research funds are allocated seem to ‘filter down’ in a rather haphazard fashion to charitable organisations, unless they happen to possess a dedicated public affairs team. Greater effort should be placed on establishing a more effective communication process.”

\(^4\) Ipsos MORI poll: September 2008 (Commissioned by AMRC)

\(^5\) AMRC subscriptions data for 2009-2010


\(^7\) OSCHR, Chairman’s First Progress Report, 2008
It is also clear from our survey that Government and its agencies need to work hard to counter the perception of smaller medical research charities in particular that the system is unfairly biased against their involvement:

“The amount of money small charities give to research precludes involvement. The assumption here is that spending more money means better quality research which it doesn’t. This is unfair. It’s not all about money.”

Medical research charities are cognisant of the difficulties for Government in consulting with a wide range of stakeholders and in a way which does not hamper effective decision-making. However, there is a strong view from our members (80 per cent of respondents to AMRC’s survey) that charities could be engaged earlier and on an ongoing basis:

“Bring the stakeholder groups together at an early stage, include condition specific charities where appropriate. We know what needs to be done, what isn’t being done and we know where money is being wasted.”

“The more information available, the greater the likelihood that common funding priorities can be identified and the smaller the chances of inadvertently creating ‘research gaps’.”

“We think that more effort needs to be made with communication to help researchers understand the changes in place following the establishment of the Office for Strategic Health Research (OSCHR), and to make it easier for them to know where they should apply for funding.”

Are existing objectives and mechanisms for the allocation of public funds for research appropriate? If not, what changes are necessary?

Approximately (70 per cent) of research charity funding goes to higher education institutions (HEIs) across the UK, and AMRC and its member charities continue to support the dual support system for funding research in the UK.

For medical research charities the most significant recent development within the context of this system has been the establishment by the Government of the Charity Research Support Fund (CRSF). Set up in 2006, CRSF is an important acknowledgement that charity funds should not be used to pay for indirect costs associated with research and provides funds to universities to cover some of these overheads.

CRSF’s operation has been strengthened in recent years with revised guidance from the Higher Education Funding Council for England (HEFCE). Nonetheless significant questions remain over whether the monies available through CRSF are sufficient going forward. In addition, AMRC believes that HEFCE, universities and university associations could be doing much more to raise awareness of CRSF within institutions and, with it, the importance of medical research charities as a source of income. Unless and until these issues are addressed we remain concerned that researchers are being discouraged by their institutions from applying for charity grants as amply highlighted in Breast Cancer Campaign’s report earlier this year: “Full Economic Costing (fEC): the effects on charity-funded research.”

Against this background, it is absolutely essential that Government commits itself to CRSF and appropriate funding levels for this mechanism in the long-term if charities are to continue to be a growing source of research investment income in coming years. A message echoed in the recent Research Councils UK/Universities UK review of fEC.9

The Committee may also wish to note that a not dissimilar system for funding allocation has also been established by NIHR for clinical trials and studies in the NHS. Under this scheme, NIHR will meet the NHS support costs of eligible funding partners. Once again, however, the process by which eligibility is granted has been opaque and not without its difficulties for charities to navigate. Following representations from AMRC NIHR is now looking to improve this process.

How is publicly-funded science and technology research aligned and co-ordinated with non-publicly funded research?

How can industry be encouraged to participate in research efforts seeking to answer societal needs?

AMRC member charities are increasingly active in looking to form collaborative funding arrangements with other partners including industry and the research councils. It is also clear that the recession has brought into sharper focus for all funders the potential opportunities and greater reach through co-operation.

8 “Full Economic Costing: the effects on charity-funded research” Breast Cancer Campaign, 2009
From the response to our survey, it would appear that AMRC members are generally—but not always—positive about their experiences although we would urge that collaboration continue to be prioritised by all funders going forward:

“Our experience has been with the MRC in terms of clinical training fellowships and this was extremely positive and they were very easy to work with.”

“Our experience of collaborating with the MRC has been overwhelmingly positive. We collaborate on two fellowships, and have found MRC eager to collaborate and willing to pick up the FEC aspects of the grants.”

“Since a lot of charities for rare diseases are small or medium size trying to partner with the MRC feels like we are supporting the MRC rather than the other way round.”

“We recently made considerate efforts to establish a partnership with the MRC. The problem is that the MRC funds overheads that the charities are excluded from and this makes transparency—what exactly is the money used for—difficult. Since a lot of charities for rare diseases are small or medium size trying to partner with the MRC feels like we are supporting the MRC rather than the other way round.”

**How can industry be encouraged to participate in research efforts seeking to answer societal needs?**

A recent report by the Alzheimer’s Research Trust has indicated the potential opportunities that could arise out of better co-ordination of research funding across different sectors—public, charitable and private. The study completed by the Office of Health Economics, found that publicly-funded basic research—science carried out to understand fundamental principles, such as what causes Alzheimer’s disease—appeared to stimulate particularly high levels of private investment. For example, one US study analysed in the report suggested that a £1 investment in basic research led to £8.38 of further investment over eight years.

Looking across AMRC’s membership as a whole it is clear that an increasing number of medical research charities are forming highly innovative and dynamic relationships with industry in which the focus is on identifying research priorities for future funding. We expect this trend to continue and are ourselves conducting a short piece of work this autumn to explore how patients and patient groups can be more involved in discussing future research priorities and by which mechanisms public and patients can be engaged and involved in setting priority areas, as that is likely to lead to short-term fluctuations in funding levels, which could be very harmful for research.

However, there is much more widespread support within the sector (63%) for finding suitable mechanisms by which the public and patients can be engaged and involved in discussing future research priorities and by which they can participate in funding decisions:

“Yes, with caveats. I think public engagement is very important in setting priority areas, but it needs to be informed by expert thinking on how tractable these areas are, and in developing a research strategy to meet these needs. We have developed a network of over 150 ‘voices’ who we involve in developing research strategy as well as in policy and campaigns. At the moment we are running a survey asking them where they feel the most important research needs are, based on their own personal experience. We would not claim that this is academically robust research, but we are finding that one issue in particular—the problem of accurate diagnosis and prognosis—is cropping up very regularly. This is certainly something we will take into consideration when we develop our new research strategy next year.”

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10 “Forward Together,” Alzheimer’s Research Trust, 2009
11 “AMRC/National Voices/James Lind Alliance Workshop: ‘Does industry listen to patients and if so why?’” October 2009
12 AMRC 2007
We feel that this debate should therefore not be couched only in terms of identifying the most appropriate research questions for future funding but also in terms of finding the best mechanisms for involving the public and patients in such discussions. This should be on an ongoing basis and managed in ways in which all participants are clear about the role they are being asked to play and with what purpose. We would be happy to discuss these issues in more detail with the Committee.

September 2009

Examination of Witnesses

Witnesses: Mr Colin Smith, Director of Engineering and Technology, Rolls Royce, Mr Simon Denegri, Chief Executive, Association of Medical Research Charities, and Ms Anne Glover, Chief Executive, Amadeus Capital Partners, examined.

Q346 Chairman: Good morning. Many thanks for coming along; it is much appreciated. You will see we have nameplates out; my name is Sutherland and I chair the Committee. We have the embarrassment, would you believe, where the House of Lords Select Committee on Science and Technology is being slightly delayed by technology. We are web broadcast live and as soon as that is in place we can formally go, but I can cover the preliminaries. There is a transcript and a recording being taken of our business. This will be published as part of the evidence as with any report that we issue. You will see a copy of this transcript within ten days or so. There will be a copy sent to you in case you have any comments. Perhaps a last point on the questions, we are going to be, we hope, very disciplined—he said, looking around the Committee—and short, precise and concise in our questions with a view to covering the ground completely; your cooperation would be appreciated. The way in which we operate is basically to pick up the themes we have notified you of and take them in order. I understand that Anne Glover has to leave before the end of this first session. We appreciate you being willing to come early and you can see the eagerness of the Committee who have all come early, starting at ten o’clock, to take evidence. Right the system is on, in which case may I simply ask you to identify yourselves for the microphone so that your voice is picked up on the record.

Mr Smith: I am Colin Smith, Director of Engineering and Technology for Rolls Royce plc.

Ms Glover: Anne Glover, Chief Executive of Amadeus Capital Partners.

Mr Denegri: Simon Denegri, Chief Executive of the Association of Medical Research Charities.

Q347 Chairman: Thank you very much indeed. Initially we will probably be focusing on the business/industrial connection, but can I start with a fairly general question that each of you might want to respond to. What do you understand about, or would wish to be, the role of publicly-funded research vis-à-vis privately-funded research? Should there be an interplay? Should they be completely separate? What are the relationships?

Mr Smith: In our view, as an industrial company, we think that publicly-funded research in collaboration with private research has a huge part to play in helping create technology and end products. I will talk about aerospace, but I could talk about the nuclear sector as well. Typically, a new material will take 20 years to go from a sticky black mess in a test tube to something that we can fly around the sky. It is a hugely competitive environment on a global stage and certainly for the first 10 or 15 years of that research you are not sure if there are going to be any benefits. So it is quite hard to convince, in a normal economic cycle, that we should put that level of effort in when it may fail. So when grants are available that we can work with other companies, cross-sectoral if possible with the academics, it is hugely advantageous to us. I would say geographically other countries are much more coherent and stronger in funding than the UK. If it is about creating a strong UK or European economy, I think you have to look at what the rest of the world does.

Q348 Chairman: Could I just ask you to expand on the word “coherent”? You said that other countries are “more coherent”.

Mr Smith: Some of the other areas we operate in are Germany or Singapore and the US. The US has a huge military funding theme and has NASA. You know when you are going towards them there is a budget allocated year-on-year which you can have access to if you are competent.

Q349 Chairman: You as a private company?

Mr Smith: Us as a private company or as an industry and then we have to compete. In Germany it is very similar, there is the aeronautical research part. It is very clear, two companies fight over the allocation. We know it is consistent and coherent year-on-year. In the UK we are never quite sure what the theme will be in the next couple of years and if you have 15 years of technical research to get something that is close to product, it is quite difficult to know whether you can build a technical team with an infrastructure behind it when you are constantly having to apply on a regular basis.
Q350 Chairman: I think this is a very important issue and central to what we are doing, so can I just press you on one further point? In the UK you suggest it is variable from year to year; where is the source of that variation?

Mr Smith: It is actually variable on a three-year cycle but the source of the variation is that there has not been, until fairly recently, a great deal of support for manufacturing. If I went back five or six years we used to have a civil aerospace research fund and also a very strong military research fund, particularly into aviation: the ministry one has all but dried up and the civil aerospace one has now become non-sectoral, so we have to compete on a given theme, generally requested by the Technology Strategy Board.

Q351 Lord May of Oxford: How does what you have just said square with the fact that if you compare us with Germany or the US (I do not know about Singapore), as a percentage of GDP, we spend much the same on basic research but industry spends about two-thirds, if that, on R&D compared to Germany. I realise Rolls Royce is a bad place to begin in answering that because Rolls Royce is unusually good, but by and large our private industry is the source of the great gap between us and other countries in total R&D; in public spending and basic research there is not much of a gap.

Mr Smith: I cannot quite recall the data but I thought the UK number was 1.8 per cent whereas Germany was 1.3 per cent.

Q352 Lord May of Oxford: For the public it is 0.7 per cent.

Mr Smith: I was not aware of the public number.

Q353 Lord May of Oxford: Sorry, 1.8; 0.7 is the public spend. So it is 1.1 compared to something more like 2.0 in the States.

Mr Smith: As a company we spend something like 2.0 in the States.

Q354 Lord May of Oxford: You are exceptional.

Mr Smith: Why are we exceptional? Maybe that is the question, but I cannot answer it other than to say that we do have technology that enables us to compete with one or two other companies on the global stage and there are not many other truly global companies based in the UK that make things.

Q355 Lord May of Oxford: Probably you are exceptional because you are exceptional in the way you spend.

Mr Smith: We are also really driven by competing with the guys we compete with. If we are going to stay in business, we have to have a reasonably high level of research and development expenditure.

Q356 Chairman: Ms Glover?

Ms Glover: I have looked at this analysis before and completely agree with the numbers you have just mentioned, but I believe when you look at the sector mix you find that our sectors in the UK are not as R&D intensive relative to Germany in terms of the population of companies and their market capitalisation. So those who can—do; it is just that our whole economy is not shifted in that direction at the moment. To come back to how the public and private sector researchers should interplay, there is no choice, they will always do it. Research at the basic level is a global market. Talent for leading academics globally moves around the world in many ways more easily than industrial talent does. What we find with industry—and I speak from the small company sector—is that spin-outs and small companies cluster around academic institutions where world-leading research is being done and the interplay of both the flow of talent of the students that come out of those departments into those companies. The actual spin-outs themselves—not necessarily the academics but the ideas—that then develop around research institutions will inevitably follow the nature of the inquiry that that individual group is following. I do not even think that we can choose; it will happen. The market will dictate that leading research institutes will then create around them leading companies and attract leading larger companies to come and work alongside them in research areas that are alike. So the choice of the areas what basic research is done in dictates an awful lot about how the whole economy works.

Q357 Chairman: When you say “choice of the areas”, just to avoid ambiguity do you mean intellectual areas or geographical areas?

Ms Glover: I mean sector areas, the biological sciences versus physics versus chemistry. The intellectual areas are left to the academics. The leading academics will make those choices, but where the funding is by sector, I think these choices are not always made at the university level.

Mr Denegri: From a medical research charity point of view, I think the first thing we would say is that we see ourselves as quite a significant and unique feature of how medical research is publicly funded and publicly driven in the UK. In terms of the different roles that funders play from a government perspective, we see them as providing the right research base and environment, the setting within which that activity can be funded as well as nourishing disciplines and filling gaps. From many of my members’ perspectives they see industry as bringing scale which enables innovations to be realised. From our own perspective, we see our role very much as having a mission-driven/public-driven approach to funding
activity, funding people, funding grants that are outcome focused.

**Q358 Lord Krebs:** I would like to come back to a point that Anne Glover raised and ask her if she would not mind following it up. You mentioned that the market for academics is global and academics freely move around between countries in following where there are jobs and suitable funding facilities for their research. As we saw in the last week or so, the Pre-Budget Report indicates that there will be a significant cut in public funding for research (the number £600 million has been reported in the papers, although the details will still remain to be worked out) and I wanted to ask you what you think the impact of any funding cuts of that scale would be on not just the public research endeavour but on private investment in research in this country.

**Ms Glover:** It is impossible for me to speak on the economic impact because I am not an economist. Fundamentally, if it is broad based and not thoughtful it will not have a good effect, but if it is targeted there will be ways of reducing its impact I would argue. It will not have a good effect simply because there will be fewer opportunities to attract the best academics in the world unless the chairs are endowed by industry or by charity in some way. So it is going to make a difference. It would make less of an impact if the cuts are targeted more carefully.

**Q359 Lord Krebs:** Could you say how you would target them?

**Ms Glover:** I am not in the academic environment so I step well outside my area of competence here, but I believe it is possible to identify where world-class research is being done and protect it more effectively than the broader-based research that is in smaller niche areas. I would think that is possible.

**Q360 Chairman:** Colin Smith, do you want to come in on this?

**Mr Smith:** I would just make an observation. We do not have data, but from our travels we can see that many of the growing countries of the world are valuing Western academics to come and set up universities in Saudi Arabia, Middle East, the Far East, and, like Anne says, my gut feel is that in the UK we do not necessarily reward academic excellence but we try to spread across too many universities and, bluntly, I think we ought to recreate polytechnics, but I will not go down that route.

**Q361 Chairman:** That would take us back a year or so.

**Mr Smith:** I just think that good departments with good academics breed success and a lot of academics, if the research cuts follow, will take the advantage of going to the Middle and Far East and they will be welcomed with open arms.

**Q362 Baroness Neuberger:** Do you think the Government is doing enough to incentivise industry or, indeed, the charitable sector to invest in R&D? I think you are saying that there are ways that it could be much more targeted and there are obviously ways that you think we could keep academics in the country if we thought differently. I suppose what I would like to ask all three of you—perhaps starting with Anne Glover—is what incentives do you think are available to encourage private-research funders to participate in UK research efforts, whether they be UK-wide or very specifically in one institution?

**Ms Glover:** The incentives that exist today are very much about creating an entrepreneurial environment, when you are talking about investment by companies in R&D, because they have to see that investment pay off in some way. So you may think this is outside your remit but it moves to tax policy. The things that really matter for entrepreneurs to stay here and invest in R&D in new companies are the capital gains regime which is more favourable than income tax and is almost as favourable as the US—not quite but almost. That needs to be protected. The R&D tax credit allows younger companies to capture back the tax effect of their R&D payroll (this is a vital part of cash flow for young companies) and frankly it then goes to capital markets making the company successful and ability to exit. I can talk about that later, but this economic environment where an entrepreneur thrives is what matters, coupled with the presence of excellence in research in certain areas. That is what I think the Government has done and needs to continue to protect. The TSB, who will provide evidence later, is plays a central part in coordination, providing the connections between the small companies and large companies and universities. From the small company perspective, the economic and tax environment has to be favourable or entrepreneurs will go elsewhere. They are the most mobile of any market.

**Mr Smith:** I have a couple of things to add to that. I think the Technology Strategy Board is a positive step; I think its funding is an order of magnitude too low (I say that on behalf of Iain who is behind me). One of the things you have is basic research and then to create economic advantage you have to be able to take it to market; it is not just the big companies with global access but we obviously help to support all the SMEs and the infrastructure around big factories as well. If you just concentrate on basic research then, once you have a stable whatever it is that you have created, you can move that in modern manufacturing to anywhere in the world unless there is a further incentive or a financial environment that makes it worthwhile staying here. I suspect if you look at
pharmaceuticals that is the case in terms of pure manufacture. You really need to be coherent from the long-term research all the way down, in our view, to the manufacturing base. Once you have a strong support base in all the SMEs then there is a fundamental reason why you do not want to move because you know you have the support and the people who are capable of doing it. In our business we have 14 different bases in Norway and the cluster effect there is huge on world class technology that supports the oil exploration industry.

Q363 Lord Oxburgh: I think a moment ago Anne Glover more or less said that entrepreneurs really want to see a return on their investment. I think the key question is: what is the timescale of that return? Ms Glover: What do they want to see it in or what would we, as an economy, like to see it in?

Q364 Lord Oxburgh: They are the ones who have the money; in what sort of timescale are they going to want to see a positive cash flow? Ms Glover: As a venture capitalist we tend to fund the investors. We get money from pension funds and we pass it on to entrepreneurs and we like to see five to 10 year returns in terms of our investments. Right now, the holding periods have gone up to eight, nine, 10 years because there have been no exit markets. That is too long and because of that length of holding period the pension funds unilaterally are not interested in backing venture capital at the moment. When the market takes too long, what happens is our funding dries up and that is why there is a financial value chain that is currently close to being broken in the economy. That is what is so dangerous for young companies.

Mr Denegri: From my sector’s point of view, I think I would actually start by answering the question in a slightly different way. I would hope there is a very strong incentive for our research partners in working with us because we are very internationally distinctive, I think. If you look at our funding levels, the connection to the patient, the fact that we operate to the same standards as a sector, I think it would be very hard to find it anywhere else internationally. Over the last five years, we have seen funding from the sector increase by about 30 per cent. In general, particularly medium and small charities feel to some extent that the system out there is a little bit complacent and a little bit dismissive of that contribution. In terms of particular incentives, I think all my members without exception would say the most important incentive is to continue the operation of what is called the Charity Research Support Fund which was introduced in 2006 and that recognises the money that is being provided by charities has a very different provenance than any other funding stream. It enables universities to meet some of the overheads that are incurred with charity-funded research. I think, at its simplest level, without that fund in place, it can be the difference between a charity going to a member of the public and saying, “donate me a pound and I will spend it on research” and “donate me a pound and actually quite a significant proportion of that will go to funding overheads and funding university infrastructure” and that would be a huge disincentive if the fund was not there to help support what we do.

Q365 Lord May of Oxford: I actually think there is a bit of confusion here in that the medical charities, as I see it and as conventionally accounted in this discipline, are part of the research base, whereas the other two of you are, in a sense, reaching out to the “D” of R & D. The quarrel about the indirect costs, in my opinion, while important, is a distraction. Let us not pursue it but I think you are a different kind of animal from the others and one should understand that. You are “R”. We are unusually good—we are second only to the States—in the fraction of the basic science that is funded by medical charities.

Mr Denegri: I would absolutely agree with that, but you asked about incentives and the Charity Research Support Fund is a key incentive to our sector and I do not think that should be forgotten.

Q366 Chairman: These are the problems, but do you have any solutions in terms of making sure that the funds do not dry up? We have other jurisdictions in the United Kingdom. If Scotland were to say, “we’ll reduce or change the rate of business tax” would that make a difference? Or if there were regional opportunities to do that across the UK would that allow certain regions to boost industry? Ms Glover: If I may reach forward to the end of the value chain, this is a cycle and money and wealth are re-invested if they are successfully made. Our capital markets are a really vital part of our economy. They have been changing dramatically, almost unnoticed, in the last 10 years and one of the things that is an anomaly in the UK is a thing called stamp duty on shares and it has even been threatened that there might be a Tobin tax on other financial transactions which would be even worse. The liquidity of the London market is an essential asset to whether or not people stay and list their companies in this country. I have heard the Treasury say that this raises maybe as much as four billion in stamp duty. However, much of that is being traded at the FTSE 100 level and we have this anomaly all the way down into AIM and into private hands. There is a half a per cent and the cost of trading on the London Stock Exchange today
is 90 per cent tax. They have cut the costs of their trading down to 10 per cent. It is 90 per cent tax and it reduces liquidity and, because of that, investors are not interested in using it as a market. If we could simply experiment by getting rid of stamp duty on private shares and AIM listed shares. It would be a very modest hit to the Treasury and it would be a very interesting experiment in micro-economics: when you lower the cost of something, does the volume go up? If the volume goes up, then more investors will come to this country and be interested in buying into our smaller companies. It is something that is, I think, a low-risk step that will then enable those prices to be more realistic, attract more investors and then make the whole financial system work better. I would like to say take it off the whole of market but maybe that is too big a step in this current economic climate.

**Mr Smith:** I would say it is about efficiency as much as anything. We have mentioned some of the devolved governments but, again, when we have applied for research and technology grants it is quite strange and very inefficient to have to go to all the different regions and hold your cap out. Although many of them are trying to do a good job, we ended up on a research programme recently where we had to get 12 different contracts, which is bizarre, so I employ two or three people extra—which is just a tax on me—to chase these regions and, despite them trying to do a good job, frankly, whether I make a component in Newcastle or Derby when you are a global company, it seems almost trivial. To be fragmented inside the UK has created a huge inefficiency, it feels to me. Having said that, of the £3.4 billion into science and research, whether the percentage into pure research (compared to the ability of applied research that creates the economic wealth) is right, I think we would question that because, as I said earlier, the economic benefit comes mainly from creating the goods or services that are subsequently sold.

**Q367 Lord Oxburgh:** Publicly-funded research is done in a variety of institutions in this country, not just universities but many other organisations as well. What do you feel about the way priorities are set for public spending in these areas?

**Mr Denegri:** I would say, in the sphere of medical health research, we have seen quite a few strengths emerge in the last few years: the development of the Office for Strategic Coordination of Health Research and the NIHR which has a very cohesive and coordinated approach; the UK Clinical Research Collaboration was crucial in bringing together a very wide group of partners in terms of those sorts of discussions; and we have seen the establishment of things like clinical research networks (a real infrastructure which enables trials to happen and studies to be funded) and that has been backed by a lot of money. I think there is a sense in the sector that we are tackling the right issues, but I think (you probably picked this up from my written evidence) it is not quite clear how those different mechanisms fit together and how they relate to one another. I think in general there has been a lack of communication and engagement, certainly with my membership and, again, I think that gets in the way of them understanding quite why something is strategic, understanding the opportunities for them to partner or collaborate with people, and there is an impression that at times there has been a very haphazard filter of information down and it is very difficult to get a proper handle on what the bigger picture is.

**Ms Glover:** I am not aware of how the priorities are set at all; it is not obvious to me in research.

**Mr Denegri:** I would agree with Anne, I am not sure how they are set. However, it does seem to me that they are set on a much more academic base than what the real value is going to be to the economy, but that is just a feeling and certainly how EPSRC works. The actual pull through to the value-add to the country is fuzzy.

**Chairman:** This is really at the heart of what our inquiry is about, not least if there are to be cuts then I think there will be forced upon us the question of priorities unless it is a fairly random across the board basis.

**Q368 Lord Crickhowell:** I want to go back, if I may, to the very interesting comments of Colin Smith and relate them to what Anne Glover said. Anne Glover emphasised the key importance of the groups that form around the really good research at universities and so on. Colin Smith has been addressing the point that the CPI has given to us that we are spending apparently 10 times as much of our funding on the university sector and there is not anything like enough coming through the Technology Strategy Board, the Energy Technologies Institute, the Carbon Trust and so on into the onshore development phase, where you take the brilliant work of universities and turn it into actual marketable products. We are getting two slightly different views but the real core is scarcity. Therefore, we must go on funding the universities at this scale but the trouble is that we do not have enough funding through the various bodies to get the vital next phase going. Can we have just a little more clarification of exactly where the balance is and how we deal with the problem that seems to exist?

**Mr Smith:** I will give a couple of examples, if I may, where it is often viewed as big industry versus SMEs; it is often portrayed that way which is a little uncharitable. We have recently helped, or ended up acquiring, three or four small companies that span out of some of the universities. When it came to
Let me try to square the circle: I am not actually on a different side of the equation. What I was saying, and I believe to be true, is that entrepreneurs will cluster around world-class academics and, therefore, we have to support those groups. Let me use Southampton University in the area of optoelectronics and photonics, Cambridge physics, Cambridge chemistry, Edinburgh microelectronics. These are world-class departments with world-class opportunities for spin-outs. Those are the ones that people cluster around; they do not cluster round any research, they cluster around the best in the world. What you then get is exactly the phenomenon that we are describing, a wonderfully synergistic environment where you have academics doing leading research, you have small companies starting and trying to apply that, you have large companies coming in and taking those applications and continuing the research on a scale basis and the whole community working to keep the UK in the lead in a field commercially and academically. It is not basic research in every area in every university in every department; it is focused, and that is what I mean by a cluster. Does that help?

Lord Warner: Listening to this discussion, it sounds really as if we are back to the old story of picking winners. Effectively what you seem to be saying, if I have understood it, is that the entrepreneurs are quite smart at spotting the world-leading science and work that is being done; people with capital spot them; the big companies like Rolls Royce spot them. The SMEs cluster around these so money and big players congregate around particular areas. You seem to have mechanisms for actually finding this whereas the Government seems to struggle to find the Government to target its procurement resources on more innovative solutions to societal problems in a way that encourages innovation locally and actually helps support that early commercialisation phase. This is because it is the procurement of research and development—the procurement of proof of concept ideas—where, if the MoD and the Health Service actually also added, those budgets are huge, and if a tiny percentage of those focused on innovation in the United Kingdom it would make a big difference. It is already being spent so this is not adding to the budget, it is re-targeting it more effectively. That is one way that I would imagine you could begin to get to the early commercialisation phase more effectively.

Lord Crickhowell: I am entirely with you on that. I am just trying to see how we fill the gap that has been identified none the less in the development phase. We have already heard evidence about devolution. I was particularly interested in the answer about the drawbacks of breaking up the United Kingdom. It therefore sounds as if the Regional Development Authorities are not the right way of filling the gap. We have heard that the Technology Strategy Board is probably under-funded. How do we fill the gap further down the line in getting better development of the brilliance around the good universities?

Ms Glover: There is a vehicle within the TSB that is only just starting which is called the SBRI, which is the Small Business Research Initiative (it is actually not just “S”). In addition to proof of concept funding, it is possible for the Government to target its procurement resources on more innovative solutions to societal problems in a way that encourages innovation locally and actually helps support that early commercialisation phase. This is because it is the procurement of research and development—the procurement of proof of concept ideas—where, if the MoD and the Health Service actually also added, those budgets are huge, and if a tiny percentage of those focused on innovation in the United Kingdom it would make a big difference. It is already being spent so this is not adding to the budget, it is re-targeting it more effectively. That is one way that I would imagine you could begin to get to the early commercialisation phase more effectively.
Q371 Lord May of Oxford: Could I add my question to that? You were saying that the Government wastes a lot of money by well-intentioned political actions like Regional Development Agencies trying to create things and, indeed, unsuccessfully trying to mitigate it. When I was Chief Scientist I likened it to the cargo cults in Papua New Guinea where people saw aeroplanes coming with goodies so they started clearing strips so that the aeroplanes could come in and land for their community. It does not work that way. Are you really saying that the Government is not spending its money wisely and is almost counterproductive in many of the things it does?

Ms Glover: I would overstep my boundaries by going that far. I do not think we can pick winners in the way that you are talking about. I think winners emerge and when you find one then you back it and that is the difference. We have a lot of failures to find our winners and I am sure the Government will as well. We have to tolerate those failures; we have to let companies go; we have to stop initiatives and then when we find ones that really look as if they have traction and then get behind. That is the mechanism by which you focus resources. I do not think the Government reacts fast enough. Let us take the human genome, which you know a lot more about than me, as an absolute phenomenon in world science we could get behind it even more as an area of science that will make a huge difference to the economy as well as to society. That is one example.

Mr Smith: Picking winners is a term that often has two contexts, one is that in basic research it is quite hard to pick winners. As you move up the readiness chain, then you would want to pick a company that was going to win or someone who could take it to market because how else would you understand what the customer needs? So where you have a strong sector—in whichever sector it is—why would you not help target finance towards those because you are in a global economy and someone else will if you do not? An instance would be in the new nuclear area. This is a very biased comment because I have more nuclear engineers than anyone else in the country. How am I going to employ them? I need to move them off the submarine business into the nuclear business, but where is the supply chain? If we are going to be a follower, the French, the Americans and the Japanese own all the supply chains. We have a God-given opportunity to help create a new civil nuclear business, back to where we used to be, but we have to be entirely coherent in thinking it through from the research at the top end with the Manchesters and Imperials, all the way down to who is going to bend the metal. At the moment we just do not quite get that top to bottom thinking. We want more mathematics teachers and physics teachers. This is not my quote, but if you are smart enough to do physics at A level you are smart enough to know there is not a job afterwards. Creating a nuclear business will give you that synergy and connectivity, and then you drive a whole sector.

Q372 Lord O'Neill of Clackmannan: Can I come back to the role of the RDA? At a reasonably local level somebody has to provide infrastructural support for any kind of enterprise or cluster development. I think there is a case for RDAs but I think what you should be looking at is which roles the RDAs have at the moment which are not as significant at a local level which really need to be nationally determined. In the creation of a cluster, it becomes quite easy for the RDA to deal with it but, in those areas or activities where there is not a cluster, the money falls through the cracks because there is insufficient resource at the centre at the moment and this is because it is given to RDAs in general terms. Some industries, because they are spread thinly across the country, even if they are technically advanced, are not of a character that would create a cluster; but there are others which are virginal and they will grow very quickly once the seed has been planted. I think you have to be a wee bit more focused in your criticism of RDAs because I do not think you have made the case for separating the research function from the infrastructural support function which is probably is the one that we are best at.

Ms Glover: I completely agree. The question is, the even distribution of research and development support into all regions, is that the most effective? Infrastructure?—absolutely. That is local; it has to be local.

Mr Smith: I would totally support that. My criticisms on the technology side are that it did not feel efficient to do it that way whereas on the infrastructure side the RDAs are hugely supportive in creating those industrial clusters.

Q373 Lord Krebs: Coming back to Anne Glover and perhaps also to Colin Smith, you used the phrase that we cannot pick winners from basic research, winners emerge and then we have to back them. The major research universities, almost without exception, have organisations within them that are meant to promote the development of spin-out companies. My own university, Oxford, has Isis Innovation which plays this role. I wondered from where you sit how effective these organisations are within universities. Is that an effective way to back the winners and get small companies started as a prelude to private funding coming in?

Ms Glover: It is getting better. Isis is getting better and the Cambridge Enterprise is getting better as well. There is still a tendency to back too many, but as long as we all tolerate failure and accept that 90 per cent will not work then that is fine. I actually think that it is the expectation placed on them that is the problem.
rather than what they are doing. The majority will not work and we should not expect success. The fact that people have tried in itself is fantastic; it is the one or two really great ones that matter. It is actually much later in the value chain that you get behind them, not at the spin-out stages. It is two or three years later. If I may make one point about an area that we are invested in which is, I know, somewhat controversial at times, but it is the plastic electronics area. That has some successful spin-outs already, already 10 years old, but the field is moving on so fast that the university alone cannot keep up and neither can the company, so that is an area that is already emerging as a massive field that we could lead in. If we invested more in it at the basic level and at the applied level you would see more companies form.

Q374 Lord Methuen: How do existing mechanisms encourage collaboration and coordination in research activity between government, academia, industry and the charitable section? What changes, if any, would you suggest?

Mr Smith: Certainly EPSRC and the TSB do encourage very, very strongly collaboration between the different groups, to some extent too strongly. For instance, a couple of years ago, trying to persuade aerospace and automotive to get together, it was almost chalk and cheese in terms of the capabilities in most cases (in some areas like electronics there are some synergies). In general, we do a lot of collaboration; it is a mixture of supply chain and the big companies and the research companies and the advanced manufacturing centres that have recently been set up in Sheffield and there is one in Bristol being set up. They are a great way in which public funding has been put up to create a very, very collaborative atmosphere. You have the machine tool vendors there, you have the academics, you have the big companies—Airbus, Boeing—and we all work together because it is basic research where one in 10 or one in 20 ideas might work. There are some really good examples where it works very well and other examples where it is just not so strong all the way down the value chain.

Mr Denegri: From our perspective we are seeing a real increase in collaborative activity. We are currently doing an exercise at the Association to identify a map, collaborations that charities are involved, in both within the sector and across sectors. That work is at a very early stage, but we have already identified a hundred collaborations or partnerships of one form or another. An increasing feature of that collaboration, of course, is collaboration with pharmaceutical companies and I think it is true to say that whereas 10 years ago that collaboration or partnership may have been very much around marketing or information, we are seeing a lot more upstream dialogue between charities and industry in terms of trying to identify the right research questions, the right strategy and partnering through the whole pipeline. I can give you some very good examples of that. One of the things that struck us when we did the survey as part of our submission was that quite often that collaboration happens by chance and opportunity. We had people present to our annual general meeting three different types of collaboration and in two of those cases it took a significant other to be an agent provocateur for that collaboration to happen and quite often that was an MP or equivalent putting quite significant pressure on the Department of Health or another department. I think the way these will emerge will be opportunistic. It is interesting to me that we have an exercise that is currently with OSCHR in identifying UK health priorities and national ambitions for medical research and that is due out in the early New Year. Although the charity sector has been engaged since the very beginning of that process there has not been, as far as I know, an ongoing dialogue about what are the collaborations around the priorities that might emerge from that exercise. It is this whole engagement early on and ongoing that I think a lot of our members would say is missing from the current approach by government.

Q375 Lord Haskel: What is the role of government in this collaboration? Is it funder, purchaser, adviser, observer on social change? What actually is the role of government in this collaboration?

Ms Glover: I think the TSB has taken on a very important role which is supporting the networks and also supporting collaborative R&D between industry and university, and then also creating focus around specific challenges which they call innovation platforms. That ability to bring parties together needs to have people who are funded to do that and some money to crystallise it and I do not see that there is anybody else holding a candle for the UK in that group, other than a government-funded body. So the candle that has to be held for the UK is an entity which the TSB is currently fulfilling that brings all this together. A company has to look after its shareholders; the researcher has to look after their university, so there is a role for government.

Mr Smith: If the Government were to do a benchmarking exercise against some of the other big economies of the world that value knowledge-based industry, I think we will find that we are not as coherent in terms of national strategies compared to China or India where there are very clear aerospace and science national strategies which the whole supply chain and educational system are geared towards. This is an international competition for economies and, as Anne said, big companies have to go for the value to their shareholders.
**Q376 Baroness Perry of Southwark:** My question is coming at the same issues—industry funding, private funding, charity funding and university, government-funded research—but from a slightly different angle. Many universities and academics within universities feel as if they are almost being pushed towards more commercial application research; for pure research they do not get any brownie points and do not get as much money for. Whether that is a real perception or not, it is there, it is reflected in reality. I wondered what our witnesses felt should be the ideal balance between pure and applied research. It is an old chestnut, I know, but it is one that I think has risen to the top of the agenda for many distinguished researchers now.

**Mr Smith:** That is a hard question. If we look at the economies—I am not an economist—what actually adds value is not transportable and a lot of manufacturing industry or process industry is exactly that. Once you have created a world class industry, it is difficult to transport it, whereas a lightweight software company you can put on an aeroplane and move it to Shanghai. You need to make sure you have a scattergun of research but, as Anne said, it has to be targeted at good, top quality centres and create the ability for good people to learn from others. We just appear to be scattergunning it to poor centres as well as good ones. As you go down the technology chain from pure research to applied research, you just have to have decision gates in a slightly different process. If there was a national theme for space rockets, for instance, at least everybody would know what the direction was. We sort of flip-flop between it all being about finance to it all being about low carbon, but we do not have a windmill industry so why would you back that? It does not seem to be coherent within the lengths of times; in aerospace it is 15 years before you become cash positive on a project at least, so way outside the timescales. A lot of other big investments are that sort of length of time. It is really hard if you are not coherent from the top.

**Ms Glover:** I find it a very difficult question to answer in terms of balance because it presumes there is an optimum and I do not know whether there is. There are leading indicators that you can look for and if I looked at it as a company, if my best people are leaving because there is not enough basic research then I have a problem with my basic research budget. I cannot tell you where the answer is but I can tell you that you can see the symptoms if you have got it wrong and that is where you need to address it. That is probably the best way of answering.

**Q377 Baroness Perry of Southwark:** Can we see those nationally? If we were getting the balance wrong, if we did start at government level pushing the balance too far in one direction or the other, would we be able to see the symptoms nationally?

**Ms Glover:** At university level, the vice-chancellors would be able to tell you surely. I would think so.

**Mr Denegri:** From a charity perspective, I would agree with Anne, there is not an optimum and it is very difficult to give a very definite answer to that, but, of course, three or four years ago we had a very vigorous debate about this subject before the setting up of OSCHAR. I think we would be encouraged by the fact that, despite that concentration on translational research, for instance, although it is still early days perhaps in terms of taking forward these policies, there has not been a huge distortion out there that is causing considerable concern.

**Q378 Chairman:** Can I say thank you very much and try to itemise two or three things that I think have come out of the discussion? It would be interesting to have any written reactions if you think this is missing something out. Talking very significantly about the gap between very good basic research and market result identified a number of different types of problem. One is, at a very high level, the tax on trading and shares and the impact this has if you want companies to invest and to set up within the UK. That is a government matter, a very high level matter. Secondly, the problem that I think Colin Smith pointed to very clearly is that for some types of transition to market and, indeed, research you need large investment sums. You gave the example of the cost of the infrastructure of testing what is on the seabed and small companies cannot pick that up and, therefore, there is an issue of where they find that kind of money: is it alliance with a large company or is it to go the venture capitalists? We have had discussion on the role of TSB; is it filling that gap? I think the suggestions have been that perhaps yes, but they do not have the funds to fill some of the key areas. That is a point that has been made more than once. Overall, if we were going for space research or if we were trying to develop a new automotive industry—not something I would recommend—that would at least give a direction and funds would begin to appear in the right boxes. One of the key questions has been how these things emerge and it is clearly partly creating the context in which it can happen but, secondly, when it does, making sure that the context is there to take it to the next stage. I think a lot has been done in the context of what can happen. These are the problems you have helped us identify. The point about local infrastructure, having tried to do this kind of thing, if somebody does not put roads in and create little places where you can put up cabins or whatever, then you have got a problem. Maybe you have Trinity College standing behind you with its vast funds, but if not you might need something local or regional. There is the possibility of mis-spending because all of these initiatives rest in different places. That is a reaction to some of the points. I would
encourage you to think whether there is anything that we have not covered that you would like to have brought out and, if so, we would be very happy to receive an addition to your very helpful written evidence. Thank you very much. You have spent time with us; I know there are many other demands on your time and we appreciate what you have done.

Ms Glover: It is a great pleasure, thank you.
Mr Smith: Thank you.
Mr Denegri: Thank you.
Supplementary letter from Rolls Royce

May I thank the Committee and its Chairman for the opportunity to appear before them on 15 December 2009.

Lord Sutherland of Houndwood offered (Q378 refers) to accept information in addition to my verbal evidence if there were areas that had not been covered that may be of assistance to The Committee in their work.

Consequently, I thought it might be helpful to set out Rolls-Royce plc’s view of the development of the United Kingdom’s civil nuclear industry in the context of science and technology and specifically in relation to the development and manufacture of high value-added nuclear components.

This area is of particular interest to Rolls-Royce because we believe that there is a once in a generation opportunity to re-build the UK’s civil nuclear manufacturing capability. Moreover, for the UK manufacturing base to take advantage of this global opportunity urgent action is needed.

CURRENT SITUATION

There has been an extended lack of UK civil nuclear new build activity since the build and commissioning of Sizewell B between 1987 and 1995. This, coupled with the broader decline in the manufacturing sector, means that much of the capability used to deliver that programme has now been lost. Those companies still engaged in the UK’s nuclear industry have been sustained largely in activities relating to waste management and decommissioning, in-service support or the naval nuclear propulsion programme.

Very few UK companies have been engaged in the small number of global civil nuclear programmes that have continued post the Chernobyl nuclear accident of 1986. Notably, programmes have endured in Japan, South Korea, France, where strong industrial localisation policies have preserved (or in the case of South Korea developed) indigenous nuclear industry capabilities. Globally, this is the exception, not the rule.

In addition to loss of industrial capability, the UK’s civil nuclear reactor research, design and development capability has also severely declined. This was amplified with the sale, by Government of BNFL-owned Westinghouse to Toshiba. The UK is now in a position where it owns little, or no, modern civil nuclear power plant intellectual property.

One positive piece of news that Rolls-Royce welcomes is the decision that the planned closure of Imperial College’s research reactor (Consort) has been delayed for a further seven years.

As a result of this general loss of capability, as Government, power utilities and reactor vendors discuss future plans for the UK civil nuclear power programme, our indigenous nuclear industry faces the significant challenge of winning high value nuclear component manufacturing work against some major challenges.

These challenges include:

— The historic under investment in people, processes and infrastructure.
— How to compete with established nuclear component supply chains, some of which include reactor vendors themselves.
— A lack of intellectual property in the reactor designs being considered.

In addition to the local market issues, globally governments with explicit localisation, inward technology transfer and strategic industry support policies are putting pressure on reactor vendors to source components, systems and services from within their own countries.

This manifests itself in the UK through both price pressure and a difficulty in engaging with reactor vendors on an international basis, as they are aware that localisation will be a major competitive factor in winning market share in some geographies.
SETTING RESEARCH AND FUNDING PRIORITIES: EVIDENCE

ADDRESSING THE CHALLENGES
To overcome these challenges and succeed in domestic and global markets for high value nuclear reactor components, Rolls-Royce plc believes that five important steps must be taken:

1. Ensure the UK’s nuclear new build programme proceeds on time and is delivered to budget
2. Establish global nuclear manufacturing technology leadership position for the UK
3. Create, recognise and support a clear national nuclear champion which has a global reach
4. Urgently re-establish the UK’s nuclear research infrastructure to deliver a prominent UK role in global nuclear technology programmes
5. Deliver targeted development and support for nuclear-specific skills

Taking each of these in turn:

1. **Ensure the UK’s nuclear new build programme proceeds on time and is delivered to budget**

   The planned timing of the UK’s nuclear new build programme places it in a unique global position. Westinghouse and Areva are the two reactor vendors who have committed to the UK market and, while they are both involved in other programmes that are further ahead, these are all either in the reactor vendor’s home market or have significant cost, time or quality problems.

   The UK therefore represents a unique opportunity for Her Majesty’s Government, power utilities, reactor vendors and the wider nuclear industry and its supply chain to demonstrate that we can work together to deliver a programme to time and budget.

   A number of elements need to be brought together to ensure delivery of this programme:

   (a) Completion of the “facilitative actions” set out by Government in “Meeting the Energy Challenge, A White Paper on Nuclear Power” particularly in the areas of licensing, planning approvals and grid infrastructure. The establishment of the Office for Nuclear Development has been helpful and further progress could be made if departmental accountabilities were further clarified by the appointment of a single programme office with cross government authority.

   (b) The conditions must be created to attract utility investment in new nuclear power in the UK. Power utilities have lobbied for some time for increased clarity on carbon pricing and resolution of this issue between Government and the utilities is needed to remove a source of uncertainty that may delay these major investment decisions.

   (c) Ensure that the resources required to deliver are well understood and communicated as early as possible in the programme to give industry the chance to invest to provide them when needed.

   As long as the UK’s programme is running successfully and ahead of other “non home regulator” programmes around the globe then it will attract high interest and commitment from reactor vendors and give UK industry to chance to catch up with incumbent reactor vendor supply chains. If however the programme drifts then the supply chains of other countries will get this opportunity and the UK will then have to overcome not only current incumbents but other early entrants as well.

   The development of the UK’s indigenous capability is key to our new build aspirations, without which the UK will have no control over its programme which will be openly competing in an international arena for finite and scarce resources. The risk is that, against this backdrop, the potential for UK industry to realise this global manufacturing opportunity will be missed.

2. **Establish global nuclear manufacturing technology leadership position for the UK**

   In the absence of product intellectual property the UK supply chain must use other means to differentiate itself from the incumbent supply chains previously used by reactor vendors. The application of advanced technologies and lean manufacturing techniques has the potential to provide differentiators in the following ways:

   — Cost and lead time reduction through application of near net shape forming technologies, advanced joining techniques and rapid machining methods.

   — Conformance and quality assurance benefits through process capability modelling, automated inspection and design for manufacture techniques.

   — Product performance and ageing enhancements through advanced materials and treatments.
The implementation of these advanced approaches for nuclear components requires collaboration between academic, manufacturing and industry specific experts to:


— develop improvements, justify them to industry standards bodies and regulators and then implement them in real manufacturing facilities.

The recent launch of the Nuclear Advanced Manufacturing Research Centre (coordinated in its early stages by HMG and Rolls-Royce plc but now also including Westinghouse, Areva and the Universities of Manchester and Sheffield) provides the environment in which this close collaboration can happen. Continued support for this centre and coordination of other industry support schemes to encourage companies to join the centre is needed to turn the promising start that has been made into real industrial progress.

It is the integration of world-class University research programmes, together with the industrial knowledge of the UK’s supply chain which makes this development a potential global leader in high value manufacturing techniques.

3. Create, recognise and support a clear national nuclear champion which has a global reach.

Rolls-Royce plc believes that the development effort needed to make UK supply chain competitive enough to displace those currently used by the reactor vendors is significant and needs to be well coordinated to have the necessary impact, quickly enough. Competitive rivalry between reactor vendors means that this coordination will not happen naturally and while the NAMRC will help greatly we believe there to be a legitimate role for a technology neutral “national champion” to integrate the nuclear component supply chain. The national champion would deliver benefits to the UK by:

— Providing a single view of the market opportunities available.

— Consolidating quality and programme requirements across different reactor vendor standards and designs, where possible.

— Aggregating materials procurement across similar products across the supply chain, where economic.

— Deploying its global reach to identify export opportunities and provide objective international competitive benchmarking to UK companies.

Rolls-Royce plc is well placed to play this role as it is able to bring its experience in managing a nuclear components supply chain from the naval nuclear propulsion programme. Advances are being introduced into the new Naval manufacturing facilities being developed by Rolls-Royce in Derby. We can consolidate the requirements of the civil and naval programmes and are working with reactor vendors to discuss how we might be able to bring these benefits to the UK nuclear components supply chain.

4. Urgently re-establish the UK’s nuclear research infrastructure to deliver a prominent UK role in global nuclear technology programmes

While the steps outlined above have the potential to secure a meaningful role for UK industry in the build of the current generation of reactor designs, long-term sustainability of the industry depends on it developing its own product intellectual property. This most effective way to achieve this is through participation in international (mainly EU and US) programmes for the development of next generation technologies. This work will take a multilevel approach that again addresses technology maturation from early stage research through demonstration programmes and on to full industrialisation.

The UK’s current nuclear research infrastructure is weak in the area of high power materials testing and while world class irradiated materials examination laboratories have been built at Sellafield, they have yet to be fully commissioned. Attracting investment to such long-term research facilities is always challenging and a multi-sector approach including the possible markets for medical radioisotopes may be a way of solving this issue.

Rolls-Royce has developed a unique University Technical Centre network, initially with universities from the UK, which has now been extended to have global reach. There are well developed plans to continue to extend this further to provide a partnership arrangement to cover nuclear engineering disciplines which will take advantage of developments worldwide and bring these together to focus on key areas for the UK to provide global technical leadership. This partnership will have strong interface with the NAMRC to enable the latest technical advances in manufacturing to be brought to market in realistic timescales.
5. Deliver targeted skills development and support

Establishing a leadership position in manufacturing and re-establishment of the support for nuclear skills will rely on and stimulate significant growth in the UK workforce’s nuclear capability at all levels. From leading academic researchers, to safety specialists, manufacturing engineers and quality assurance professionals, the UK’s nuclear industry must re-grow the base of capability that has been eroded over two decades of reduced activity. This will take concerted, coordinated efforts to ensure the right skills and expertise are developed in time to support the UK’s nuclear aspirations. Bodies such as the National Skills Academy for Nuclear and the Nuclear Advanced Manufacturing Research Centre must continue to be properly supported to help deliver this.

The capability of the UK to deliver the new build programme has been assessed extensively recently (eg Parliamentary Select Committee on Science and Technology in July 2008, Royal Academy Meetings in December 2008 and Feb 2009 and in the COGENT study from 2009). Within the defence arena, a new initiative has been launched called the Submarine Training and Education programme which will ensure the development of nuclear skills in the MOD and its major suppliers to underpin future developments including nuclear propulsion requirements. Rolls-Royce has committed to be a major contributor to this programme.

In the academic environment, industry is discussing its future needs with universities and training providers to establish new courses and modules for engineers in order to meet the needs of nuclear new build. Although significant developments are being planned, strong leadership is required from Government to facilitate the success and integration of these developments.

Summary

In summary, Rolls-Royce plc believes that if the UK’s nuclear programme can stay ahead of other Western programmes that are deploying Areva and Westinghouse technology outside their home markets, then there is great potential for resurgence in the UK’s nuclear industry, both domestically and for export.

Further, if the UK can establish a leadership position in manufacturing technology and mount coordinated domestic and export campaigns it can become a major force in international nuclear component markets.

This success will endure as long as the current generation of plants continue to be built, but will need to be underpinned by advanced technology and product intellectual property for future nuclear power reactor designs if the success is to be sustained.

27 January 2010

Memorandum by the Technology Strategy Board

The Technology Strategy Board, established in July 2007, is a business-led organisation with a leadership role to stimulate technology-enabled innovation in the areas which offer the greatest scope for boosting UK growth and productivity. We promote, support and invest in technology research, development and commercialisation for the benefit of UK business. We spread knowledge, bringing people together to solve problems or make new advances.

Our vision is “For the UK to be a global leader in innovation and a magnet for innovative businesses, who can apply technology rapidly, effectively, and sustainably to create wealth and enhance quality of life”.

We welcome the opportunity to respond to this inquiry and have set out our response below against questions set by the Committee.

How are public funds for science and technology research allocated? Who is involved at each level and what principles apply? Where appropriate, is the Haldane Principle being upheld?

The Technology Strategy Board receives a three year funding allocation from the Department for Business, Innovation and Skills (its sponsoring Department) as part of each spending review settlement. The allocation is provided and is set in the context of a Framework letter which covers the Government’s policies and overall strategic objectives for technology and innovation over the spending review period. On the basis of the allocation and Framework letter, the Technology Strategy Board develops its strategy and delivery plans for the three year period. The Department of Business, Innovation and Skills, having set the overall Government strategic priorities, provides the Technology Strategy Board with autonomy to set the strategic direction for technology and innovation in support of UK business. The work of the Technology Strategy Board is overseen by a business focused Governing Board made up of thirteen people (from business and academia), which sets overall objectives and direction.
The Technology Strategy Board produced its first strategy “Connect and Catalyse” in May 2008 and has produced a number of underpinning strategies at an application and technology level (energy, manufacturing, bioscience, etc) setting out national strategies for where the UK has got strength (both in academia and business) and where it should therefore invest and provide support. We pick sectors and technologies where UK businesses can thrive and support innovative companies in them. We consider the size of the markets, the capability of the UK to address them and the timing. And finally, the difference our support would make.

Against the criteria we use and the priority areas we have identified, the Technology Strategy Board then allocates funding delivered through a number of support mechanisms and approaches. The strategies also provide a focus around which other public sector funders such as the Research Councils, Regional Development Agencies, Devolved Administrations and Government Departments can align and support.

What governs the allocation of funding for Government policy-directed research through Government departmental and agency initiatives? Are existing mechanisms appropriate? What is the role of Departmental Chief Scientific Advisers?

The Technology Strategy Board has been established to operate across all areas of the economy to stimulate business innovation in those areas which offer the greatest scope for boosting UK growth and productivity. The Technology Strategy Board has allocated its budget for the current spending review period across three broad themes—Challenge-led innovation which accounts for 50 per cent of the budget and focuses on major societal and market challenges; Technology-inspired innovation which accounts for 25 per cent which supports the underpinning technologies relevant to a wide range of sectors; and, the Innovation climate which accounts for 25 per cent and involves creating an innovative environment in the UK through networks, people and promoting innovation and successful projects.

The Challenge-led innovation strand is an important area where we work closely with Government Departments helping to address key societal challenges and at the same time stimulating business research and innovation. The main way we work with Government Departments on societal challenges is through Innovation Platforms, which involve the integration of a range of technologies, combined with better co-ordination of policy and regulation, linked through to public procurement opportunities. The Platforms draw on the expertise of the Chief Scientific Advisers in helping to shape the challenge to be addressed. Current Innovation Platforms are in areas such as low carbon vehicles, low impact buildings, assisted living and the latest Platform to be launched Sustainable Agriculture and Food. The Platforms bring together Government Departments, with other public sector funders and business in a co-ordinated approach to address the challenge. The Platforms provide critical mass and the Low Carbon Vehicles Innovation Platform is a good example where an initial £20 million of funding from the Technology Strategy Board brought together another £105 million from other public sector funders. The £125 million public sector funding is then matched by business providing a £250 million programme. By achieving this critical mass the UK is then able to compete on a global stage.

How are science and technology research priorities co-ordinated across Government, and between Government and the relevant funding organisations? Who is responsible for ensuring that research gaps to meet policy needs are filled?

The Technology Strategy Board has a leadership role, established as part of Lord Sainsbury’s “Race to the Top”, to deliver a national technology strategy as well as advising Government on polices which relate to technology innovation and knowledge transfer. In doing this it works closely with Government Departments, Research Councils, Regional Development Agencies and Devolved Administrations in co-ordinating and driving forward activities.

Working with the Regional Development Agencies and the Research Councils, the Technology Strategy Board will jointly invest over £1 billion between 2008-09 and 2010–11, and in doing so, create critical mass and coherence so that UK business has greater clarity and is better able to access the most relevant support available. The £1 billion includes £300 million of aligned funding—£120 million with the Research Councils and £180 million from the RDAs over the three years of the current spending review period. The Research Council and RDA funding is used in alignment and through joint funding of areas identified by the Technology Strategy Board as national priorities.
How is publicly-funded science and technology research aligned and co-ordinated with non-publicly funded research (for example, industrial and charitable research collaborations)? How can industry be encouraged to participate in research efforts seeking to answer societal needs?

As previously mentioned, the Technology Strategy Board will use 50 per cent of its budget over the current spending review period addressing major societal challenges. A key part of addressing these challenges is looking at how UK business can use its knowledge to address the challenges and at the same time create economic wealth and a leading global position. Through the Technology Strategy Board’s Innovation Platforms we are bringing together Government, business and academia to address the challenges. The funding provided by the Technology Strategy Board and other public sector funders is matched (usually 50 per cent) by business. We can therefore see real tangible interest from business through the use of its own funding. Government can also often play a role in creating markets and driving innovation through setting future direction, new standards and innovative regulation. By doing so it provides business with more certainty on which to make investment decisions.

To what extent should publicly-funded science and technology research be focused on areas of potential economic importance? How should these areas be identified?

The Technology Strategy Board considers that it is important to maintain a thriving science base, the knowledge from which will support the next generation of products and services. From the perspective of the Technology Strategy Board, we are focusing our resources in the areas where there is both academic excellence and business strength with the capability to exploit that research in areas where there is a growing global market. To support our work, it is important that we continue to build on those areas of the science base where UK business is best able to exploit the results for economic benefit. The recently published New Industry New Jobs document sets out some of the key areas where the UK has strength and the opportunity to be highly competitive. Our areas of focus align closely with those set out in New Industry New Jobs.

We identify the areas of potential economic importance through working closely with business and other stakeholders and gaining an understanding of markets and trends. The knowledge we have through the people we employ is an important factor in setting priorities and the future direction. The people we employ predominately are recruited from business and so join us with a good understanding of the future direction of business and the areas where there is most potential. We also work through our Knowledge Transfer Networks which provide us with links to business and an understanding of future business direction.

30 October 2009

Memorandum by the Centre for Process Innovation

Introduction to the Centre for Process Innovation

The Centre for Process Innovation (CPI) was set up as a Company Limited by Guarantee by One North East—the regional development agency for the North East of England—in April 2004. It is one of five Centres of Excellence that were created in response to a consultancy report that identified that the region had a gap in the Innovation Phase that develops University research into new products, processes and services for the commercial market. CPI was created to fill this Innovation gap for the process industries. Since inception it has grown at over 50 per cent per year. It has created a national and international reputation in two main technology areas:

- Sustainable Processing—CPI is home to the National Industrial Biotechnology Facility. This is targeted at delivering collaborative public-private projects that move research ideas to proven processes. As well as improvements to established technologies the Sustainable Processing Centre develops processes in technologies such as biomass fermentation, anaerobic digestion to produce energy, aquaculture and algae production. It also works on the practical development of fuel cell systems, novel fuels, related infrastructure and a full range of process intensification activities. It creates highly resource efficient biological, chemical and physical processes producing novel low carbon, low impact and highly resource efficient processes.

- Printable Electronics—CPI is home to the National Printable Electronics Centre (PETEC). Again the Centre is targeted at transferring experimental processes to manufacturable products. It targets barrier coatings, advanced material deposition processes, printable electronic materials, printable circuits for high resolution display and smart packaging applications, solid state lighting and organic photovoltaics.
In 2008–09 CPI turned over £17 million and has a staff of over 100 people. 67 per cent are degree qualified scientists and engineers and the whole team is a group of highly qualified scientists and engineers with extensive management, project management and commercial experience.

As such CPI is an unusual organisation in the UK as it works to transfer technology concepts from research to proven market ready commercial processes and technologies. Much of the success can be attributed to its physical and knowledge links to the largest cluster of process industry activity in the UK. The Centre is now drawing technology development work in from Asia, Europe, North America and India.

Response to the Committee’s Questions

A point of Definition

While the USA was developing the technology that landed men on the moon NASA developed the concept of Technology Readiness Levels (TRLs). This methodology is highly relevant to the Committee’s questions and provides a useful context to the answers presented below. The TRL system is shown in the diagram below.

![TRL Diagram](image-url)

In simple terms University research takes place over TRL 1 to 3, Innovation and Development Phase in TRL 4 to 7 and commercial exploitation in TRL 8 & 9. The responses to the Committee’s questions refer to these TRL levels throughout.

1. What is the overall objective of publicly-funded science and technology research?

Publicly funded science and technology research serves two main purposes:

- To further knowledge for the national and international good (TRL 1–3).
- To create and protect science and technology that creates economic value for the UK through licensing, products and processes that bring social, environmental and economic benefit to the UK (TRL 4–7).

Currently the UK system appears to value the former (TRL 1–3) more highly then the latter. There is insufficient emphasis and resource put into the process of transforming work at TRL 1–3 into market ready products, processes and services at TRL 7 that can create significant value in the economy.

Publicly funded science and technology research requires the investment of tax revenues and can only take place when the country has sufficient income. If public investment in science and technology does not create intellectual property that returns value to the nation the system runs at a loss and continued investment is difficult to justify or afford.
CPI carried out a simple benchmark exercise that showed that if the development of a scientific discovery in TRL 1–3 costs one unit research another 60 units are required to turn that discovery into a marketable product at TRL 9. However, research does not always yield valuable product so it is necessary to fund work to make a number of discoveries before one can be identified that is ripe for development into a commercial product. In addition public funds are not required to fund the total development.

Public funds are used in the research and discovery phase where risks are highest and uncertainty of success is greatest. This work must continue to further scientific understanding as well as to discover ideas that could create economic value. However, there is a need for the UK to adopt a more focused approach to the selection of research for development into commercial products at TRL 4&5 and to develop and demonstrate the technology at TRL 6&7. This is the Innovation Phase and there is a public role in supporting this phase. From TRL 4–7 public funds should be used in collaborative relationships with private organisations. In the UK the amount of funding going into TRL 4–7 is insufficient to ensure that value is created from the public investment in science and technology at TRL 1–3.

In summary the UK is not exploiting much of its excellent research produced as it does not have enough Innovation Centres to develop commercial processes.

2. How are public funds for science and technology research allocated? Who is involved at each level and what principles apply? Where appropriate, is the Haldane Principle being upheld?

CPI believes that UK funds are not allocated to create best value for the nation. It is difficult to gather accurate data, but it appears that the funds invested in pure research (TRL 1–3) could be 10 times greater than those spent in innovation and technology development (TRL 4–7). Although support has grown in recent years the innovation and development funders in the UK such as the Technology Strategy Board, Energy Technologies Institute and Carbon Trust have insufficient funds to make major public interventions in collaboration with private companies and investors. As a result it is difficult to ensure they create value for the UK at TRL 4–7 and above.

The Haldane principle that scientific discovery should be undertaken independent of administrative supervision is correct up to a point. The acquisition of knowledge for the sake of understanding the underlying principles of science and technology is vital to the development of knowledge and this is best undertaken without administrative supervision. However, in a market economy there is a need to convert this knowledge into value creating products, processes and services if the economy is to thrive and have the funding to invest in continued scientific investigation. This Innovation Phase needs to be carefully managed to create best value.

3. Are existing objectives and mechanisms for the allocation of public funds for research appropriate? If not, what changes are necessary?

There is a need to create a framework within which public funds are deployed. This framework needs to balance the acquisition of knowledge with the creation of economic, social and environmental benefit. This requires the setting of a long term strategic direction for science & technology research and the creation of programmes to create value from the investment. To increase success it is proposed that a series of cross sector National Technology Advisory Groups are created in selected technology areas. These should cross departmental boundaries in Government but also include senior industry, finance and third sector figures. Their role would be to create national science and technology partnerships that define target areas and work collaboratively to cover all the technology readiness levels. At TRL 1–3 the Haldane principle should be upheld, but as ideas are selected to move through TRL 4–9 more focus is required on the conversion of the ideas into value creating products, processes and services.

Evidence from all of the UK’s major competitor countries indicates that there are targeted research and development programmes that encompass all the TRL levels. These include publicly funded University Research that drives discovery and knowledge (TRL 1–3), public-private intermediate institutes that exemplify ideas and demonstrate their viability (TRL 4–7)—an example is the Fraunhofer Institutes in Germany—with commercial companies and investors delivering the product, process or service to market (TRL 8&9). In comparison to its competitors the UK is weak in the TRL 4–7 Innovation phase. CPI is an example of an Institute that operates in the Innovation phase. It is a public-private collaboration that uses assets and cross sector knowledge to prove and exemplify processes for the Sustainable Technology and Printable Electronics markets. CPI is five years old and has received significant public funding to establish its asset base and its expertise. This is increasingly being matched by funds from private firms who are working with CPI in the TRL 4–7 space. It is proposed that the UK needs a much stronger network of independent—CPI is a not for profit company limited by guarantee—Innovation Institutes similar to CPI to cover other

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1. CPI International Benchmarking Research.
technology areas. These Institutes would initially be set-up with public funding. Over time the public funds should be reduced as collaborative private funding is secured. However, some long term establishment funding from the public sector will be required to maintain stability.

These institutes would have their work guided by Boards made up of leading members of the academic, industry and public sectors with skills and knowledge that are relevant to the work of the Institutes. Significant research and planning is required to define how many Institutes there should be and what technology areas they should target. The principles of independence, core public funding (to ensure financial stability and independence) and cross sector collaboration must be enshrined in their statutes.

Institutes of this nature operate in the same TRL range as the Technology Strategy Board and this body could be seen as the co-ordinating body for the network of Institutes.

4. What governs the allocation of funding for Government policy-directed research through Government departmental and agency initiatives? Are existing mechanisms appropriate? What is the role of Departmental Chief Scientific Advisers?

The dispersion of funding in the UK is inadequate in TRL 4–7. The value of funding calls is usually low relative to the cost of technology development in this Innovation Phase. Funding calls are managed through entirely open competitive tender. They are assessed by independent assessors that are only loosely coupled to the call area or to the awarding body. This results in a long and highly bureaucratic process that can result in a number of small interventions being made that are not sufficiently large to make an impact in a competitive global market. In addition the cost of the whole process for both the bidder and the awarding body is high and can result in significant waste where publicly funded organisations unsuccessfully bid for public funds.

The rigour of competitive tendering should not be lost, but larger integrated nationally co-ordinated programmes targeted at value creation are necessary. These could link together Universities and the Innovation Institutes proposed in the previous answer. These programmes will require an increased focus on the creation of technology that can deliver National value.

The Departmental Chief Scientific Advisers should play a major role in the process of determining development targets. They should act as a catalyst between academia, public sector, private sector and Innovation Institutes and would be leaders in the creation of partnerships for delivery. They also have a role in ensuring that science and technology collaborations across and between Governmental departments are created and that interdepartmental working is common.

5. How are science and technology research priorities co-ordinated across Government, and between Government and the relevant funding organisations? Who is responsible for ensuring that research gaps to meet policy needs are filled?

CPI is not in a position to comment on this question.

6. Is the balance of Government funding for targeted versus response-mode research appropriate? What mechanisms are required to ensure that an appropriate and flexible balance is achieved? Should the funding of science and technology research be protected within the Research Councils or Government departments? How will the current economic climate change the way that funds are allocated in the future?

See answer to Questions 2 and 3. There is a need for an increase in the proportion of science and technology funds that are targeted at developing applications in the market. This would involve a change in the balance of the way funding is delivered. This could be achieved by increasing the proportion of funds available for work in TRL 4–7. It does not necessarily require an increase in overall funding.

The Technology Strategy Board could be an appropriate place for these funds to be owned and managed. This is a cross departmental body that is independent of the knowledge creation interests of the Research Councils. It is focused on supporting the Innovation Phase. An increase in the number of delivery oriented Innovation Institutes would strengthen the delivery of value creating products further. However, the strength that comes from having a diverse range of support mechanisms, such as regional funds, should be retained to ensure National programmes can be created.
7. **How is publicly-funded science and technology research aligned and co-ordinated with non-publicly funded research (for example, industrial and charitable research collaborations)?** How can industry be encouraged to participate in research efforts seeking to answer societal needs?

As stated earlier the majority of non-publicly funded research takes place in TRL 4–7. By strengthening the UK’s presence in this Innovation Phase there will be increased interest from non-public bodies. In our response to Question 3 it was proposed that the UK requires the setting of long term strategic direction for science & technology research and the creation of programmes to create value from the investment in science and technology. To increase the success of the allocation of UK funds it is proposed that a small number of groups are created in specific technology areas. These should cross departmental boundaries in Government and include senior industry figures. Their role should be to create national science and technology partnerships that define target areas and work collaboratively to cover all the technology readiness levels. By increasing the emphasis on TRL 4–7 non-public involvement will be more attractive. In some ways this proposal can be likened to the work of the Innovation and Growth Teams. However, in this proposal IGTs would be permanent teams that influence the deployment of funds on an ongoing basis rather than meet to work on a specific issue before disbanding.

8. **To what extent should publicly-funded science and technology research be focused on areas of potential economic importance?** How should these areas be identified?

The emphasis on research that can create combinations of economic, social and environmental value should be increased. The UK has to generate tax income to invest in science and technology so the value that is created from the research must at least match the investment. The areas for development should be identified to match national policies and needs. For example it is clear that energy, sustainable resource efficient processes and low carbon communities are vital to the future prosperity of the UK. These areas have been identified as of national economic importance. The requirement is to create a structure that can translate the need into research and development that leads right through to practical economically viable solutions. The cross sector collaboration identified in the responses to earlier questions is vital to this success: As is an increased emphasis on the translation of research into products, processes and services. The TRL 4–7 activities that have been discussed in the responses to previous questions are important delivery mechanisms for the innovation required to deliver the products, processes and services.

9. **How does the UK’s science and technology research funding strategy and spend compare with that in other countries and what lessons can be learned?** In this regard, how does England compare with the devolved administrations?

CPI does not have definitive data that can be used to answer this question. It does however have observations that have been gleaned from its collaborative work with public and private organisations within and outside the UK. Our perception is that the UK is not spending too little in the area of science and technology research, but that it is spending inefficiently. In the UK the balance between pure research and development is skewed towards research with the result that the UK generates significant amounts of good science, but that it does not develop significant value as a consequence. In most of the UK’s competitor countries there is a significantly larger spend in the Innovation Phase with a number of countries having a larger innovation and development budget than research budget. As stated in Question 1 to improve the performance of its science and technology system there is a need for the UK to rebalance funding to ensure that there are sufficient resources going into TRL 4–7. In addition there is a need to redistribute the way funds are used to create larger co-ordinated development programmes. Currently funds are dispersed into a large number of small uncoordinated programmes that often include duplication. These small interventions are unlikely to deliver value. It is proposed that this change is effected by the creation of a national network of Independent Public-Private Asset Based Innovation Institutes. These could be similar to the existing CPI. Institutes would be distributed around the country, but would be the National Centre for the chosen technologies. Their work would be targeted at TRL 4–7 and they would be managed by collaborative Boards made up of public, private and academic members that are linked to the National science and technology strategy. Funds would come from both public and private sources. They could be facilitated by the Technology Strategy Board.

*September 2009*

**Memorandum by the Energy Technologies Institute**

**ENERGY TECHNOLOGIES INSTITUTE—BACKGROUND**

The transformation of the UK Energy System by 2050 to meet the energy needs of the UK and achieve Government’s objective to reduce greenhouse gas by 80 per cent, represents a major challenge. The Energy Technologies Institute (ETI) was established to help meet this challenge.
Operating in the space between work typically funded by the Research Councils and full scale commercial deployment, the ETI focuses on the development of large-scale and integrated engineering solutions required to meet UK energy needs to 2050.

The ETI was launched in 2007 as a private-public partnership between the UK Government and up to 10 technology industrial partners. Its remit is to accelerate the development and deployment of technologies required to deliver affordable, secure and sustainable energy (excluding nuclear) to meet the UK’s need for heat, transport and power within an integrated energy system, including the associated infrastructure.

Founder Members comprise BP, Caterpillar, E.ON, EDF Energy, Rolls-Royce and Shell, each of which contributes equally to the ETI up to a maximum of £5 million per annum over a 10 year period. Together with the UK Government’s matched funding, this creates a potential investment fund of £1 billion dedicated towards accelerating low carbon technologies.

Public funds are received from the Department for Business Innovation and Skills (DBIS) via the Technology Strategy Board and the Engineering and Physical Sciences Research Council (EPSRC). These organisations together with the Department for Energy and Climate Change (DECC) are engaged directly in the ETI’s governance, strategy development and programme delivery. The ETI is a founder member of the Low Carbon Innovation Co-ordination Group whose expansion to include DECC and the Research Councils was announced in the Low Carbon Industrial Strategy.

The ETI’s programme portfolio currently focuses on offshore renewables in wind and marine; carbon capture and storage; transport electrification and infrastructure; distributed energy (heat, power and controls) and networks and buildings.

Since its establishment, the ETI has funded projects to the value of £25 million, with a further £100 million of projects in development.

What is the overall objective of publicly-funded science and technology research?

The development of low carbon technologies is a demandingly complex and costly challenge, necessitating public sector support. In collaboration with Government, the ETI uniquely leverages the complementary technologies, skills and market access routes of its Industry members in collaboration with Government. It carries the risk associated with large-scale engineering and technology demonstrations which may not have otherwise been implemented by the individual members.

Innovation however is not solely the responsibility of large industry and Government, but requires “pull through” from small and medium sized enterprises, as well as academia. Public funding provides a platform for these organisations to collaborate and pool resources thereby helping to deliver new technologies to the marketplace. The ETI is working with this cross section of stakeholders to establish new mechanisms for this type of commercial development and deployment of highly integrated systems.

In leveraging private-public funding, incentives are required to help address the large scale deployment, building of infrastructure, development of skills and production of the regulatory framework needed for large scale technology including those required to meet the UK’s future energy needs and help deliver the Government’s climate change targets.

Are existing objectives and mechanisms for the allocation of public funds for research appropriate?

Developing low carbon technology requires underpinning public funding through the stages of initial concept and design, prototyping, full-scale demonstration, to manufacture and roll-out. Such funding is essential if the UK is to be successful in competing in a “low carbon economy” where delivery will require a radical transformation of the UK’s energy infrastructure, underpinned by a portfolio of low carbon technologies capable of being deployed cost effectively and at scale.

The continuum of public funding is vital to the sequence of research that will enable these technologies to be successfully deployed into the market place.

In identifying which technology programmes to fund, the ETI understands the requirement to secure “added value”. In deciding whether to support a particular technology programme, the ETI critically determines whether the programme will; add to the UK economic and knowledge base; lead to the creation and exploitation of IP; produce a financial value; and positively impact on the UK energy sector and if so, how.

The strategic analysis required to focus funding is underpinned by a unique Energy Systems Model developed by the ETI, which is capable of identifying specific technology areas depending upon performance, supply geography, demand and infrastructure. Importantly, the model includes the use of statistical techniques to reflect uncertainty. By “backcasting” from 2050, the model assesses the optimal (or least cost) energy system solutions.
How is publicly funded science and technology research aligned and co-ordinated with non-publicly funded research? How can industry be encouraged to participate in research efforts seeking to answer societal needs?

The ETI works collaboratively with the Research Councils, with DBIS and DECC alongside the Technology Strategy Board and the Carbon Trust to deliver complementary but distinct objectives. By working together, the huge complex scale of the energy landscape is being addressed and through combined efforts, resources maximised.

The presence of the ETI introduces a unique leverage to the low carbon energy landscape. It is distinct in the UK in addressing the full potential of the future UK energy system and the interactions across power, heat, transport and supporting infrastructures.

This platform leverages non-publicly funded industrial research and achieves important synergies including the sharing of knowledge and skills and provides an opportunity to apply this knowledge to inform the public policy-making process. This is exemplified by the development of the advanced strategic modelling tool that provides a knowledge base only available through the unique leveraging opportunity provided by the existence of the ETI and its industrial collaborators.

To what extent should publicly-funded science and technology research be focused on areas of potential economic importance?

Low carbon innovation is a strategic priority for the UK. The UK energy innovation landscape requires technological innovation, but also the development of new infrastructure, new markets, a skills base and a regulatory framework.

1. The ETI recognises that the emerging energy sector will need to be resourced by a specialist skilled workforce. Many ETI funded projects are helping to highlight and ultimately fill the potential skills gaps and opportunities in the sector.

2. In support of early stage research, aligned with key areas of economic opportunity and social need, the ETI inputs to the Research Council Energy Programme, both directly and through the Low Carbon Innovation Coordination Group (LCIG).

September 2009

Examination of Witnesses

Witnesses: Mr Iain Gray, Chief Executive, Technology Strategy Board, Dr Graham Hillier, Director of Strategy and Futures, Centre for Process Innovation and Dr David Clarke, Chief Executive, Energy Technologies Institute, examined.

Q379 Chairman: May I welcome our second tranche of witnesses. We very much appreciate the written evidence you have put in but also your willingness to come and spend time with us today. I will just remind you of a couple of things. One is that we are being webcast live so your words are out there in the ether and they will be with posterity in that we take a record of the proceedings and that will be published with any report that we put out. You will see a transcript of that report that just to make sure there are no huge howlers but, on the whole, there tend not to be but you will see that in good time. I wonder if I could just ask you to identify yourselves basically for the microphone.

Mr Gray: Good morning. I am Iain Gray, Chief Executive of the Technology Strategy Board.

Dr Hillier: I am Graham Hillier and I am the Strategy and Futures Director for the Centre for Process Innovation. I must convey my CEO’s apologies to you because he has a board meeting today.

Dr Clarke: I am David Clarke, Chief Executive of the Energy Technologies Institute.

Q380 Chairman: Thank you very much indeed. Can I start with the questions and we will go round the table. Is there a distinction in your mind between the types of research that should be done in the private sector and the types that should be very much publicly funded and in the public sector whether universities or research institutes? Or is that too sharp a distinction?

Mr Gray: The Technology Strategy Board is still a relatively new organisation but it was quite specifically put in place to see the exploitation of science technology and innovation for UK business benefit. It is quite interesting as an organisation in that people working in the organisation have predominantly come from business itself; people have come from business and understand the needs of business and are now working in a public sector organisation looking at how to exploit science technology. I think that is a statement in its own right, people from business seeing the value of the public sector role. If you look at the wider landscape, the underpinning capability goes right across the
different sectors and different technology themes; with regard to how you actually exploit that underpinning technology and capability, I think there is a role for both public and private sector in both of those. I would characterise the differences being essentially around timescale and around risk. Where there is a relatively short timescale, where there is a relatively low risk, then I would say there is a strong role for the private sector. Where there is a relatively long timescale and higher risk, there is a role for public/private sector partnerships. I think the real role of the public sector is bringing the partnership together, bringing different sectors—business and academia—together and actually working with Government to help create the market that pulls things through. For me there is very definitely a role for both and a role for public/private sector partnership.

Dr Hillier: I would agree with that. The way we look at this is that there are really three stages here. There is discovery and invention which is done in the universities, the research departments of companies or by individuals in garages, to be quite frank. There is a strong role for public sector intervention in this stage because you are looking at something that is going to be commercialised a long way in the future and the chances of success if you are trying to create something are relatively low. In addition, you have to try a lot of things to get one to be successful, so you do not know which one is going to work. It helps if somebody intervenes to give you a bit of help in that situation. The second stage—which is where all three of us sit—is the innovation that converts that research into something that is ready to go to market. So you are now into a timescale of about 18 months to five years; public intervention does help here quite significantly and it provides a third to two-thirds of the amount of money in this stage. The difference between us lot is that these two guys put partnerships together and fund things but we at CPI have a set of assets that sit between the university and the market so that people can try things out and prove whether they are going to work or not at relatively low risk to themselves. They can do things they are not sure about or work on things they do not really understand. It helps to have an organisation like CPI which is independent from everything else. The third and final stage is commercial readiness and market launch and that should really be pretty much all at the expense of the person who is going to take it to market and make the vast amount of money that they are hoping to make as a consequence.

Dr Clarke: From the point of view of the ETI, we are in a fairly unique position I think in that we sit exactly on the boundaries of what Iain was describing in terms of that kind of risk and exploitation point. We are specifically set up as a partnership between private industry in the form of BP, Caterpillar, E.ON, EDF, Rolls-Royce, Shell and the UK Government as a limited liability partnership. The advantage of that—is this one point that Iain did not stress—is that there is a question about risk and the desire or not of the private sector to take a risk; there is a timescale to exploitation, but I think critically, from the point of view of the private sector (I think this was raised by one of the previous interviewees), is the question around timescale to actually deliver financial benefit rather than just the exploitation. It is the time to get to a commercial benefit. I think in the energy space, particularly low carbon energy space which is where we work, historically it has been a very conservative industry, it has been relatively immature obviously and we are trying to bring all of those points together in terms of funding projects which are risky, which would normally take a long time to get to exploitation and which will still take a long time to get to commercial benefit. I think that is the advantage of us, as a kind of balance point between the public and the private, in that we can target that particular niche problem in the energy space.

Q381 Chairman: Do you see a role for organisations in helping to set priorities for public funding research and where the emphasis should be? Do you have a role in that or should you have a role in that?

Dr Clarke: We have a very explicit need inside our organisation to set priorities for our investments and, in round numbers, half of that is public sector funding. We have had to set up a very distinct capability which is available to the public sector and which is now being used by DECC, BIS, Department for Transport, Committee for Climate Change to provide some of that expertise and capability in assessment of the future needs for the UK energy system and of where priorities should be. So I think the answer to your question, in my mind, is quite definitely yes, there is a role for us there. We have set up something specifically for our needs and we have been able to take that to the public sector. There is now a distinct pull from the public sector to use that capability for their benefit as well.

Q382 Chairman: You have properly said for your needs; is it easy to illustrate briefly how that works?

Dr Clarke: Our strategy has been running for just two years and, in the first year, one of the things we had to do was to develop an investment strategy to go forward. That clearly had to be one which delivered value to all of our members, both private sector and public sector. So we deliberately set up an in-house strategic modelling team to assess the UK energy system, both through development of a specific analytical model as a tool—which we have done—and through dialogue with a range of industries, not just my board members but a range of industry groups, trade bodies, public sector experts and key
academics to try to develop a rounded view as to what would be the critical requirements across the UK for the future. That in-house group now constitutes 10 people; we are recruiting two more and certainly it is now providing a distinct service into the public sector.

**Dr Hillier:** I think we do have a role to play here and one of things we do not do as well in the UK as maybe some other countries is to bring together all the various influences and interests. If we could get together the academics and various government departments, all in the same place at the same time, plus the industry, plus the people who are acting in the intermediate spaces, and set up a structure that can do the analysis and make the decisions so that we can have some kind of national strategy that everybody could sign on to, then I think we can make progress. I think one of the reasons we have a role in that organisation is that we actually practically do things so we are in a situation where we can say, “That might work or that will not work”. I do not see us doing that quite as well as some of our industrial competitors in other countries. That collaboration is lacking in the UK at times.

**Q383 Chairman:** Mr Gray, do you want to add anything?  
**Mr Gray:** Very briefly, I would say, as was referred to in a previous session, our overall strategy is called “connect and catalyse”. Under the banner of “connect and catalyse”, what we have identified are essentially three pillars, what we call technology-inspired innovation, challenge-led innovation and the innovation climate (which is more about the environment in which things happen). Technology-inspired innovation is a pretty broad playing field. It covers the underpinning capabilities and, whilst we do need to make some choices, we need to cover that in a fairly broad sense. Whereas, when we look at challenge-led innovation (which is where we would put the bulk of our resources and effort), I think that is where we start moving into an area where we actually focus around a smaller number of key things. There is this issue of a broad underpinning capability and I think we need to cover the entire field, and then there is the issue of prioritisation in terms of pull through. We need to pull through; we need to make choices around a relatively small number of areas where we really focus in on and pull through. In our remit, the challenge-led innovation approach really is about prioritisation and making choices.

**Q384 Lord May of Oxford:** In some sense you have provided a kind of answer to the question I wanted to ask which is rather specifically, I guess, to Mr Gray but it picks up more generally on what you have just been saying. The role of the TSB is to set out national strategies for where the UK has strength, both in academia and business, and where it should therefore invest and provide support. What mechanisms do you use to identify these areas? You have all spoken about that, but speaking from my perspective—for 11 years I was the Vice-President for Research at Princeton and then Chief Scientist here—you gave answers which were all about process and that is what the civil service is really good at, much better, I think, than the American civil service. How are you going to identify appropriate new knowledge and carry it though, apart from describing elaborate processes? Frankly, I think it is all a waste of money.

**Mr Gray:** Process is important to my mind.

**Q385 Lord May of Oxford:** It has a place but the civil service is obsessed with it.

**Mr Gray:** If we look at the role of the Technology Strategy Board, from a partnership point of view, it is a very important junction, as you describe, between business, academia, the regions and government departments. I described three different approaches but in the technology-inspired approach what we have done is, working with industry, we have published quite specifically technology priorities with technology road maps that indicate those sorts of areas we should be investing in (nanotechnology, electronics, photonics, electrical systems, manufacturing, materials to give examples). So we take those national priorities and those are devolved through the various networks that we operate—the knowledge transfer network, mechanisms through collaboration with business and academia—and we set up collaborative research and development type programmes to support underpinning capability. There was a very good example just last week in the announcement of the competition related to plastic electronics, a very specific collaborative R&D investment in a technology area that was identified through these technology strategies as a priority. We then have what we call application areas which are not specific to individual technologies; they are almost technology agnostic but they are looking for solutions to particular problems, for example in the healthcare e-health-assisted living type of area. A solution may come from a healthcare or a life science subject; it may come from an ICT solution; it may come from an energy or a transport solution. The application strategies that we develop look at roadmaps of how we pull together different parts of the technology jigsaw. One of the key delivery vehicles we have is what we call innovation platforms. A very good example of that would be the Low Carbon Vehicle Innovation Platform. That was an area that we identified as a priority area. We believe there is a unique opportunity for the UK to reinvent its automotive industry around low carbon technologies, particularly around electric vehicles.
and hybrid power trains and batteries. What we have done is to develop specific responses to that area. 

**Dr Clarke:** In the last 18 months I have invested about a million pounds in the analysis work I described, half of which was public money. As a consequence of that we have identified 17 key areas where we should put immediate funding and I have committed £54 million this year into those areas and into major technology demonstration projects. There is quite a difference between you having to do the process to make the robust investment and process for process sake. All of my staff in investment planning area are ex-industry and this is not the case of process for process sake; this is a process to decide on a commercial investment. That activity supports the Technology Strategy Board in their future thinking in the same way.

**Q386 Lord Krebs:** What I have heard from both of you are input measures and nothing about output. 

**Dr Hillier:** I think that is the crucial thing really. In the UK, we go through our process and we come out with a good idea. Unfortunately we do not actually commit ourselves to delivering the things that make the good idea a commercial product. We do not invest in the bits of kit that are going to make it happen. These guys are moving in that direction but the UK system is skewed towards researching deep into theory rather than actually doing things that create a commercial process or a business.

**Q387 Lord May of Oxford:** In a sense that is the essence of the reservations that some of us have. Could you provide a couple of examples of things, even if you have to go back into the past, rather than explaining how you have spent the money that you have pinched across the ring-fence from the research councils? 

**Dr Clarke:** I cannot tell you the answer to how effective are the output measures because the ETI has been running for less than two years. The first major projects were announced in January this year and they will be complete in June of next year. At that point I can start to tell you how they affect the output measures. My output measures are delivering capability which takes the UK towards its energy targets for 2020 and 2050 as they change from time to time. For instance by the middle of next year, I will be able to put down on the table an indication of how we would cost reduce, if it is possible from an engineering point of view, offshore wind turbines to take us towards incentivising the industry to deploy those machines to the 2020 target.

**Q388 Chairman:** We may have you back then. 

**Dr Clarke:** I would be very happy to come back and tell you.

**Q389 Lord O'Neill of Clackmannan:** Perhaps Dr Clarke could comment on what seems to be the rather confusing process involved in the development or the encouragement of carbon capture and storage. We were having competitions; we were going to have one; we were going to have two; now we are talking about four. Is there any kind of rationale here or is just a minister bearing the weight of the last person who sat on them and then delivering it to you as a national objective? I do not want to disparage carbon capture and storage—I know Lord Oxburgh is a great supporter of it as I am myself—but I find it very confusing to see any rationale behind the development or support for this kind of technology in the UK. Maybe you could lead us through it. 

**Dr Clarke:** I cannot comment on the Government policy around numbers of demonstrators; that clearly is not my remit. We act as a private sector company to invest in engineering and technology development around system demonstration and that is below the point of a full scale CCS system. I cannot comment on the specifics of the numbers of demonstrators. In terms of the development of technology, from the point of view of the UK we have very strong UK capabilities around certain aspects of CCS technology from a business and industrial base in the UK. The Technology Strategy Board certainly have been instrumental in supporting some of those and ensuring we get maximum benefit for the UK economy as a consequence. From the point of view of taking CCS technology forward more generally, my interests are two-fold really. Through the strategic analysis work we do, we have identified two critical issues and opportunities for the UK, one of which is around geological underground storage where there is a somewhat unknown level of storage around the UK. We understand oil and gas fields; we do not have good quantification of saline aquifers which potentially is an order of magnitude bigger than oil and gas reservoirs, so it is important to understand what opportunity we have got there from the point of view of the UK energy base going forward. We are conducting a £3.5 million study to try to understand where those aquifers are in terms of the optimum injection sites. The second part is, if we were to move to a world where CO\textsubscript{2} targets became even more stringent than they are set at now, we would be in a position where current CCS technologies would be difficult to deploy and still meet those targets simply because the efficiency of the systems does not catch all the CO\textsubscript{2}. From my point of view, there is a major opportunity in the UK technology base—where we have very good expertise in the science base around that area of CO\textsubscript{2} separation and membrane technology and so on—to test some of those new technologies at realistic scale and see if we can actually find a way of getting more efficient and lower cost systems which again will incentivise the industry
to put those systems in now with the knowledge that they will meet even more stringent targets if they were to come in in the future.

**Q390 Lord O'Neill of Clackmannan:** Has nobody else thought of this internationally? Is this a gap in the market or is it something we are trying to play catch-up with simply because we need to have a Union Jack flying over this particular industry regardless of the cost that it might be to the UK if we were, by other means, to licence the technology that other people are developing?

**Dr Clarke:** There are elements in the UK technology base which mean you can seize an opportunity; there are some really good capabilities in the UK technology base and we should build on those and we are doing so at the moment from the UK industrial base point of view. In terms of the underpinning science base, it is absolutely right that there is capability being developed worldwide and part of the opportunity I have in my organisation and the way we are structured is that I can access international capability and bring it to the UK to be deployed here; I do not just have to fund UK development. If there is something better and already pre-existing elsewhere in the world I can bring that in, and we are already doing that in certain projects, in fact around offshore wind we are bringing offshore capability into the UK.

**Q391 Lord Crickhowell:** Following up on the point that has just been raised about the international context, this area—CCS—is one in which the European Community is involving itself. I am on another committee which is doing a report at the moment on the European Community in China and on our visit to China we found there was a huge interest in—although not much progress on—a joint European/China project on all this and the committee has just issued some strong criticism that everyone has been talking about it now for about five years but very little has yet happened. In developing the UK's potential, how are you fitting in what you are talking about with the very big scale of things that are supposed to be happening in the European or other context?

**Dr Clarke:** In the context of that I think you have to go right back to the fundamental of what does the research and development activity look like overall and I think the CCS space and the EC activity is a good example. There is an awful lot of debate at the moment around what you do right at the kind of pre-commercial deployment end and that is where the EC money is going and that is where the big demonstrators are going in the UK. It is about the immediate pre-commercial deployment to take the risk out of a full-scale industrial plant.

**Q392 Lord Crickhowell:** We do not yet know if it works so it is a rather important step.

**Dr Clarke:** That is correct. All sub-systems have been demonstrated as sub-systems; nobody has put the complete set together in a full-scale working plant. I think that is a key step the industry has to take before you will see the major energy companies investing in that kind of capital. I would support that example.

**Q393 Lord Haskel:** We were talking about priorities. In the papers we have had—particularly from the TSB—you talk about one of the priority areas being to deal with the challenges in society. How does innovation deal with that?

**Mr Gray:** Perhaps I could draw into my response here the previous conversation about impact as well. From my perspective there are some big societal challenges. We all recognise the societal challenges associated with climate change, the ageing population—those being two very topical prime examples—but what we sometimes do not see are the commercial opportunities that arise coming out of those challenges. The Technology Strategy Board’s remit is about exploitation of science and technology for UK business benefit. For the societal challenges, government has a very strong role to play in establishing regulation and in establishing what the future market looks like and it is that future market that creates business opportunities. So the societal challenges form a very, very good framework upon which to create business opportunities. A key challenge for us is impact: how do we understand what the impacts of those are? Just taking one of the societal challenges—low carbon, again picking on the low carbon vehicle story—there is some very, very strong anecdotal evidence in the last six to nine months of that challenge and the approach the Government has taken to investing in the low carbon vehicle challenge actually influencing some key corporate decisions—foreign-owned companies as well as UK-based companies—in terms of where they site their research work and where they place their demonstrator vehicles. My fundamental premise is that societal challenge can create business opportunities and the Technology Strategy Board is looking at ways of harnessing that to create UK economic benefit.

**Dr Hillier:** The societal challenge is very large because developing technology is not something you can do systematically. Getting people to adopt new technology and use it is not necessarily easy. We did a piece of work that the Sustainable Development Commission chose as a breakthrough idea for the 21st century. We looked at a city of a million people and theoretically you can reduce the carbon emissions from a city of a million people by 90 per cent without fundamentally changing their way of life, but what you have to do is completely restructure the way you
supply a lot of your utilities. You still have fossil fuel systems making electricity and heat, but you then start asking how you are going to catch that carbon dioxide. You conclude that algae and plants are the best way to do this. This is a huge technical challenge, but you are also starting to say that you are going to use waste as a feedstock. When you have taken whatever it is you have grown and you have extracted what you can from it—it could be oils, it could be pharmaceuticals, it could be nutraceuticals (both these guys are looking at that; Iain has funded a couple of projects that we are doing and he has funded projects with other people on the beginnings of this)—that gives you a biological waste which you could burn to make energy or you could put into an anaerobic digester to make electricity. Again you are using your waste and into that digester you could put all your sewage. So for your societal changes you have to think different about how you integrate all these components together and you also have to intervene to develop the technology that makes that system work. The challenge to society is that it has to be done differently from the way it is being done now; you have to look at it from a system point of view rather than a lot of little plants and see if you can get those plants to fit together one day. They will not do so unless somebody goes out to make this happen. I think it all fits together; it is sustainability, if you like.

Q394 Lord Oxburgh: All of you have relevant experience, so would you like to comment on the right way that government should provide incentives to industry to invest in R&D and probably then participate in your organisation’s activities? Does it, for example, make adequate use of its procurement policies?

Mr Gray: From my perspective, different sectors behave in different ways, and different types of government intervention help different sectors in different ways. We have just heard from one of the large aerospace companies about the importance of funding. From my perspective there are other sectors where setting the regulatory framework is a hugely important part. I think procurement is another huge opportunity. SBRI, which is an initiative that we have re-launched in the last nine months, is already showing how Government investment in research—the procurement of research—can engage small companies that previously had never worked with government. We now have, for example, eight different government departments procuring research from small companies with fresh and innovative ideas that are really making a difference to the government agenda whilst providing real stimulus to small business. There are many different ways of doing it. It is not just about funding; regulation is important, procurement is important and procurement of research is important.

Dr Hillier: The Government is the largest single buyer in the UK so they can have a massive impact if they decide to, but often, when you are buying something that is more efficient, so that its through life efficiency is greater, it has a higher capital cost. If we are in a situation where we are trying to save money and reduce the amount of capital we spend we tend not to buy the good long term solution that will ultimately drive us forward. These procurements should look at the whole life cost—both the capital and the operational costs. There are fiscal incentives and regulatory incentives and construction industry and planning and all those kinds of things can have a huge impact on what kind of buildings you use, how efficient they are, what kind of technology are you going to develop as a consequence, taxation does as well. We have quite a large suite of grant incentives in the UK and I think, as we have already mentioned, we do not necessarily look at the whole picture and try to get it to coordinate so we get the effect we want. We have a lot of little bits that do not fit together. I think integrating our actions is probably one of the most important things we could do.

Dr Clarke: The key thing, from my point of view and coming from an industry viewpoint, is that if industry is going to invest in a certain area, whether it is technology or geography, it needs confidence that the market is going to be there and the support it needs is going to be there for the long term. I think the key issue from our point of view is about procurement, taxation, fiscal policies and so on; it is about clear, long-term, consistent policy direction and support for that policy and, with that in place, industry in general will view this as a positive place to invest.

Q395 Lord Oxburgh: Insofar as it is within the Government’s competence rather than EU competence, how important is the setting of standards?

Dr Clarke: From my point of view, certainly in the energy industry, which is a highly regulated industry obviously, the combination of standards and policy is absolutely key. Referring to a previous question from Lord Haskel around societal change, certainly standards from the point of view of the consumer will be key in actually incentivising and driving change in the domestic setting.

Mr Gray: I would like to add to that standards are hugely important. Many of the international standards we have now have come out of the UK. I think what is hugely important, as we move forward and there are business opportunities that arise around emerging technologies—whether it be in life science, whether it be in digital, whether it be nanotechnology—the setting of standards for emerging industries and emerging technologies is a key opportunity for us in the UK. Those who set the
standards actually will help shape the future business as well, so for me that is a very, very important part.

Q396 Lord Oxburgh: You have all said that this is very important, but I have not really got a sense from you whether you feel that present level of government activity here is adequate. My impression is that you feel that it broadly is, but would you like to confirm that or otherwise?

Mr Gray: In the two years I have worked in this role I have seen a changing emphasis and an increased recognition of the role of standards. I think there is more that can be done to make people realise just what benefits can accrue from actually setting standards. So I think what I am observing is a much more positive recognition of the role. I think there is much more we could do to reinforce the importance of standards.

Dr Hillier: I think the problem is that we do sometimes use things that have an effect but it is not necessarily the overall effect we are after. Our standards should allow us to make an improvement. We should try and set our standards to get an effect rather than legislate for specific technologies that may not be the right answer. We are in an environment where there are a lot of technologies that are coming along and they are all surpassing one another, so we do not actually know what the right answer is at any time.

Q397 Baroness Perry of Southwark: Mr Gray, I was very seized by the way in which you repeated two or three times that regulation was very important. I can see that regulation is important in the way that consumers pick up a particular innovation, but can you give me an example of how you could use regulation to stimulate innovation?

Mr Gray: A very topical example, again around the low carbon environment, is around buildings and building regulations. One of the key regulations that is now being put in place is that by 2016 there would be net zero carbon homes, that would be extended into office space. It is now being applied into the retrofit older buildings as well. So setting a regulatory framework has actually proved to be the catalyst in what we know is a very, very fragmented industry segment. We are seeing fresh, good ideas. We have launched the Retrofit for the Future Competition and we have been working very, very closely with a number of key construction companies around new building standards technologies to meet the 2016 requirements. I think for me that is a very topical and good example of a new regulation that has actually pulled together a sector that was quite fragmented in its approach and not particularly technology driven in its output. Without that regulatory change I do not think we would have achieved the kind of collaborations we are seeing at the moment.

Q398 Baroness Perry of Southwark: That example is a way in which regulations changed the behaviour of industries in the way they operated; it did not generate any new technology. It was not an innovation, it was a way to change industrial behaviour, but it was not innovation in terms of any of the industries being driven to create some totally new technology.

Mr Gray: With respect, it is fundamentally changing the technology because the technology did not exist to meet that 2016 net zero carbon standards, so it is forcing companies who were previously not particularly inclined to invest in new technology to now look for new technology because without new technology we would not meet that 2016 standard. In fact, another very strong point of the regulation was that it was not just an end point at 2016, there were some intermediate milestones as well that have driven the evolution of technology on a timescale sense. I am using that and citing that as an example. It has not just altered consumer or industry behaviour, it has driven business to work with academia, to work together to drive new technology and that new technology is then available to UK businesses to apply in a much broader international context.

Baroness Perry of Southwark: Thank you, that is very helpful.

Q399 Lord Colwyn: This is a question that came up in our first session this morning. I am not sure whether you were all in the room or not so let me repeat the question. What does government, industry, the charitable sector and academia gain from collaboration and coordination of research? To what extent and how do existing mechanisms encourage collaboration and coordination in research activity between them? I think Colin Smith felt that collaboration is encouraged too strongly. Simon Denegri said that he saw increased collaborative activity, particularly with the pharmaceutical industries, but he felt that collaboration occurred by chance. Anne Glover felt that the Government were supporting creative R&D and that the TSB fulfil this role very adequately. Can we have your views on collaboration and coordination?

Mr Gray: From my perspective, collaboration happens in a lot in different ways and different business sectors and industries have different cycles, so what you were hearing this morning is different perspectives depending on which sector or which kind of business people were in. The example given by Colin Smith was very much about collaboration within a supply chain; it was about building a supply chain within a sector. From a Technology Strategy Board point of view, we also see it as very important to develop collaborations that transfer knowledge from universities into business, that see transfer of
knowledge from one sector into another sector. It is through mechanisms like the knowledge transfer networks, the knowledge transfer partnerships; it is about bringing centres together which force sectors who might not otherwise have spoken to each other to see the ideas and business opportunities that arise. From my perspective, collaboration is a hugely important part of government. The trade organisations themselves tend to be fairly good at organising collaboration within a sector, but what we need to look at is ways and means of transferring knowledge between sectors, between academia and the business sectors. That is fundamentally the connect and catalyse approach.

Dr Hillier: That is pretty fundamental to CPI’s approach to any of its problems. The solutions to a lot of problems come from across different disciplines or across different industries. If you can get that knowledge to come together you can change something. At CPI turn batch processes into a continuous processes—this comes back to Lord May’s question about what have we done. We have brought together two or three companies and a set of assets and design a new process that halved the capital cost of the project, reduced its operating costs by 90 per cent, and reduced its emissions by 80 per cent as a consequence. That was because different technologies came together from different places to make the collaboration happen. It picked up research work to take a new process to the market. In printable electronics you probably know that we run PETEC for the UK and we are running a large project at the moment on the printable electronics supply chain. If you cannot get the whole product supply chain to work, all the research you did comes to nothing, so you have to get people and organisations to collaborate across that whole chain. It must be attractive for companies to move into it to give yourself a chance to fill the gap. Without understanding that and getting companies to collaborate it is not possible to fill those supply chain gaps.

Dr Clarke: From my experience, I would say that there are two key issues that we see around the collaboration side. The first one is around the sharing of expertise and knowledge—both technological expertise, technological knowledge—but also operational type capabilities. For instance, in the projects I do, I never dreamt that I would be teaching major UK companies how to handle health and safety in major engineering projects, for instance. I did not think I would be teaching them about business investment selection processes and it has turned out that we are transferring knowledge between some of our major industry members and other sectors in that regard. Similarly, from the point of view of industry and government and coordination and collaboration, I think we are in a very fortuitous and unique position in that our board is actually made up of senior government representation, including John Beddington—one of Lord May’s successors—and CTO-type level individuals from major global companies, and that gives us a major opportunity to share expertise and knowledge at that level. That is one major benefit that comes into the space around coordination and collaboration and the other one, as alluded to by two previous speakers, is quite simply that most of the projects that we are talking about for the future—low carbon, pharmaceuticals, energy or transport—are now getting so big and so complex there is no one company that can do this, no one person has the entirety of the answer. It is about developing a broad, capable supply chain which can actually deliver the full answer and about strengthening that right through, not just at the top level. That would be to the benefit of the UK industrial base and economic base, as well as delivering the answer to a specific project in whatever sector it is in.

Q400 Lord Colwyn: So no changes to the mechanism.

Dr Clarke: You need the mechanisms but how they are organised and where they are placed I am not sure I would get too worried about it to be honest. You need a range of mechanisms to persuade these people to work together because if they do not you will not get the full benefit and not everybody responds to the same mechanism, the same set of incentives. You need a mixture and you need to find the most efficient way of delivering them.

Mr Gray: Just to reinforce what I believe is the importance of the challenge-led approach as a mechanism that actually does pull together knowledge transfer across different sectors. A technology-agnostic approach to a challenge suddenly brings together people from the healthcare industry, from the defence industry, from the energy industry, from the manufacturing sector, people who previously have all worked in their own little worlds and never seen the crossover. So I think a challenge approach is an extremely good government mechanism to create that knowledge transfer.

Dr Clarke: You need to find a way of getting the unusual suspects into the game.

Q401 Lord O’Neill of Clackmannan: Do you have anyone from the Treasury involved in any of your operations, for example, at the end of the day, if you need extra money quickly you are going to have to get it from the Treasury. Are they involved at any stage of the process?

Mr Gray: If I could comment from a Technology Strategy Board point of view, we work very closely with the Treasury and with Treasury officials. The whole question about impact is a very important
question for us and we are actually doing a piece of work at the moment to take to our board—a proposal from an impact point of view—that we can work with the Treasury. It is also important to recognise that, just in the last 12 months itself, we have seen increased funding come into the Technology Strategy Board both through the SIF funding that was announced during the budget period and also just last week the PBR included an additional £70 million allocated to the Technology Strategy Board. All of that was work where we have worked very closely with Treasury officials. We need to continue to work even closer so that they can understand the real benefits that come through the investment in innovation. We are working with our colleagues.

Q402 Lord Krebs: What percentage of your annual budget do you spend on administrative overheads? Mr Gray: The Technology Strategy Board is about 1.5 percent. Dr Hillier: I do not know the answer to that.

Q403 Chairman: A written answer would be acceptable. Dr Clarke: Four per cent in ETI.

Q404 Lord Krebs: Coming to the main point I wanted to focus on, your different organisations have been established in order to try to up the game in this country in relation to the transfer of basic knowledge into application through industry and eventually to make money. You have alluded earlier on—so have other witnesses in other sessions—to the fact that the UK has in some ways a rather poor history of this kind of transfer of technology. If you look at countries that are better at it than us, do they have organisations like yours? Are we adopting good practice from other countries and reflecting in the organisations that have been set up under your leadership? Dr Hillier: CPI is an organisation that has a combination of physical assets that trial and prove processes and cross-disciplinary people. We focus on two specific areas: sustainable processes for the chemical industry and printable electronics. If you look across Europe there are organisations doing similar things; there are organisations in the States doing similar things; there are organisations in Japan doing similar things. I think this innovation activity between the university and the market is vital. We operate as an independent organisation, we are a company limited by guarantee, and again the structure that we have is quite similar to the ones in other countries. We are successful enough in our chosen fields that the overseas organisations are wanting to collaborate with us or are beginning to see us as a threat in certain circumstances. CPI is being successful enough at getting new processes to work and things are moving to market. My belief is that the UK needs more organisations like us that operate in that innovation space. We are not part of the universities and are not part of the market, but act to move technology to market. My belief is that we should have organisations like CPI for whichever technology sectors we choose to be the most important for the UK. At least a proportion of public funding is required. If you benchmark what other countries do you will find that organisations like CPI are roughly a third public funded just to keep them going, about a third of funds from public/private projects (which is where the Technology Strategy Board and ETI come into it) and then about a third of their funds come from direct private investment. That is where CPI’s model is taking us, but we are too young to have got to this funding split at the moment; we are probably 50 or 60 per publicly funded but we are moving to that space1 and I think CPI’s model would be a good one to adopt in other technology sectors if the UK is going to fill the innovation gap.

Q405 Chairman: So you will come back in 18 months’ time as well and tell us how it is going. Dr Hillier: Yes.

Q406 Lord May of Oxford: I cannot speak with any authority for any of the other countries except the States—and it may have changed—but I do not see anything like the analogue in relation to GDP to the organisations you speak for. What there is—it is something we have tried to copy but I do not think it has succeeded particularly well although, there was great enthusiasm from Lord Sainsbury—are some very specific things to encourage SMEs (minority SMEs particularly), government purchasing and things like this which you have mentioned and which are good but which are not thick with civil service structure. It is just legislative things that are done. It may be that we are doing it right, and they are doing it wrong, in the way that people like yourselves, with the fairly elaborate processes of thinking about things—about which I may be wrong and it may be good—but I would be interested, if the States have changed that much, if they really are on the scale we have these enterprises. There may be in other States outside of New Jersey. Dr Hillier: There are certainly organisations like us in the States.

Mr Gray: From my perspective, I will comment in a broader sense and come back to the States. We have to look at best practice that exists around the world and there is best practice in a number of areas. There is the Finland example; there is the US, the DARPA-type schemes, the SBIR type schemes.

1 The balanced 33:33:33 model.
15 December 2009  
Mr Iain Gray, Dr Graham Hillier and Dr David Clarke

Q407 Lord May of Oxford: DARPA is not like you really, it is more like a research council
Mr Gray: There are elements of the DARPA-type scheme in a cultural sense which are similar but I agree with you. We have to take advantage of that best practice and apply it. I think SBRI is a very good example. SBRI is modelled on the SBIR initiative in the States. SBIR operates at scale, it has a budget, it works across the departments.

Q408 Lord Crickhowell: Can we have a translation for ignorant chaps like me when we get into the acronym world?
Mr Gray: We have SBRI which is Small Business Research Initiative. We have tried to pull back from using its full title and we do refer to it as SBRI as an initiative; that is what came out of Race to the Top. Fundamentally, it is about how the government procurement of research across the different departments is met through ideas and innovation in small business. It is a way of supporting small businesses to come forward with fresh ideas to meet the challenges of government research. SBRI I think is a very good example where we need to operate at scale. We have introduced a pilot which has been very successful. We have extended that pilot in the last nine months; we now have eight government departments involved, but we are still only operating at a relatively small scale in comparison to the impact that that mechanism has in the States. So we need to look at ways and means of scaling up. What does not surprise me in a broader comparison sense, however, is how other parts of the world are increasingly looking in on initiatives like the Technology Strategy Board as a benchmark and looking at ways they too can introduce themselves to our type of initiatives, particularly around the challenge-led approach. That model, I think, is now being applied and benchmarked by other countries as the way to do things. Whilst we need to get the best practice from other countries and we need to get to the right level of scale, there are things that we are doing here which are now being modelled by other countries as best practice.

Q409 Baroness Perry of Southwark: In their submission to us the CPI said that innovation and development funders were not getting enough money to do some of the things they felt were desirable to be done. I know no chief executive ever thinks they have enough money, but perhaps I could ask Mr Gray, would you be able to justify having more money for the TSB in the current climate?
Mr Gray: From my perspective, we are more than just a funding agency. The money that we are spending I think is already making a big impact and is making a difference. The fact that industry itself is asking for us to have more money is a testament. This is not me asking for more money; this is business itself saying they see the value in what we are doing and they see the need for more money to come through the Technology Strategy Board.

Q410 Baroness Perry of Southwark: It was the CPI that said they needed more money, not the CBI.
Mr Gray: CPI and the CBI have said that.

Q411 Chairman: Do the others want to comment?  
Dr Hillier: I think I better had seeing as I said it in the first place. I think if we want to get our innovations into the market in the UK we need to re-adjust the balance so that we spend a little more taking the ideas that we are generating in our universities—which are fantastic—into products and processes that generate value for the UK rather than letting other countries do it on our behalf. The CBI have some data from when they did a quite in depth comparison with the US. They reckon that the US spends about 15 per cent of its non-defence R&D on the actual development of technology, turning research from an idea into a product in the market, whereas the UK equivalent, in 2005–06, was 3.4 per cent at the time. The UK has significantly increased its spend through both TSB and ETI since then, but I still think we are about half the level, in proportion to what the United States is spending. That is not my data; that is CBI data and I think that is publicly available.
Chairman: Thank you very much. The Committee has other business it has to move on to so I thank you very much indeed. There were one or two areas we would like to have probed further and if you have any written comments on these we would appreciate that very much indeed. Thank you for your written evidence and for giving us time today; it is much appreciated.
Supplementary memorandum by the Technology Strategy Board

This letter provides the additional evidence requested from the Technology Strategy Board in response to questions raised by the Committee (which are set out below)

1. *What assessment has been made of the TSB’s impact on the exploitation of research findings?*

2. *What progress has been made on the impact proposal on which Iain Gray is working with the Treasury (Q401)?*

3. *What role does public funding play in developing research from Technology Readiness Levels 1–3 to TRL 7? What role does industry play? How should the Government support research and development activity at each Technology Readiness Level?*

**Response to Questions 1 and 2 is Combined.**

The piece of work on metrics and measures described to the Committee by Iain Gray was reported to and discussed by the Technology Strategy Board’s Governing Board on 12 January 2010. The Governing Board endorsed the recommendation that the Technology Strategy Board should use it as the basis of establishing a new performance management system which will focus on identifying and measuring the future impacts which our activities will achieve.

Work is therefore in hand to create a new system designed to capture the strategic impacts which our programmes are targeting over the longer term with additional nearer term interim measures to provide confidence that we are progressing in the right direction. It will link assessment of performance at various levels from the individual projects and competitions up to whole programmes with the aim of providing regular performance information to help manage activity. The new management system and the vast majority of the programmes to which it is applied are however relatively new and as yet insufficient information has been collected to provide firm evidence of the impact of the Technology Strategy Board’s programmes.

In some cases however there is already anecdotal evidence that the Technology Strategy Board’s programmes have helped achieved positive outcomes for the UK. For example, the Low Carbon Vehicles demonstration programme, which with 340 cars on UK roads is now the largest demonstration of its type in the world has been cited by some multinational vehicles manufacturers as supporting the case for locating the production of new low carbon models in the UK.

Recipients of Technology Strategy Board support have also been surveyed to provide information about the expected returns from projects. A survey of a sample of Technology Strategy Board collaborative research grant recipients in 2009 indicated that the companies expected on average to achieve a benefit of 4.4 times the cost of the project as well as, in the majority of cases, benefits in terms of jobs saved or created and extra R&D investment. Another survey in 2008 of firms participating in Knowledge Transfer Partnerships programme gave the following benefits from each £1 million invested in the scheme:

- 54 jobs.
- 395 staff trained.
- £1 million in-year profit.
- £3 million increase in annual profit.
- £2 million new capital investment.

A more recent evaluation of the impact of Knowledge Transfer Partnership commissioned by the Technology Strategy Board, which is currently being finalised, has also estimated the net additional GVA per pound spent by public sector sponsors under the programme to be on average in the range £4.70–£5.20.

These results and the work on measuring Technology Strategy Board impact have been discussed with Treasury and the Department of Business, Innovation and Skills to ensure that they understand the benefits that Technology Strategy Board programmes are expected to deliver.

**Response to Question 3.**

Public funding plays a different role across the Technology Readiness Levels 1–3 to TRL 7. At levels 1–2, public funding is primarily focused on supporting basic research which is not explicitly linked to industrial or commercial objectives. Public funding at levels 1–2 is mainly provided by the Research Councils. At levels 3–4, public funding is used to support the translation of the basic research to ensure it has more direct commercial application. At levels 3–4, the Research Councils and the Technology Strategy Board would, for instance, jointly fund collaborative research & development projects between academia and business, with business providing a contribution to the project costs, in most cases 50 per cent. At levels 5–7, it is more about the
development and demonstration of the technology, with funding provided by the Technology Strategy Board and other public sector funders such as the Regional Development Agencies and Devolved Administrations, again matched by business. At levels 5–7 businesses involved in projects would be contributing higher levels of funding, usually 75 per cent of the projects cost with the remaining 25 per cent provided by the public sector. At levels 8–9, businesses are taking the lead and so there is generally no further public sector funding for R&D. There is some funding for deployment of technologies, but this is mainly around the deployment of renewable energy technologies.

Across the Technology Readiness Levels industry plays an increasingly important role. At levels 1–2 industry would be an interested observer. At 3–4 industry would start to take a closer interest looking at the potential for commercial application. At 5–7, industry is looking at the development and demonstration and for levels 8–9 the commercial application. There is a sliding scale for public sector funding (determined by EU State Aid rules) with more public sector support available to support projects furthest away from commercialisation and less funding for projects closest to market.

There is strong unmet demand from industry, particularly at levels 3–4, where the collaborative R&D projects between industry and academia, such as support jointly by the Technology Strategy Board and the Research Councils, are 10 times oversubscribed for the public sector funding available. Increased industry participation in projects helping to commercialise research outputs could certainly be achieved with increased public sector funding.

In response to the question of how Government should support research and development activity at each Technology Readiness Level, the answer will vary depending on the technology or sector being supported. In general however it is important to maintain a broad spread of activity at levels 1–2 and then increasingly focus as industry becomes more involved. A comment also often voiced by business is the need for greater support for the demonstration phase (levels 5–7) where the costs are often prohibitive for a single company and particularly difficult for SMEs. Increased support for the demonstration phase would enhance the potential for commercialisation (often within a shorter timescale) for many businesses. The main issue overall however is not the support at each level, but ensuring a continuum of support across the levels and across organisations. By providing such support it should be possible to more rapidly commercialise ideas from the science base.

22 February 2010

Supplementary memorandum by the Centre for Process Innovation

During my appearance before the Committee on 15 December last year I noted that there were two specific questions that the committee asked of me and I have pleasure in providing the answers to those questions. In addition I have included some comments about the role of the Regional Development Agencies (RDAs) in the innovation process. I was aware prior to my appearance that this information was of interest to their Lordships, but time did not allow for a full answer at the hearing. My final comments are a brief summary of the Centre for Process Innovation’s (CPI’s) view of how innovation in the UK can be improved and driven harder.

Administrative Overheads

The nature of CPI’s work and the wide range of public and private funding sources that support its operation mean that administration is complex. However, the administration system is highly effective. The cost of administration is in a range between 10 per cent and 20 per cent of income, depending on the funding source and reporting requirements.

CBI Data on Innovation Spending

During my evidence I referred to data that had been put together and reported by Tim Bradshaw, the CBI’s Head of Enterprise and Innovation. Mr Bradshaw discussed his data and findings at last year’s Science and Innovation ‘09 Conference. I have attached his speech to this letter. It contains a range of very useful information and I commend it to the Committee.

The Role of RDAs in the Innovation Chain

RDAs have a significant role to play in the innovation chain. One North East’s (ONE’s) insight created CPI almost six years ago to address an identified gap in the part of the Innovation Chain that converts research to market ready processes. The process industries are core to the economic success of North East England and make a major contribution to the UK economy. Having an internationally recognised innovation centre is viewed by ONE as being essential to the sector’s ongoing success in the region and beyond.
However, the RDA’s role is to support economic development in its own region. It can only fund programmes in the region it serves and is unable to take on a national role without financial and policy support from central government. CPI does run some regionally based economic support projects that are specific to the North East of England, but its work is increasingly nation and international in nature. However, ONE funds the regional economic support projects and it is consequently a vital supporter of CPI and its work.

This internal focus on the region means that RDAs are tempted to set-up their own regional innovation centres for local markets. This parochial behaviour leads to the UK having many sub-optimal competing centres working in similar technology areas. Few are excellent or have the critical mass to succeed or make a difference internationally.

As CPI has developed it has grown to become a national and, increasingly, an international Centre of Excellence for the process and printable electronics industries that is based in the North East of England. ONE’s foresight has created a Centre of National Significance and currently less than 20 per cent of CPI’s funding comes from ONE’s direct funding stream.

If the UK is to succeed internationally in the innovation phase of development it needs to select markets that are vital to the national economy. It should create UK owned national centres to serve these markets. These should be funded through the Technology Strategy Board (TSB) or another National body that drives innovation in preference to research. There should be a number of National Centres each with a specific area of technical excellence (eg CPI for Sustainable Processes and Printable Electronics; NaREC for new and renewable energy). These should be located in areas that are most appropriate to their area of excellence. There should also be a second level of innovation support that is provided locally across regions and which must be under the aegis of the relevant national centre. These sub-centres will support the local application and development of technology and will be associated with the relevant National Centres. This network of regional innovation support centres should be funded by the RDAs.

THE CPI VIEW OF DRIVING PRACTICAL INNOVATION IN THE UK

The over-arching justification for a National Innovation Framework and Infrastructure arises from the fact that private capital is internationally mobile and will be invested wherever the investor chooses without regard to wealth-creating needs of any particular region or nation. Public intervention is nation-specific and nurtures the wealth-creation of that nation. The UK innovation investment lags significantly the innovation infrastructures of our competitor nations. As a consequence the UK struggles to create value through innovation.

In summary, CPI believes that the UK needs:

— Policy and financial support that drives the Innovation Phase of development if it is to create significant new value for the nation.

— A network of internationally competitive “Technology Innovation Institutes” (TIIs) like CPI. These will address the major technology areas that create economic value for the UK. They will move technology from Technology Readiness Level 3 to Technology Readiness Level 7.

— The TIIs to be part of a cross sector national strategy that is a partnership between academia, industry and government.

— Funding for research and innovation to be rebalanced so that the proportion of funds for the “Innovation Phase” that develops technology for market is increased by a factor of at least two—This will move the UK towards the average level of its major competitors.

— The TIIs to be supported with long term strategic public funding that covers 33 per cent of the costs of operation (similar to the UK’s competitor nations). The funds would be administered by a National body such as the Technology Strategy Board. TIIs would be expected to raise the other 67 per cent of their funding from a combination of collaborative public/private activities and direct private investment.

— Regional bodies such as the RDAs will have regional sub-centres that support the national centres in driving innovation within the regions.

I hope that I have adequately answered the questions that arose from CPI evidence I gave to the Committee and I hope that the additional clarifications are of use. If there are further questions for CPI I would be very happy to answer them.

29 January 2010
Letter from Professor Andrew R Watkinson, LWEC Director, Living With Environmental Change

Please find my responses to some of the questions that you are addressing below.

Please note that the responses to the questions are mine as Director of LWEC and do not necessarily reflect the views of the Partner organisations. Also note that Lord Selborne is Chair of the LWEC Partners Board.

1. What is the overall objective of publicly-funded science and technology research?

The overall objective of publicly-funded research in science and technology should be to drive innovation and understanding, stimulate the economy and meet the needs of society.

2. How are public funds for science and technology research allocated? Who is involved at each level and what principles apply? Where appropriate, is the Haldane Principle being upheld?

In responding to this question, I restrict myself to outlining the role that the Living With Environmental Change partnership plays in determining the allocation of funds by Partners.

The 20 partners within LWEC that fund and utilise the results from environmental research increasingly make each other aware of issues that are of concern or where research funds might be made available. Where there are areas of common interest discussions are then held on how best to deploy resource, for example, by creating a larger common pot of money, by aligning activities or by inputting into discussion on the nature of the research call so that the end results can potentially be of increased use for end users.

As an example, I would take the Insect Pollinator Initiative that from original concerns expressed about the health of honeybees to be funded by Defra and Wellcome expanded into a programme supported also by NERC, BBSRC, ESRC and the Scottish Government (SG). This is because it was increasingly realised that the decline in honeybees was part of a larger problem associated with pollinators in general and which required input from a range of disciplines.

3. Are existing objectives and mechanisms for the allocation of public funds for research appropriate? If not, what changes are necessary?

The expenditure mechanisms of individual research councils, government departments and delivery agencies work well for areas that fall clearly within the remit of those bodies. Where major challenges such as food security, climate change and ecosystem management require more integrated research programmes involving interdisciplinary or multidisciplinary science, then current mechanisms do not always work well as it is difficult to align priorities and funds.

LWEC provides a mechanism for bringing the funders together to tackle such challenges in the field of environmental change, ensuring that the research councils, policy and delivery agencies deliberate on the challenges and the appropriate research directions. It does however require one or two of the agencies to champion a particular research challenge.

A clear necessity is that there should be sufficient knowledge of the priorities and working of the different partners, which are substantially different, and a recognition of the importance of networking in delivering joined up research. The AVOIDing dangerous climate change programme provides a good example of where government departments (DECC and Defra) outlined the research challenges that were necessary to provide the evidence base for developing policies in the run up to Copenhagen. The Met Office Hadley Centre, Tyndall Centre, Grantham and Walker Institutes have stepped up to the challenge of addressing complex research issues in an unprecedented time frame. Essentially a small additional investment from government is drawing on the diverse capacity in the other organisations provided by a range funders, both public and private.
4. What governs the allocation of funding for Government policy-directed research through Government departmental and agency initiatives? Are existing mechanisms appropriate? What is the role of Departmental Chief Scientific Advisers?

From an LWEC perspective it is clear that the Departmental Chief Scientific Advisers are playing an increasing role in articulating the research priorities of the government departments and communicating those priorities. For example, the government CSA has clearly raised the research profile of food, water and energy security. LWEC has responded, for example, in terms of the issue of water by developing a water cycle programme that involves NERC and Defra together with international partners so that the potential funding in this initiative is approximately three times greater than the original NERC commitment. The Defra CSA has also made it clear he expects Defra through its Evidence Investment Fund to work increasingly with partners through LWEC on its three big challenges of climate change, food and ecosystems. In terms of ecosystems, for example, the Defra CSA has brought together a number of the partners to fund the National Ecosystem Assessment, while other initiatives from the Partners are bringing together a comprehensive research programme around ecosystem services.

It is, however, clear that the CSAs within different departments exert varying levels of influence on the research agenda of their departments, depending on their position within the management structure and access to funds.

5. How are science and technology research priorities co-ordinated across Government, and between Government and the relevant funding organisations? Who is responsible for ensuring that research gaps to meet policy needs are filled?

There are a range of mechanisms including regular meetings between the chief executives of the research councils and the CSAs of government departments and through organisations such as ERFF and LWEC. While ERFF provides a strategic overview of environmental research funding, LWEC increasingly provides a mechanism for co-ordinating research activities. During its initial phase it has concentrated on co-ordinating new developments such as in environmental health (MRC/NERC/BBSRC/DoH/SG), but it is increasingly looking at how to best co-orderate existing activities, such as research into flood risk management.

Through active systems mapping LWEC is increasingly playing a role in identifying research gaps that need to be filled to meet policy needs. It is currently carrying out a gap analysis with Partners and ERFF of research gaps in climate adaptation and flood risk management.

6. Is the balance of Government funding for targeted versus response-mode research appropriate? What mechanisms are required to ensure that an appropriate and flexible balance is achieved? Should the funding of science and technology research be protected within the Research Councils or Government departments? How will the current economic climate change the way that funds are allocated in the future?

Given the scale of the challenges that have been identified in moving towards a low carbon society, ensuring food, water and energy security, and increasing the resilience of vulnerable people, places and infrastructure in a changing world it is essential that the natural, social and physical science research is in place to meet those societal needs. I would therefore argue that research be protected within both government departments and the research councils. Funding in the different types of organisation allows partnerships to be formed to address common challenges. In the face of cuts it also allows leverage to put together sufficient funds to address priority issues.

7. How is publicly-funded science and technology research aligned and co-ordinated with non-publicly funded research (for example, industrial and charitable research collaborations)? How can industry be encouraged to participate in research efforts seeking to answer societal needs?

There is a great deal to be done in this area as it is currently not well aligned; the current state of agricultural research shows that we do not have a sufficient research base in either the public or the private sector to address land use change issues in a changing climate. Difficulties over the introduction of GM crops also arose in part because of the lack of co-operation and alignment between the public and private sectors as witnessed by discussions on ACRE, the Advisory Committee on Releases to the Environment.

LWEC is engaging with both business and the third sector. The key to success with business is involvement between the research agencies and business sector from the beginning in partnerships that are both deliberative and analytical. Partnerships between the TSB, research councils and government departments (encouraged in part through LWEC) are beginning to change working practices, but there is much more that needs to be done to encourage such partnerships in the environmental sector that we are beginning to work on.
Again with the third sector we are beginning to work on projects together from their inception. For example, in the National Ecosystem Assessment the LWEC Partners are engaging organisations such as RSPB, WCMC, WWF and BTO; indeed the NEA is being co-ordinated by WCMC with Defra and the Scottish Government providing the co-chairs. In the field of climate change and social justice we are also exploring how to work with the third sector through the Global Humanitarian Forum and Joseph Rowntree Foundation to address issues of climate change adaptation and social justice.

8. To what extent should publicly-funded science and technology research be focused on areas of potential economic importance? How should these areas be identified?

As part of its remit it has been made clear that LWEC should promote the delivery of research that is useful to society through an active knowledge exchange programme. Through the co-design, co-production and co-delivery of research LWEC is also attempting to identify research questions that will be of use to government and its agencies, business and society. For example, the Partners through LWEC are engaging in research that will further climate prediction and services, the management of ecosystem service trade-offs in land use, behavioural change in climate adaptation and the resilience of infrastructure systems to a changing environment.

Clearly there is a need to promote blue skies research, but the research challenges that we face in areas such as food security, climate and ecosystem change are profound and need to be targeted in that they will have significant influence on human well-being and the economy. The enormity of some of these challenges requires significant research teams to address them. These are not easily promoted through traditional responsive mode funding.

Priorities need to be identified through the dialogue between researchers and stakeholders that are being established through networks like LWEC. Early engagement, partnering and networking all facilitate the identification of priority areas for research that will have an impact on economic activity. For example, the Department of Health is engaged in discussions with us on delivering to health policy and practice across the full breadth of LWEC. Input from the Local Government Association, DCLG and DfT is also helping shape the future strategic direction of research needed on the health aspects of buildings and low carbon aspects of urban areas and the associated infrastructure systems. These partners are also positioned to take up results from recently awarded research grants looking at adaptation in urban areas. All of these areas of activity will impact on regulatory reform and business activity.

The establishment of an LWEC business advisory group with support from NERC and TSB is also looking to identify opportunities where LWEC research activities can stimulate the green economy, through for example research on marine renewables, geoengineering and the water cycle.

9. How does the UK’s science and technology research funding strategy and spend compare with that in other countries and what lessons can be learned? In this regard, how does England compare with the devolved administrations?

It should be noted that the NSF of the USA has requested a meeting with LWEC to learn more about how LWEC facilitates the delivery of research to policy and delivery agencies. There is also clear interest in the LWEC experiment in countries such as India and China.

In working with the devolved administrations it is clear that there are considerable differences between WAG and SG in the way that they interact with the UK research community. In the environmental area WAG relies to a considerable extent on influencing Defra and the EA. The Wales Environment Research Hub is also providing an increasing focus for knowledge exchange. The SG acts much more independently. In the environmental field it is noteworthy that the Macaulay Land Use Research Institute provides a research focus for land use, an area of research that does not fall comfortably within the remit of the research councils.

In the field of climate change it is noteworthy that the WAG and SG have funded initiatives (SAGES and C3W) to strengthen climate research capacity within the devolved regions. There is no equivalent funding for England where there is a reliance on the research councils for funding of UK capacity. There are no clear means of research co-ordination across these activities.

8 October 2009
Memorandum by the Office for Strategic Coordination of Health Research (OSCHR)

INTRODUCTION
1. This memorandum provides background on the establishment, operation and progress of the Office for Strategic Coordination of Health Research (OSCHR). It was prepared by the OSCHR Office with input from the Department of Health (DH), Department for Business, Innovation and Skills (BIS), and the health departments/directorates in the Devolved Administrations.

2. The memorandum is designed to augment the OSCHR Chairman’s First Progress Report, which was published in November 2008 and is attached at Annex 1 (submitted but not printed).

BACKGROUND TO THE ESTABLISHMENT OF OSCHR
3. On 31 March 2006, the then Chancellor of the Exchequer, Gordon Brown, appointed Sir David Cooksey to lead a review to build agreement on the best institutional arrangements for a new single fund for health research announced in the budget. The report of the review, “A Review of UK Health Research Funding”, was published in December 2006.
4. The review concluded that, although good progress had been made in some areas, further work was needed to ensure that publicly funded health research was carried out in the most effective and efficient way, and to facilitate rapid translation of research findings into health and economic benefits. The report recommended specific actions for the Government to take to achieve this. In his Pre-Budget Report on 6 December 2006, the Chancellor announced that he and the Secretaries of State for Health and for Trade and Industry (now Business, Innovation and Skills) welcomed the report and would take forward its recommendations.
5. The review recommended the establishment of a new Office for Strategic Coordination of Health Research (OSCHR) that would take an overview of budgetary division and research strategies of both the MRC and NIHR.
6. OSCHR was set up in January 2007 following the blueprint laid out in Sir David Cooksey’s review, in order to develop a more coherent strategic approach to health research in England. During 2008, this role was extended to all three of the Devolved Administrations. This change reflects the collaborative, multi-disciplinary, multi-centre nature of much health research, and the need to maximise UK competitiveness in a global health research environment.

ROLES AND RELATIONSHIPS

OSCHR
7. As recommended by the Cooksey Review, OSCHR was created as a jointly-staffed and funded office of the Department of Health (DH) and the Office of Science and Innovation (OSI) (now part of BIS). OSCHR is headed by a non-executive, independent, Chair who is appointed by, and reports to, the Secretaries of State for Health and for Business, Innovation and Skills. Professor Sir John Bell, Regius Professor of Medicine at Oxford University and President of the Academy of Medical Sciences (AMS), was appointed as the first Chair of OSCHR.
8. The work of OSCHR is overseen by the OSCHR Board, which first met in January 2007. Terms of Reference and membership are given at Annex 2. The Board has three non-executive members recruited through the Appointments Commission in accordance with the procedures set by the Office of the Commissioner for Public Appointments and appointed by Ministers.
9. Initially there was representation on the Board from BIS, DH England, MRC and NIHR, with a single representative for the Devolved Administrations. Following discussions with the Scottish Government, the Welsh Assembly Government, and the Northern Ireland Executive, Scotland, Wales and Northern Ireland agreed to become full Partners in OSCHR in 2008 and now have full representation on the OSCHR Board.
10. The research funders:
   — the Medical Research Council (MRC),
   — the National Institute for Health Research (NIHR) (for England),
   — the Chief Scientist Office (CSO) (for Scotland)
   — the Wales Office of Research and Development for Health and Social Care (WORD), and
   — the Health and Social Care R&D Office of Northern Ireland
are now referred to as “The OSCHR Partners”.

The OSCHR Office

11. The Office is administered by DH England under an agreement between DH and BIS, and is funded jointly by the DH, BIS, CSO, WORD and HSC R&D.

The Roles of the OSCHR Partners

12. The key messages emerging from the Cooksey Review were that there was a need to:

— ensure a more strategically coherent approach to publicly-funded health research;
— create a step-change improvement in the translation of basic research into health and economic benefits; and
— encourage a stronger partnership with the health industries and charities.

13. The OSCHR Partners are responding to these challenges by developing a shared Vision for UK Health Research. The Partners are working together to realise this Vision through the development of an integrated plan to deliver the Vision supported by five key areas of work:

— translational research,
— public health research,
— E-health records research,
— research methodology, and
— human capital.

14. All the OSCHR Partners remain the direct funders of research with their own budgets and lines of accountability. Each has, and continues to develop, its own strategy. The major difference since the Cooksey Review is that, under the oversight of the OSCHR Board, the OSCHR Partners are now coordinating their strategies to deliver the shared Vision for UK Health Research.

The Role of the OSCHR Board and OSCHR Office

15. The role of the OSCHR Board and OSCHR Office is a) to forge agreement between the OSCHR Partners on the UK Health Research Vision and their integrated plan to deliver the Vision, and b) to monitor the coordination and implementation of the OSCHR Partners’ delivery of the Vision.

16. Since the establishment of OSCHR in 2007, the OSCHR Partners have worked to coordinate their strategies in specific areas such as translational medicine, and have then brought these to the OSCHR Board for discussion and agreement.

17. OSCHR has the additional role of submitting a single funding bid to the Treasury covering the activities of the MRC (UK-wide) and the NIHR in England, and the allocation to the MRC and the NIHR rising to over £1.7 billion p.a. by 2011 of Government funding needed to deliver the Vision.

Progress to Date

18. Full details of progress between January 2007 and November 2008 are summarised in OSCHR’s first progress report, which was published on 18 November 2008 (Annex 1) (Submitted but not printed).

19. The purpose of the OSCHR progress report was to highlight the main elements of the combined approach that has been put in place by the National Institute for Health Research (NIHR) and the Medical Research Council (MRC) since the Cooksey review. This period has seen an unprecedented commitment to health research in terms of funding, infrastructure, research programmes and the volume of health research commissioned.

20. There is a much closer working relationship between the OSCHR Partners, the major public funders of health research. Together, as part of a coordinated approach, they are now investing much more into research aimed at translating basic science ideas into new products and approaches to the treatment of disease and illness.
Progress in the five key areas of work

21. During 2007–09 the MRC and NIHR, under the oversight of the OSCHR Translational Medicine Board, chaired by Prof Sir Alex Markham, jointly developed an ambitious new approach to translational medicine research. Coordinated strategies were created that are designed to increase translational research activity and capacity.

- A system was created which is designed to swiftly identify the latest advances in basic science, develop their potential into promising interventions, and evaluate effectiveness, value for money and broader impact for use in the NHS.
- By working closely together, a coherent approach to public funding of translational medicine research was developed by the MRC and NIHR that provides opportunities for those choosing to move basic medical research discoveries towards commercialisation and clinical use.
- For the first time, the “development gaps” where support was not consistently available have been addressed.

22. In the area of electronic records research, in 2008–09, the OSCHR E-Health Records Research Board, chaired by Prof Ian Diamond, worked to facilitate coordination of funders’ strategies in the area of E-health records research in order to maximise preparedness of the research community for the exploitation of the CfH Research Capability Programme. A Strategic Framework for Health Informatics in Support of Research was agreed to aid coordination of UK funders’ strategies (including: maximising current investment, funding of infrastructure & novel research, training of human capital etc.), and a Strategic Coordination Group, bringing together the major funders from the Government and charity sectors is taking forward the Framework.

23. It is envisaged that the Research Capability Programme and equivalents in Scotland and Wales will enable faster and easier access to health-related data sets. This will lead to increased numbers of research applications linking health data with population based research data including biological (genomic), trials, epidemiological and social science data.

24. Progress in methodology. The MRC and NIHR share a vision that the UK should lead the world in the development of pioneering research methodologies. A programme of research now supports this aim. It is hoped that research in universities and the NHS will benefit from new and improved ways of designing and conducting clinical research, and translation into patient benefit will be supported by better tools to inform regulatory and adoption decisions, and to support industry R&D needs.

25. Progress in public health research. The MRC and NIHR have each taken a strategic coordination lead in two major areas of public health need, with the MRC leading on Ageing and on Addiction & Mental Health, and the NIHR leading on Obesity and on Infection. In 2008–09, the Public Health research Board chaired by Professor Ray Fitzpatrick oversaw the production of a map of public health research funding available in the UK and provided input to the work of the OSCHR Partners Human Capital Working Group (see para 26), and discussed the challenges and opportunities in public health research.

26. On Capacity building, the OSCHR Partners have undertaken a UK fellowships survey, which has now been published. The mix of clinical specialties attracting research training support through the integrated academic pathway for clinical trainees will be reviewed in 2010 in order to examine the extent to which the pattern of take-up of the existing allocation of fellowships and lectureships is likely to deliver the breadth of clinical research capacity that an innovative health service will require. The review will look, in particular, at whether there are vulnerable clinical specialties that need specific support in the next round of allocations.

Progress in other areas of work

27. One of the key recommendations from the 2006 Review of UK health research funding by Sir David Cooksey was to establish “… an agreed and understood set of health research priorities for the UK that target the biggest and most important health challenges for the UK over the coming decade.” During 2008, OSCHR coordinated a multi-stage project with the overall objective of identifying and prioritising “UK health research opportunities” over the next decade. Extensive debate and discussion led by the MRC identified that the key opportunities for maximum impact in health research over the coming years would be the application of new and developing research approaches across a range of diseases and disorders. The Health Research Opportunities were published on the MRC website in February 2009.

28. To take forward the OSCHR Partners’ communication of the combined funding landscape and interactions with industry, a series of biomedical “Capability Clusters” will be created across the UK. The main focus of these clusters will be on early clinical development. The clusters will bring together a small number of outstanding centres, which will work together to deliver exploratory development programmes in each of a number of therapeutic areas, tailored to the therapeutic indications deemed most important by
industry. To ensure the UK-wide coordination needed to deliver this vision, government funding agencies and the major charities involved agree to work within a single “UK Framework for Industry/Academic/NHS Collaboration in the Life Sciences”. This will ensure that funding initiatives providing support for programmes in, for example, experimental medicine or cohort development will fit within this UK Framework. Oversight of this programme rests with a “Capability Cluster Delivery & Oversight Group” that reports to the OSCHR Board, and which is made up from industry and the public sector.

December 2009

Annex 2:

OSCHR BOARD MEMBERSHIP AND TERMS OF REFERENCE

OSCHR Board and Key Functions

OSCHR’s mission is to facilitate more efficient translation of health research into health and economic benefits in the UK through better coordination of health research and more coherent funding arrangements to support translation. The key functions of OSCHR are to:

— Work with officials from DH, BIS and the Devolved Administrations to set the Government’s health research strategy, taking into account the advice, priorities and needs set out by NIHR and its equivalents in the Devolved Countries, MRC and the NHS;
— Set the budget required to deliver this strategy and submit a single Spending Review bid to the Treasury;
— Communicate the UK’s health research opportunities to major stakeholder groups;
— Monitor delivery of the strategy against objectives and report to Parliament on progress; and
— Encourage a stronger partnership between Government, health industries and charities.

OSCHR’s role is a) to forge agreement between the OSCHR Partners on the UK Health Research Vision and their integrated plan to deliver the Vision, and b) to monitor the coordination and implementation of the OSCHR Partners’ delivery of the Vision.

Membership of the OSCHR Board

— Professor Sir John Bell— independent Chair of OSCHR.
— Professor Sir Leszek Borysiewicz— CEO MRC.
— Professor Dame Sally Davies— Director General R&D, DH, England.
— Dr Russell Hamilton— In lieu of CEO NIHR.
— Professor Bernie Hannigan— Director of HSC R&D, PHA, Northern Ireland.
— Dr Tony Jewell— CMO Welsh Assembly Government.
— Sir Alan Langlands— CEO HEFCE.
— Professor Sir John Savill— Chief Scientist, Scottish Government.
— Professor Adrian Smith— Director General of Science and Research, BIS.
— Ms Julie Moore— CEO University Hospitals Birmingham NHS Foundation Trust (Non-Executive member).
— Dr Patrick Vallance— Senior Vice President, Drug Discovery, GlaxoSmithKline Plc (Non-Executive member).
— Sir Mark Walport— Director of The Wellcome Trust (Non-Executive member).

In attendance: OSCHR Office lead officials.
Examination of Witnesses

Witnesses: Professor Andrew Watkinson, Director, Living With Environmental Change; Professor Sir John Bell, Chair, Office for Strategic Co-ordination of Health Research; Dr Graeme Sweeney, Executive Vice President, CO2, Shell, the Energy Research Partnership; and Professor John Loughhead, Executive Director, UK Energy Research Centre, the Energy Research Partnership, examined.

Q412 Chairman: Welcome to our first session of the New Year. Thank you very much for being in attendance prompt and early. I think that you know the main purpose of this inquiry and the report that we shall issue. I would remind you of a couple of practical things. One is that this is on record and it is probably being broadcast on the web. We do keep a record of the statements made and the responses. You will receive a copy of that to comment on within about ten days. We hope to report within the next two to three months at the very most, and may I also say thank you very much for your written evidence. It is much appreciated. That has been absorbed and some of the questions will be responding to it. I understand that the colleagues from the ERP had thought they might like to make a statement at the beginning. To be honest, I have been trying to discourage those because we have a limited time, but may I suggest that you incorporate the main points into your responses perhaps to the opening question, which is fairly general? We have a range of matters we want to discuss, and I wonder if I can ask you, as an opener, to give briefly—and I do stress that we will try to be brief, which will also help—an overview of what your organisation does, but particularly its impact on research co-ordination, which is something in which we are very interested. I do not know who would like to start. Since I have mentioned ERP, would you like to begin, Dr Sweeney?

Dr Sweeney: I think that the Energy Research Partnership is a unique high-level body that brings together both public and private funders with the specific purpose of discussing the matter of co-ordination and the effectiveness of the move through the pipeline, through demonstration, to deployment. It provides strategic direction and it tries to maximise the impact and the coherence of all energy innovation activity. Importantly, it is led by two co-chairs, who unfortunately cannot be with us today. Currently they are Nick Winser from the National Grid, and from the public sector it is currently David MacKay, the DECC Chief Scientist. Membership therefore covers a wide range of folk, including Shell, BP, E.ON, Ceres Power, including too UKERC, which John runs—and, I should advise you, of which I chair the advisory board—the research councils, the TSB, the Carbon Trust and the ETI. We would argue there is no comparable body in the UK that fulfils this role or takes such a wide range, given such a set of stakeholders. We attempt to meet and to brief, and recently we met with two senior ministers in 2009, Lord Hunt and David Kidney—both of whom we believe expressed support for ERP and noted the fresh perspective that ERP had given them. I think that comes from its unique membership. We have produced a significant set of reports of various kinds. We may come to those in more detail in due course. However, it is the purpose to co-ordinate and to give strategic direction to that wide range of stakeholders that the ERP exists to deliver.

Q413 Chairman: Professor Loughhead, do you want to add to that?

Professor Loughhead: No, I think that is comprehensive and I will not take time by repeating things.

Q414 Chairman: Sir John?

Professor Sir John Bell: Let me say a little bit about the Office for Strategic Co-ordination of Health Research (OSCHR) of which I am the chair. You will probably be familiar with this, because it was set up after the Cocksley Report in 2006. It was set up in January 2007. It was established to try to implement the main recommendations of Cooksey, of which there are really three that we focused on. The first was to ensure a much more strategically coherent approach to publicly-funded health research. You will be aware of the fact that pre-Cooksey there was an uncertain relationship between the Medical Research Council and the Department of Health’s funding activity in the National Institute of Health Research, and there were lots of gaps in the activity that was done and also a lot of redundancy; so that was the main purpose for which OSCHR was created. In doing so, it was also recommended by Cooksey—and we have focused on that—to produce a significant step-change improvement in the translation of basic science in the health sector into health and economic benefits. Finally, we were asked to consider how we could improve the partnership with the health industries, particularly the pharmaceutical and biotechnology industry but also the device industry, and with charities. We were set up as a small organisation with a small office staff and we had a set of partners, which has now expanded, and they include the Medical Research Council and the National Institute for Health Research. We have brought in all the devolved administration Departments of Health, so Wales, Northern Ireland and Scotland are now in and also, as of this year, the Technology Strategy Board. I think that in the public sector health funders, we have therefore virtually everybody in the tent, which makes its operations a great deal more effective. We focused on a set of issues that we felt were important in the first three-year
timeframe, which were: translational medicine, as I have described; public health research, which of course has not been strong in this country for many years; public health records research; methodology research; and human capital. These are the areas where we set up some procedural boards to manage those for us. We believe that over the course of the last three years we have made quite a substantial difference to the co-ordination of activities in that space. We certainly enhanced interactions with the commercial sector, and I think the UK now is the envy of the world in terms of its translational research activities.

Q415 Chairman: Could you give us examples of that? This is very much where we want to focus and one of our main areas. The successes? Professor Sir John Bell: I can give you examples of all three of those things. We have developed a range of programmes interacting with industry. Perhaps the one most apparent at the moment is the “capability clusters”. They are designed to develop loci of excellence, which might be anywhere in the UK but groups of five or six centres that have particular expertise in individual therapeutic areas; so, for example, cancer, diabetes, inflammation. Those are being established to try and create places that industry can readily go to to do what has turned out to be the most challenging bit of the development pipeline, which are early, Phase IIA development projects, where one has to decide rather quickly whether a molecule that you have is effective or not in small numbers of patients, and it requires a lot of scientific input into those. That has been entirely driven out of the OLS process but led largely by OSCHR. All the funding partners are involved; the TSB, NIHR and MRC are involved and industry, as far as we can judge, is very enthusiastic about it. They all come to all the meetings and are pushing very hard to see those developed. I think that is a very good example of how that has evolved. In terms of the co-ordination piece, I think that engagement with industry has got a lot better. Engagement with charities has not worked quite so well, I think it is fair to say. We have been pretty busy and we have not spent a lot of time bringing the charities in, but they will now be systematically involved in the capability clusters, because they map rather helpfully onto the therapeutic areas of cancer, CRUK, diabetes, Diabetes UK, Arthritis and Rheumatism Council on inflammation. That will happen, therefore; but, in fairness, I think that it would be wrong for me to say that we have made that work smoothly up to now. I think that we have greatly improved the co-ordination of activities between the two major agencies and indeed around the whole of the UK. We now have an agreement whereby all the devolved administrations can participate in funding calls in translational space. They put their share of the money in and it gets distributed in a way that has been agreed between all the Departments of Health; so we help to deal with the devolution issues, which are not straightforward. The MRC and the NIHR have rather helpfully divided up the space, translational space in particular, where one or other of them has become the lead organisation and spends the money on behalf of the other organisations; so we actually have a single common call for experimental medicine, for large-scale trials, for methodology and the like. Those things have all worked rather well, therefore, and, in fairness to them, the funding agencies have worked hard to make that work. It has not been OSCHR that has made it work; it has been they themselves who have made it effective.

Q416 Lord Krebs: Where does the Wellcome Trust fit into this? Professor Sir John Bell: I am fortunate in that OSCHR has had, from its inception, three very effective non-executive members of the OSCHR board. Mark Walport has been a non-executive member and has been our major engagement with charity. They have helped, not in the precise funding of public sector funding — because our job is to make sure public sector funding works — but they have definitely engaged in some of the other areas, particularly very actively engaged in the electronic health record piece which they have been very interested in. They also have their own programmes in translational medicine, which, knowing what the public sector is doing, has made it a great deal more effective for them to operate in that space. Of course, their very significant contribution to the Health Innovation Challenge Fund, which is now being distributed in the area of genomic medicine, is another example of how they have engaged with public sector funding in a productive way. I would not say that they are in the tent, therefore, but they have their head inside the tent and they know what is going on.

Q417 Chairman: We might come back to aspects of this, but I am keen for Professor Watkinson to give his response. Professor Watkinson: I am Director of Living With Environmental Change, which is a programme that was established in 2007, which brings together 20 publicly-funded partners. That is, the research councils; key government departments that have an interest in the environment such as Defra and DFID; devolved administrations; and a range of delivery agencies, such as the Environment Agency, Natural England and the Technology Strategy Board. They have agreed six objectives which define the work...
space for Living With Environmental Change that relate to how we deliver a low-carbon society, how we enable food, water and human security, and how we increase the resilience of vulnerable people and places. The partnership works through using very variable geometries, variable funding mechanisms, but all of the programmes have essentially a research and end user context. We involve the third sector but, again, our interactions with the third sector are really only just developing, and we are engaging business; we have a business advisory board, which is chaired by Colin Drummond. In the development of the programmes relating to our objectives, however, essentially co-design, co-production and co-delivery are important in enabling us to deliver on the research. We see co-design in the partners coming together at a very early stage, where the delivery agencies and the research funders essentially negotiate what should be the appropriate research programme. We see co-production where we see the partners evolving different working mechanisms. We see that for example with the Met Office and NERC, discussing issues around intellectual property. We see that with Defra and the Environment Agency, NERC, EPSRC, negotiating how best to cover flood risk research. Then, in co-delivery, we are looking to make sure that the results get passed on to government departments, businesses, effectively and efficiently as possible. With the Avoiding Dangerous Climate Change Programme, we worked very quickly to make sure that the scientific research on climate change fed through to members of DECC as quickly and effectively as possible, running up to Copenhagen. Essentially, it is this co-design, co-production and co-delivery around these six agreed objectives that form the key for the success of the Living With Environmental Change Programme.

Chairman: You have each given us things we will pick up as we go through, but I wonder if we could move on to Lord Broers to take up the discussion.

Q418 Lord Broers: This really adds to what Professor Watkinson was talking about. To what extent, and how, do existing funding mechanisms through the research councils, HEFCs and government departments encourage both co-ordination and collaboration in research activity? What difficulties have you encountered and what changes, if any, do you suggest?

Professor Loughhead: Speaking on behalf of ERP, because of the nature of ERP and its membership, I do not think that we are in a position to propose specific changes, but what we can do is to say that during the discussions of the partnership a number of issues have come up, and it is clear from that that our members have different perspectives and different views on this whole question. However, there are issues around the different rules and approaches taken by each of the different funding bodies. That applies between research councils but it also applies between the different government departments and other bodies that fund this type of work, including the Technology Strategy Board, the Carbon Trust and the Energy Technologies Institute. What we have done is to identify that this is a particular problem when you seek continuity of funding along the whole breadth of the innovation chain. Of course, energy itself is not a science but really a system that involves a large number of different technologies for its successful implementation, getting that continuity in innovation is extremely important. ERP recognised that this was a difficult issue and one of the moves that it took was that it recognised the potential for confusion and almost contradictory work between the Technology Strategy Board, the Carbon Trust and the ETI, and it persuaded them to develop the joint strategy for co-ordination. That led to the establishment of something called the Low Carbon Innovation Group, which effectively is a means by which those three bodies could discuss exactly what areas they were going to push; how the different elements of their programmes would fit together; not simply justifying their expenditure of money but also from the perspective of those that they were funding—that they had a clear understanding of what role the different organisations were playing in this rather long chain. That group has recently been expanded by the addition of DECC’s Environmental Transformation Fund team and also the research councils. What it will try to do is, as far as possible, facilitate effective co-ordination and coherence of the publicly-funded research. ERP can act as an advisory body to this group, and the particular value of that is that it brings in the industrial and the non-governmental perspective to the reflections of that body. However, effectively it still works on a voluntary basis.

Q419 Lord Broers: It strikes me that there are bodies advising bodies advising bodies and then overall bodies getting all those together and advising again, and that what we really need is a fairly clear organisation with a clear interface with industry so that we can get on and do some of these things. Would you like to comment on whether my view is a pessimistic one or whether you think that you do have a clear interface with industry and does industry know what you are going to deliver and when, so that they can get on with it?

Professor Loughhead: I will ask my colleague who is a mainstream industry person to give a perspective on that but, before I do, I think that you touch upon quite an important area. This is an extremely complex subject in energy, and I know that you are well aware...
of that. There are a large number of government departments that have a very valid vested interest; there are a large number of funding organisations that have an interest. It is therefore an extremely complex situation to start with. It has not deliberately been made complex; it is inherently complex. I think that what you propose is a very rational solution to it and, on a personal basis, it would make my life a lot easier if there was something like that; but I can imagine that there are a number of other issues that might be made more difficult by such a thing. However, I think that we do have an extremely complex landscape and I could not reassure you that it was necessarily as efficiently operated as we might like.

Q420 Chairman: Cue Dr Sweeney, I think!
Dr Sweeney: The point that John has made is that it is very important to get the scope of the individual parts right. I would say that it is clear from the conversations inside the partnership that there is scope for improvement in that process. What does this mean? It means that, particularly where the public funding at particular parts of the innovation chain through to delivery are significant, they are not always as well connected with the final delivery as they could be. I think it is fair to say. As a result of this, it is likely that we are slower than some other structures to deliver. Against this, one of the arguments that is made by those who support continuing to have this kind of approach is that you get a richer set of innovations, and there is some trade-off to be made between those two pieces. I think that, particularly where you have already made your choices and you know what it is that you want to deliver, then, as John says, there is scope for streamlining the current set of processes.

Q421 Lord Krebs: Briefly, to try to understand more about how your organisation works in comparison with the other two that we have heard about, do you have a set of priority themes, as we heard from Sir John Bell and Professor Watkinson? If so, could you tell us what they are and why?
Professor Loughhead: ERP in an early stage reviewed what it perceived to be the key energy technologies from a UK perspective. It has identified 12 of those. It has further developed those into what it called the “matrix”, which was to try to take those energy technologies and relate those to the underpinning science, and then use that as a framework for its discussions amongst its membership to say: “How well are we covering these? Who is taking the lead on the different areas? Do we believe there is sufficient effort going in?”. ERP itself, of course, cannot take any decisions about this, but hopefully by providing that common framework it provides a common language that the different funders and stakeholders can speak in and at least recognise what they are doing. That was something that did not exist before ERP put it together and promulgated it.

Q422 Lord Crickhowell: I want to switch the same line of questioning to Professor Watkinson if I can. In your paper, Professor, you have been pretty critical of the arrangements. In your comment 3 about existing objectives and mechanisms you say, “the expenditure mechanisms of individual research councils, government departments and delivery agencies work well for areas that fall clearly within the remit of those bodies”, but then you suggest that “current mechanisms do not always work well” in other aspects. You pick up on publicly-funded science and technology research aligned and co-ordinated with non-publicly-funded research and you say that there are considerable difficulties there. Then, later in your paper, when you talk about the need to promote blue-skies research in the whole area of climate change, ecosystems, human well-being and so on, you say that these are “not easily promoted through traditional responsive-mode funding”. So there are a whole string of pretty detailed criticisms of the existing arrangements, and I wonder if you would comment further.
Professor Watkinson: As we move away from straight environmental science issues and consider the grand challenges which the CSAs and chief executives are beginning to articulate around climate, energy, ecosystems, food security and water security, I think that all of those clearly require some form of interdisciplinary or multidisciplinary approach towards tackling them. From that perspective, it is clearly necessary for a number of the research councils and government departments to come together to work through those. In some cases I sense a considerable willingness. I saw it, for example, in the case of ocean acidification and in the case of the Insect Pollinators Initiative, which arose out of issues surrounding honey bee health—where partners came together and agreed to work together on these particular challenges. There are other areas where I sense that we are not moving as quickly and efficiently forward as we perhaps could—coastal vulnerability is one that comes to mind, for example, in relation to adapting to climate change and sea level rise—where there is a certain amount of work that is coming together. However, putting together the social science and physical and engineering science with the natural science to enable that work to happen does take time. There are times when I certainly get very frustrated at the speed with which...
we are working in those areas; but if it was not for an organisation like Living With Environmental Change I think perhaps some of those issues would be addressed even more slowly.

**Q423 Chairman:** Clearly there are two different processes at work here that each of you have in your own way identified. One is the setting of priorities and the other is co-ordinating the effort to meet those priorities. I was wondering which of these is the more difficult. Is it a negotiation—to use the word you use—on your group, which is how you perhaps go about setting priorities? Is that more difficult than actually once they have been set, or are they set by someone else? What is your role in this?

**Professor Watkinson:** In terms of setting priorities, I think that one of the things that the Living With Environmental Change programme did initially was to get the partners together. They then negotiated what they wanted to do together, and that seemed to work fairly effectively. It took a while, given that there were 16 organisations at the time; but they came up with an agreed set of objectives. That has been incredibly helpful because, without that, you will not get the collaboration and co-ordination that is necessary. Actually translating the commitment towards those common objectives into action at times is patchy. It helps enormously if there is championing from CSAs and chief executives around particular areas, if one is going to see action on them.

**Q424 Lord Crickhowell:** As a former chairman of the National Rivers Authority, you will perhaps understand why I pick up immediately on the whole area that you have highlighted about flood protection, coastal protection and so on. We now have an Environment Agency, and indeed the chairman is going to address a meeting in this House tomorrow on some of these issues, which I am looking forward to hearing. My question is this. Where you have a major agency covering this area, how far can it take the lead in providing the kind of co-ordination that you are seeking in an area like this, or is there a problem here?

**Professor Watkinson:** The Environment Agency and SEPA north of the border can certainly help enormously in providing a clear steer on what research needs to take place but the funds that they have for research in this area are fairly limited. If we are to have a comprehensive flood risk management research programme, therefore, it is essential that the research councils, NERC and EPSRC, ESRC in particular, feed into that. One of the things that is evident at the moment is that two of the major programmes that are being funded by the research councils are coming to an end over this next year; so if we do not have a re-evaluation of the priorities and further investment from the research councils in that area we will see a substantial diminution in the funds going into flood risk management research. The research that the Environment Agency and Defra can do together is all very much tied up at the operational level; so if we are to see new research, seeing new vulnerability assessments that will feed into, say, the Climate Change Act’s needs, then one needs fundamental research coming through from the research councils that is of the right sort to feed into the delivery agencies.

**Chairman:** Dr Sweeney wants to come in and then Lady Perry wants to press you further, I suspect. **Dr Sweeney:** I think that the task of establishing what priorities might be is not so difficult. You get people together; they may agree or disagree but, 80:20, you get to the core pieces fairly quickly. The issue is that it is advice; it is not a decision. You can advise away and those who decide may or may not take that advice. That is not to say they are unreceptive to it, but the point is that you do not have control over whether the advice is adopted. You have to decide whether you want to have that or not. If it was a business, you would not work that way. You then get to the bit about execution, which is that execution is multiple—because of the overlap, because it is a complex system—and it actually becomes more difficult to give substantial advice about the execution piece. It is why we have set up this Low Carbon Innovation Group. The key focuses of ERP are low carbon innovation in the context of maintaining energy security and providing a response to climate change for the whole energy system. Therefore, I think that the point here is that you must decide how you wish to operate. If you only want advice, then you shall get advice. Then you need an effective execution process for the advice, and currently that is also in a sense voluntary. However, the really powerful bit of what has happened as a result of the co-ordination activity is that three participants in the execution have in effect agreed to use ERP as their advisory board; but was something that they agreed to do—it was not an executive decision.

**Q425 Baroness Perry of Southwark:** All of you have quite rightly described what I might call the top-down kind of collaboration, where you talk about bringing research councils together, bringing chief executives together and forming partnerships, but it is increasingly the case at individual university level, in the great research universities, that they are themselves creating collaborative teams of people doing research. I wondered if you had good examples...
of bottom-up collaboration, of proposals coming to research councils, for example, from these multidisciplinary teams at the individual university level, or indeed collaboration between several universities, which is also increasingly common now. The people who are actually doing research in a particular field kind of bubble over and discover that somebody else down the corridor from a completely different discipline is doing something relevant, and they come for research funding generally. Surely that is where some of the really innovative thinking is going to come from, is it not?

**Professor Loughhead:** I think that there are some extremely good examples. Probably the best exemplar is the “sandpit” activities that the Engineering and Physical Sciences Research Council has facilitated, which bring people together to try to develop things of that form. In fact, my own organisation together with NESTA last year ran something very similar, called the Carbon Crucible, which did the same type of activity. I think that those do bring up very good interdisciplinary proposals on a bottom-up basis. However, excellent though those may be as innovative forms of research activity, they do not necessarily provide solutions to some of these problems that we are trying to address at the scale of the energy system or the environmental system. They will provide little building blocks. To emphasise what Graeme said in his earlier response, I think that we have done as much as can be done to co-ordinate the bodies together but, with these large interdisciplinary problems that go to the root of the infrastructure of the country, most of our funding mechanisms tend to be discipline-founded—so the EPSRC will fund its disciplines, NERC will fund its disciplines. When they come together, again it is bottom-up. What is lacking is somebody with responsibility for making the totality deliver and work. I would say that is a reflection of the system that we have in the UK. We have the universities; we have industry; we do not have the equivalent national laboratory type of structure that other countries have, where you would naturally seek to find that leadership I think. I do not make that a plea for a national laboratory but simply to say that, when that is not there, there is no obvious responsible person delivering.

**Professor Sir John Bell:** Can I come in on this? I think that the points that have been raised by my colleagues are all true of health, but perhaps I could be a little bit more forceful. That is, I think there is a problem of cross-departmental working across government and it is a really serious problem. It affects science probably more than it affects anything else. Let me give you an example. Public health is a big issue. However, public health does not reside in the hospitals that are run by the NHS; it resides in teaching, in training, in education; it resides in how many cycle paths you build; it resides with the environment people; it resides with the energy people; it resides across government. So when government decides to fund an initiative in public health, as it did through the OSCHR process, it says, “Actually, we think it’s important and we’re going to give you some new money to do it”, and it drops it into a department over a three-year timeframe. That is dust, actually, because there is precious little you can do once that has arrived to mould and develop that programme over a period of time. That is not to say my colleagues in health and MRC have wasted any money. That is not true. They have been very effective. However, where they have run into real trouble in the public health arena is that, when they bring the scientific advisers of all those other departments together and say, “This should be a major government priority. What are we going to do about it?” and they say, “Sorry, you guys, we’ve got other things to do. Bye, bye”, there is precious little you can do about it. I think that this is a really serious issue. It relates to energy and to environment, because all those things need buy-in from multiple departments. It seems to me that one of the few ways you can manage that is to say, “How much money are we going to support this big initiative with? We are going to hold that money back and allow it to feed programmes run by different departments who are prepared to play the game. If they don’t want to play the game, no money”. I know that is a different model of government and you are probably not going to like it very much, but I see some real problems getting these big scientific questions addressed with the current structures.

**Q426 Chairman:** That is very interesting. Do not worry about saying to us that we will not like it. We are not government! We will give our advice to government. That leads me to ask to whom do you give advice, and is that part of the problem? The related question to that is this. Is your advice public?

**Professor Watkinson:** In relation to Living With Environmental Change, I think that we differ a little perhaps from the other organisations in that we are essentially about doing. It is not about giving advice. In the case of ocean acidification, when that was recognised as an issue by the Natural Environment Research Council, they initially highlighted the activity and said this was a concern; they then initiated a discussion with the other partners within the LWEC framework and a number of other partners then came to the table saying, “Yes, we are also critically interested in this. We’ve got these specific interests. We would therefore like to add some money into a common pot, which will then enable the research to take place”. In a number of
cases, therefore, one department or one research council taking the lead on a particular initiative has said, “We’re interested in this” and that has then enabled the pot of money that can be used in the particular area to grow very considerably. The Living With Environmental Change partnership therefore allows individual organisations to state what they are doing and then developing that with other partners.

Q427 Lord Krebs: I want to follow up the point that Sir John Bell raised and it is also relevant to Professor Watkinson’s intervention. It is about areas in which natural science interfaces with the social sciences. Public health will be a classic example, because the solution to many public health problems arises not through more research in molecular biology but more research in how people may be persuaded to change their behaviour, how organisational structures are set up that discourage healthy behaviours and might be changed. I wondered, both in LWEC and in OSCHR’s area, how the social sciences and the government departments that have responsibility in those areas—for example, the Home Office—are brought into the picture.

Professor Sir John Bell: I can speak for OSCHR. We have had a helpful engagement with the other research councils around some of these activities, particularly in the area of electronic health records, which are pretty central to any public health initiative and where Ian Diamond from the ESRC has been very actively engaged, and indeed has chaired one of our programmes in that area. We rely also on the research councils talking to each other. The ageing initiative amongst the research councils, in which the MRC has been actively involved, is another example where public health has been a dominant theme. At some level at the research councils, I think they do address some of these issues pretty effectively. The real problem—and I think public health is a very good example—is that the research councils in a sense cannot do the crucial infrastructural experiments without the buy-in of the government departments. If you cannot get the Department for Transport or local councils to understand that you need to do some evaluation of whether getting people to ride bikes to work is actually going to make a difference to long-term public health, if you cannot get the infrastructural pieces in place, you cannot do the experiment and you cannot get the data to work out whether that is something the country should be pursuing. I think that this is a real issue for us. You can see how you could make that happen if you actually had some money that you could distribute and allow departments to do it, but the trouble is—and this is human nature, I think—once departments have their budgets, they spend their budgets how they feel they want to spend their budgets. It is like university departments, to be honest. Getting them to work between departments is not always that straightforward. It is the same siloed problem.

Professor Watkinson: In relation to Living With Environmental Change, the AHRC and the ESRC are both involved in the programme; so it is not just scientific research, it is also the arts and humanities that are involved. Those research councils get very much involved in leading on a number of research programmes with other partners, such as the Engineering and Physical Sciences Research Council, on issues in relation to culture, with government departments on issues relating to risk and behavioural change. There is no problem in getting them involved in some of these issues, therefore. Where I think there is sometimes an issue with social science research is that there are times when a programme clearly requires social science research but it is not necessarily cutting-edge social science research; rather, it is perhaps fairly mainstream social science research but applied within an interdisciplinary context. That is the novelty of it. It is sometimes rather difficult getting programmes together which incorporate that type of social science research.

Q428 Chairman: Offering money often helps!

Dr Sweeney: It may not at first sight be obviously so, but we would echo those remarks. On demand side management there is a great deal to be done about the behaviour of individuals and indeed how individuals collectively, as parts of society, may respond to changes that society at large wishes to make in what they are allowed to do, which may not be so innovative specifically but the multidisciplinary piece. We would see the same challenge in making all of those pieces fit together.

Professor Loughhead: I talked earlier about the research councils being set up with particular themes. Andrew has highlighted this issue of double jeopardy. There may be true innovation but very often it can fall at the hurdle of, say, the ESRC review process, which says, “This is not new social science. Application rejected”.

Professor Watkinson: The research councils indicate that they cover those types of programmes, but when you actually talk to the researchers in university departments you frequently find that there is a case of double jeopardy; that that type of research is not being funded.

Lord Oxburgh: The question that I was going to ask has been pretty substantially worked over in the discussion we have just had, but not in all respects. Formally, the question was how should multidisciplinary research efforts to answer grand challenge issues such as climate change be co-ordinated and funded? Let me say that I come to this
question having, rather more than a decade ago, chaired a late and little lamented co-ordinating committee for environmental research between government departments and research councils. Everyone came to the meetings and I think it was very much as you describe: they sit round the table; they have great discussions; they all say, “Thank you very much” and they go off and do exactly what they were doing before. Our aim was very much your aim: effectively to bring together a collaboration or a coalition of the willing and get people to identify holes and say, “Maybe we could do that”. As I understand it, however, all of your organisations really have co-ordinating functions; they do not have any spending functions. They can identify holes and they can promote collaborations where people are willing; but you cannot actively say, “This important challenge is not being properly addressed”; and you do not have anyone to say that to. You could say it to the newspapers; you might address a letter to a government minister, but you cannot do much more than that. Sir John has suggested one solution to this problem: effectively, sequestration of departmental funds for a particular purpose. First of all, is my representation of the way you operate at the moment too gross a caricature? If it is not, how are you going to go about it?

Q429 Chairman: Who is going to start?  
Professor Loughhead: I will volunteer. I think that your representation is fairly accurate. That is a problem. I have to say that there has been a high degree of receptivity to the comments that ERP has given to the ministers. They have been very interested; they have been very engaged. However, much of the funding that one would like to access is not necessarily under the minister’s control. It goes into many organisations. I have spent most of my career in fairly heavy industry and the first question that we always asked was, “Who controls the budget?”. In these areas—and I repeat that these are not scientific disciplines, they are the realisation of complex systems that we are talking about in many of these cases—there is not a budget, there is not a budget-holder. It is rather like forming a club. You have to go round and whip up interest from people, against the competing interests that they have in serving the established role that they have had, in many cases for the last three decades. The structures have not changed much over, I would say, 25 years, and we are trying to solve the twenty-first century problems with twentieth century systems, to a large extent.

Dr Sweeney: It comes back to the point that I was trying to make earlier. There is nobody in executive control of meeting the objective. You cannot find them. There are lots of really interested people and they are all doing their best. That is not in doubt. Many good things get done. That is not in doubt either. But if you were to hit one of the grand objectives, it would be a matter of serendipity. You do not have a mechanism for guiding the ship home.

Q430 Lord Oxburgh: What you are saying is that there is no project manager.
Dr Sweeney: Right.
Professor Sir John Bell: I think it is also true that, of all the things that government does, science and the sort of quasi-science of the application of science, which John rightly alludes to, is the one area where you really do need cross-departmental and cross-disciplinary input. It is a real issue in that space. You will have to ask the current Science Minister yourself what he thinks about this problem, but I have suspicions that he would share some of the views that we have expressed; that is, that it is really difficult to get things done if you are sitting in one department with one budget and you are trying to get progress. Although I have to say from the OSCHR perspective I have been very fortunate that the sort of authority of ideas which you describe has carried a lot of momentum with it, and I think that has been helpful. I think that it becomes more difficult if somebody is planning to do something completely different, but you need them in the boat in order to make it work; because there is no way to make that happen in the current structure.

Professor Watkinson: I think that having agreed strategic objectives at the outset of Living With Environmental Change helped enormously. All the partners are essentially bought into the same agenda. They are looking to collaborate with others on a range of initiatives. There is evidence that we are seeing the partners work in rather different ways; work in partnerships that they have not done before, to deliver on a number of their objectives. Certainly there are areas where it is challenging. I take for example the area of climate change adaptation, in that at one level that becomes everything, because you are dealing with biodiversity research; you are looking at how people respond, communities respond; how infrastructure responds and how those should be adapted. All of the research councils, all of the government departments must therefore be involved in an adaptation research programme. What I am trying to do is to make sure amongst the partners that somebody can stand up in front of a committee at some stage and say, “We have the research in place that will enable adaptation to occur”. It clearly does not fall within the remit of any of the research councils or of any single individual government department, but I think there is a mechanism there which enables us to keep returning to this and to make sure it happens.
Q431 Lord Oxburgh: As we move into a period of financial stringency, which we do not doubt, all of your constituents, all of whom sit round your table, may well have different priorities. One might say, “I’m sorry but we have no alternative but to cut and to withdraw our support from this collaborative initiative in which we were involved”. Do you see that as a problem?

Professor Sir John Bell: Can I speak about the OSCHR position? We were fortunate to have a ring-fence, as it was described, put into place, supported by Treasury at the time the Cooksey uplift arrived, to help us do what we wanted to do. I think we all understand that the world has changed. Things are going to be extremely challenging. However, I have had very sensible conversations with the MRC and with the Department of Health that, were budgetary constraints to require a contraction of the ring fence, and they are different, we would do that in a grown-up and mature fashion to make sure that somebody did not arbitrarily pull out a piece that meant the whole thing would collapse. If you are going to have these coordinated functions, you have to take some group responsibility in making sure that you do not destabilise it. To date at least, that has looked rather positive.

Chairman: We have a number of questions we would like to ask but time is running short and I am very keen that we pick up the question of international comparisons. I wonder if Lady Perry could pick this one up.

Q432 Baroness Perry of Southwark: My question is whether there are models in other countries, either of the way in which research is funded, the funding model, or in terms of co-ordination for major issues, from which we could learn. Perhaps I could add this question to that. In your dealings with government do you find that the Government is interested in looking at other countries’ models to see whether we can learn from them?

Professor Watkinson: I would say that we are probably at the forefront of developing funding models in comparisons with other countries. Activities like the Tyndall Centre, the Rural Economy and Land Use Programme, have attracted very considerable international attention. I have been asked to go to Norway next month to talk about interdisciplinary research and the way that we foster it in this country. I am going to talk to the NSF in the USA shortly. They are interested in learning about how we have developed the Living With Environmental Change partnership, because they see generating these interdisciplinary programmes across research councils and government departments as much more problematic in the States. There is therefore considerable interest from other countries in the sorts of programmes that we are developing in this country. That said, I think there are things that we can learn from other countries. When I look at, say, some of the Co-operative Research Centres in Australia, the long-term commitment that they have to those programmes is something that we do not necessarily see. The research councils often will give two rounds of funding to an initiative but will then withdraw funding; so I can see longer-term commitment in some other areas. In countries like Germany I also see the top-down control that they periodically exercise as being extremely beneficial. If you take an area of research like coastal vulnerability, an area that I have been involved with, if you have a lot of bottom-up projects you can end up with a lot of good projects on sediment dynamics, on biodiversity and on climate change, but they do not actually fit together and allow you to assess how the vulnerability of our coastline will change. That requires some form of top-down co-ordination which makes sure that all these projects talk together. At times in the UK, I do not see enough top-down control that enables some of these projects to be brought together, to do what John referred to earlier: to address these very large-scale challenges. We are much better with our research-funding programmes at tackling very much smaller-scale initiatives.

Dr Sweeney: My sense is that something like the CO2 capture and storage storyline tells us some stuff about what it is that we do well and where we could do better. I observe that that conversation started here, almost in front of anywhere else in the world. I observe that we have not yet let our first demonstration project and I note that the Australians, the Canadians and the United States have. So somewhere along the line—and I think it is a bit about the front end with the real innovation piece—a lot of this very good bottom-up work works very well. Then, as we get into the bit that says you now need to draw the strands together, focus and drive through what is usually called the “valley of Death”: particularly when those require significant public funding, to create the desired outcome—in this case de-risking this technology set by 2020 so that it can be deployed—we spend a lot more time spinning wheels and talking; whereas a more focused approach with that top-down control enables some of these projects to be brought together, to do what John referred to earlier: to address these very large-scale challenges.

Q433 Lord Crickhowell: You cited an example where it is not just a UK priority but it has been for five years a European priority, and we are supposed to be
involved in a great joint project with China. Yet another committee I am on has just issued an extremely critical comment about the total lack of progress on this on the European scale. Is the European involvement in this sort of project a benefit or a complication?

Dr Sweeney: You probably ought not to ask me, and I will explain why. For sins I no doubt committed in a previous life, I chair the European Commission’s Zero Emission Fossil Fuel Power Plants Technology Platform Advisory Council, which is a fine institution—of course I would say so—composed of a wide-ranging set of folk, including academics, NGOs, the equipment manufacturers, the oil and gas industry and the power utilities. I think that again the early conversation has been extremely good and where we are struggling at the moment is to close out the funding issue; whereas others, who were not so early to the conversation, appear to have been able to direct their resources to the problem earlier. That is advice that we have given the European Commission as well. I think that in this particular case it is advisable to have international collaboration, because the point I would make is that the size, the scale and the scope of the task is beyond any one company or any one nation. The issue is to get effective execution within the partnerships that you choose to work with.

Professor Loughhead: Very briefly, I just wanted really to reinforce a point that Andrew made. Looking at the systems adopted by other countries for the prioritisation and execution of research programmes, you find a very broad range of processes that they follow to decide what those should be. What is distinctive is they all end up with a budget holder with responsibility for delivery, however they get there. If you go to any other country, you can find the person responsible for the programme with the budget and the ability to dispense or withdraw money. I would say that what distinguishes the UK is that in our system you can never find the budget holder. You find a committee of sub-budget holders, all of whom actually are looking in various directions because that is what their organisation is for.

Chairman: I think it is fascinating.

Q434 Lord Broers: What we have been saying and what you have both just said is very useful. I do not think your analogy to the “valley of Death” is good, though. That is to do with small companies. I am just trying to think what it is. It is finding your way through the wall of noise that comes from too many people talking at once about the same thing, but we have a serious, serious problem there. If you talk to the Chinese, they do not have this problem of course. They are building 12 nuclear plants, most of which will be finished in four or five years, and we are struggling to see if we can produce one by 2017 or 2018. This is the core of our problem. I do not know whether you have any final thoughts. One thing I would observe, looking at America, is that it is a matter of getting into the private sector where there are huge, fast-moving, private organisations that can do it. If you can, in energy, in clean transport and other things, I see that as an issue of trying as soon as possible to stop the government playing as much of a role as it does. I do not know whether you have any thoughts about that.

Professor Sir John Bell: In that health space, if you just take co-ordinating a range of different health research activities, there is a variety of international models, many of which are shambolic. The American model has some attractions and some disadvantages. The American model, of course, is to have all your health research funding in a single agency and put somebody in charge. The engagement of the NIH with the commercial sector is very large indeed. They spend about $4 billion a year funding activities that are in small companies. David Cooksey looked at this quite carefully before he wrote his report. That model is attractive. It has some other disadvantages of course and that is you have all your eggs in one basket. The relationship to some of the physical and social sciences of course is rather more strange because you have a single, big health agency. I would not want to say it is perfect but, in terms of getting that jump into the commercial sector, it has worked remarkably well in the biotech and pharmaceutical sector in America.

Q435 Chairman: Are there other final thoughts on Lord Broers’ question?

Dr Sweeney: I think it is a matter of horses for courses. I am afraid it is an “and” and not an “or”. I think there is a specified set of things in particular inside the grand challenges where the reality is that the risks for the private sector going it alone are so significant that it will not occur. Therefore, there is a role for government in partnering with the private sector to deliver in those areas but with a clear road map which explains how deployment to the wide market occurs using private resources alone at the end. This is part of that cycle of delivery rather than the point of endless subsidy.

Chairman: May I say thank you very much. It has been a very helpful and stimulating session. Thank you for your straightforwardness in answering the questions. It is much appreciated. If you have further thoughts that you have not had a moment to put to us, please do let us have a note in writing. Can I leave with you my question which was: whom do you advise? Is it public advice? If it is easy to put on one side the answer to that, that would be very helpful. Thank you all very much indeed. It is appreciated.
Introduction and Summary

1. This is a welcome opportunity to contribute towards a call for evidence in a neglected area of public policy. The focus of this contribution is a) the relationship between research and industrial innovation, and b) the impact that changing priorities will have in the medium to long term.

2. In summary we suggest that a) policy models that allocate funding towards directly applicable research based on an assumed linear relationship between scientific outputs and innovative economic development may be misleading, b) that such models might lead to policies, such as making academic research more industry-focused, that may be ineffective and possibly counterproductive in the long run, and that c) the key innovation policy issue for the UK remains weak firm-based technological capabilities in some (but definitely not all) sectors that are difficult to influence effectively through changes in the balance between directed and response mode funding.

3. This submission highlights an alternative policy model that draws on academic research in science policy over the last twenty years. It suggests that the economic value of the research funded by governments mainly comes indirectly from long term improvements in the background knowledge, skills and techniques that are used by industry rather than directly from research findings, inventions, licensing or even spin out firms. Consequently, shifting resources from the former to the later is likely to have an opportunity cost and may be ineffective.

4. The submission highlights a) the relatively small size but high quality of the UK research system particularly in elite departments (which despite the claims of university Vice Chancellors may not always be in elite institutions), b) the existing relatively low levels of government spending on research compared to the US and the small European high-tech nations, c) the diverse and indirect links between research and innovation that differ across sectors, and d) the importance of building up stocks of technical knowledge in UK firms.

The Current Policy Context

5. Given that the backdrop to the call is a shift in economic conditions, from a long period of sustained economic growth to an economy moving out of a major economic crisis, we start with some general points about current circumstances.

6. First, while the Government seeks to rebalance the UK economy away from financial services, it is important to be realistic about the extent to which such changes are driven by forces beyond government control. One cause of the current financial crisis has been a global imbalance between saving and investment which has seen capital moving from China to the United States (and the UK). This has helped drive a property bubble in the US and a rise in non-traded (financial) services in the UK. Science policy is an important and under-estimated element of government policy, but its ability to influence such large global forces in the short to medium term is limited.

7. Secondly, the shift from manufacturing towards services is part of a long term structural change in the UK economy. High-tech manufacturing is now a small part of the UK economy (less than 3 per cent) and much of it is already world class (ie pharmaceuticals) so it is not realistic to expect even major changes in how research funding is prioritised and allocated to have major structural impacts.

8. Thirdly, one outcome of the UK’s stimulus package has been an increase in government debt, leading to cuts in public expenditure and a shift in public policy towards short term economic goals. However, UK public debt is less than it has been in the past (after the Second World War it was over 150 per cent of GDP) and the costs of servicing this debt are historically low. Effective knowledge production in firms, universities and government requires continuous funding and can be easily damaged. The long term opportunity costs of changes in funding should be considered.
THE CURRENT SCIENCE POLICY CONTEXT

9. Compared to the 1980s and 1990s the last decade has seen widespread agreement about the economic value of science and about the mechanisms by which science influences the economy (Salter and Martin, 2002). Multiple studies, using various methodologies, have come to similar conclusions about the benefits of public investment in research, with the social rates of return being high. Typically they are in the region of 30–50 per cent (ibid). Public policy in the UK has been supportive of the science system which has seen increases in funding from £1.3 billion in 1997 to £3.7 billion currently.

10. However, while this improvement has been significant it needs to be seen in the context of large increases in research funding elsewhere in the world. In the US and the smaller European high-tech nations such as Sweden, Denmark, Finland and Switzerland government support for research has increased considerably. In Feb 2009, for example, President Obama signed over an extra $21.5 billion (£15 billion) in federal research and development support as part of his stimulus package. This included an extra $10 billion for the National Institutes of Health (NIH) on top of their current $29 billion budget. The National Science Foundation (NSF) received an additional $3 billion, on top of a previous budget of $6bn, and the Department of Energy’s Office of Science an extra $1.6 billion on its previous budgets of $4 billion. This is just direct Federal support and does not include state-level investment, nor does it include the large subsidies that the US government gives through tax breaks for firms investing in research. UK public investment in research is much better than it was, but is a long way behind the US and leading EU countries.

11. Various quantitative performance measures suggest that increased investment has produced the desired effect and the UK now ranks among the top performers in science. In many measures the UK is close to, or in some cases exceeds the performance of the US. The citations measures (normalised for different population sizes) in Dosi et al (2005), for example, show 39.7 for the US, 42.6 for the UK and 23 for the EU-15. For the top 1 per cent of cited papers (again normalised for population) the UK is 0.08, just behind the US at 0.09, but ahead of the EU-15 at 0.04. On measures of the highest performing scientists, measured by the top 1 per cent in citation counts, the US excels with 815 of the top 1,222 scientists in the world (66 per cent), but the UK has 100, ahead of Germany with 62 and France with 29 (ibid). This suggests the UK is behind the US on this particularly demanding quality measure. While the superior performance over Germany and France may reflect English-language bias in publications, it does suggest better performance. Increased funding has also produced a major change in academic culture with much greater external engagement.

12. The general policy agreement about the value of this increased investment in the 2000s has hidden an underlying disagreement about its basis. There has been an increasing tension between academic science policy and the rhetorical models used to justify current public policy (Dosi et al 2005). While both stress the importance of supporting research, they do so based on different assumptions of the links between research and socially valuable outcomes. The differences between the two models—one linear and one indirect—are illustrated in Figure 1 below.

13. In the linear model, which underpins much government policy thinking, (particularly in the EU), innovation is driven by flows of research findings, typically from universities. In the second model, innovation draws on stocks of firm-specific technical knowledge that may not necessarily draw on university research directly. However, the stocks of knowledge in firms do draw on publicly funded research indirectly through the provision of trained technical staff with the background knowledge and skills needed to solve complex innovation problems.

14. A variety of studies have highlighted the indirect routes of influence and these have been formalised in the SPRU taxonomy (Martin and Tang, 2005). These include:

(a) training of high-quality researchers;
(b) providing access to international research networks;
(c) solving key puzzles in technology;
(d) developing new instrumentation and methodologies that have wide industrial application;
(e) formation of new firms (spin-offs); and
(f) social spill-overs from social and economic research.

15. While there has been considerable hype about the value of direct outputs, their real economic impact is often lower than suggested. Universities in the US received $1.25 billion in licensing revenue in 2006. This was highly skewed with the top 20 universities receiving approximately three quarters of this ($923 million). But
this amount is only approximately 7 per cent of their $12.6 billion research budgets. It is therefore misleading to suggest licensing will replace government funding or that academic research might fund itself (Steinmeuller, personal communication). Similarly, in work conducted for the BVCA and NESTA on public venture capital policy, we found that the performance of university spin out firms was poor in comparison with non-university start ups.

Figure 1
CONTRASTING MODELS OF INNOVATION

Linear Model

a) Direct flow of research findings

Science → Innovation

More realistic view

a) Direct flow of research findings

Science → Stocks of Firm Tech → Market

b) Indirect flow of trained staff, methods, instruments

16. The linear model has some major problems related to an over-emphasis on academic scientific discoveries and lack of attention to stocks of technological capabilities in firms. The experiences of post-war Korea and Japan suggest it is possible to become highly innovative without a world class university system if these firms can develop technical capabilities. The model also has a tendency to conflate innovation with R&D, research with science and then science with science conducted in universities. Moreover, the implied direction of influence can be questioned. In numerous historical instances scientific theory and explanations have emerged after the technologies they are seeking to explain. The Wright brothers flew before aerodynamics was developed and the steam engine was operational before thermodynamics was understood. Technology often advances slightly ahead of science, and industrial innovation provides problems for academics to solve.

17. As a result of these problems, the linear model has been displaced in academic science policy by what has become known as the SYS Synthesis (Stanford-Yale-Sussex) (Dosi et al, 2005). This model highlights how scientific and technical knowledge have particular features that influence how they are produced and used in the economy. Firstly, technical and scientific knowledge have an inherent tacit element, which makes it “sticky” in the sense that it is embodied in people and passed on by face to face contact. As a result it tends to remain localised within firms and nations. Secondly, technological knowledge is distinct from scientific knowledge and is generally much more experimental and empirical because theory is a weak guide to practice when producing complex technologies. The fact that roughly 2/3rds of R&D spending is on development suggests that technical skills are very important and that research on its own is insufficient to produce innovations. Public research can help guide the application of this industrial technical knowledge but its main contribution is through the provision of skilled people. Even in areas such as pharmaceuticals where there is a close link between academic research and industrial innovation, large amounts of money have to be spent by firms before they can apply academic findings to innovation. The extent of this investment in technical knowledge even for individual firms can be extremely large. Pfizer, for example, spent more on R&D in 2007 ($8.1bn) than a technologically advanced medium sized nation such as Switzerland ($7.5bn). When firms “under-invest” in this internal research capacity their ability to innovate is compromised, but this weakness cannot be addressed by displacing industrial research into academic settings.
18. Support for the relatively greater importance given in the SYS model of indirect inputs compared to direct research findings can be seen in Table 1 which presents the results of a major survey of US R&D managers. It shows that when R&D directors are asked about the value of university research they highlight the limited direct applicability of much research outside a few areas and the greater importance of universities in generating skilled staff with background knowledge.

**Table 1**


<table>
<thead>
<tr>
<th>Scientific Field</th>
<th>No. of sectors with high scores (&gt; 5) for relevance of university research</th>
<th>No. of sectors with high scores (&gt; 5) for relevance of knowledge of the field</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology</td>
<td>12 Animal Feed, Drugs, Processed Fruits/Veg</td>
<td>14 Drugs, pesticides, meat products, animal feed</td>
</tr>
<tr>
<td>Chemistry</td>
<td>19 Animal Feed, Meat Products, Drugs</td>
<td>74 Pesticides, Fertilisers, Glass, Plastics</td>
</tr>
<tr>
<td>Geology</td>
<td>0</td>
<td>4 Fertilizer, Pottery, Non-Ferrous Metals</td>
</tr>
<tr>
<td>Mathematics</td>
<td>5 Optical Instruments</td>
<td>30 Optical instrs, machine tools, motor vehicles</td>
</tr>
<tr>
<td>Physics</td>
<td>4 Optical Instruments</td>
<td>44 Semiconductors, Computers, Guided Missiles</td>
</tr>
<tr>
<td>Agricultural Sci.</td>
<td>17 Pesticides, Animal Feed, Fertilisers, Food</td>
<td>16 Pesticides, Animal Feed, Fertilisers, Food</td>
</tr>
<tr>
<td>Applied Math, OR</td>
<td>16 Meat Prods, Sawmills, logging</td>
<td>32 Missiles, Aluminium, Motor vehicles</td>
</tr>
<tr>
<td>Computer Science</td>
<td>34 Optical Instruments, Sawmills, logging, Paper, Machinery</td>
<td>79 Missiles, Semiconductors, motor Vehicles</td>
</tr>
<tr>
<td>Materials Sci</td>
<td>29 Synth. Rubber, Non-Ferrous Metals</td>
<td>99 Primary metals, ball bearings, aircraft engines</td>
</tr>
<tr>
<td>Medical Sciences</td>
<td>7 Medical instruments, drugs, coffee</td>
<td>8 Asbestos, drugs, surgical/medical instruments</td>
</tr>
<tr>
<td>Metallurgy</td>
<td>21 Non-Ferrous metals, Fabricated metal</td>
<td>60 Primary metals, aircraft engines, Ball bearings</td>
</tr>
</tbody>
</table>

19. The relative importance of scientific knowledge and technical knowledge to innovation can also be judged from the data in table 2. This data shows the number of citations patents have to other patents and to scientific papers, as well as the percentage of the total science citations taken by a particular sector. It shows that outside of Chemicals, Drugs, Instruments and Electronics, scientific research published in academic journals has a relatively small input compared to technical knowledge in patents. Moreover, even in these sectors (with the exception of pharmaceuticals) scientific journals are a smaller source of technical knowledge than technical knowledge in other patents.

**Table 2**

THE RELATIVE IMPORTANCE OF TECHNOLOGY AND SCIENCE TO INNOVATION (PROXIED BY CITATIONS TO PATENTS AND SCIENTIFIC JOURNALS IN PATENTS). (SOURCE, CHI INC).

<table>
<thead>
<tr>
<th>Manufacturing sector</th>
<th>No. of Patents</th>
<th>No of Citations per Patent</th>
<th>% Sectoral share of all citations to scientific journal papers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemicals (less drugs)</td>
<td>10,592</td>
<td>9.8</td>
<td>2.5 (18.5%)</td>
</tr>
<tr>
<td>Drugs</td>
<td>2,568</td>
<td>7.8</td>
<td>7.3 (43%)</td>
</tr>
<tr>
<td>Instruments</td>
<td>14,950</td>
<td>11.8</td>
<td>1.0</td>
</tr>
<tr>
<td>Electronic equipment</td>
<td>16,108</td>
<td>8.8</td>
<td>0.7</td>
</tr>
<tr>
<td>Electrical equipment</td>
<td>6,631</td>
<td>10.0</td>
<td>0.6</td>
</tr>
<tr>
<td>Office and computing</td>
<td>5,501</td>
<td>10.0</td>
<td>0.7</td>
</tr>
<tr>
<td>Non-electrical machinery</td>
<td>15,001</td>
<td>12.2</td>
<td>0.2 (1.5%)</td>
</tr>
<tr>
<td>Rubber and misc plastics</td>
<td>4,344</td>
<td>12.4</td>
<td>0.4</td>
</tr>
<tr>
<td>Metal products</td>
<td>6,645</td>
<td>11.6</td>
<td>0.2</td>
</tr>
<tr>
<td>Primary metals</td>
<td>918</td>
<td>10.5</td>
<td>0.8</td>
</tr>
<tr>
<td>Food</td>
<td>596</td>
<td>15.1</td>
<td>1.3</td>
</tr>
<tr>
<td>Oil and Gas</td>
<td>998</td>
<td>15.0</td>
<td>0.6</td>
</tr>
<tr>
<td>Motor vehicles &amp; transport</td>
<td>3,223</td>
<td>11.3</td>
<td>0.1</td>
</tr>
<tr>
<td>Textile</td>
<td>567</td>
<td>12.4</td>
<td>0.3</td>
</tr>
<tr>
<td>Aircraft</td>
<td>905</td>
<td>11.6</td>
<td>0.1 (&lt; 1%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>99,898</strong></td>
<td><strong>10.9</strong></td>
<td><strong>0.9 (7.2%)</strong></td>
</tr>
</tbody>
</table>
20. Contrasting Policy Implications

21. While both models support the value of public investment in research, they have contrasting policy implications and suggest contrasting diagnoses of the problems facing the UK economy. With the linear model the policy goal of increasing innovation can be achieved through funding research that is directly relevant to industry. The paradoxical situation of academic excellence and low and declining R&D spending and performance in various innovation metrics in the UK implies a need to make research more targeted to improve the commercialisation of research through more licensing, better links to industry, more use of technology transfer offices (TTOs), and an emphasis on encouraging university spin outs. While the model is widely associated with proposals to concentrate resources in a small number of elite research institutions, this conclusion does not necessarily follow. The model could equally well support the suggestion that the problem has been too much research concentration.

22. The SYS model on the other hand highlights the missing importance of firm-based technical knowledge as a necessary condition for successful innovation. Since innovation is about linking a technical capability to a market demand, organisations such as universities that have limited connections to the market are unlikely in most instances to be major sources of innovation, let alone the source of innovation. The main role of the academic research system is to supply well trained people, and in this instance despite its high quality the small size of the UK research system compared to the US is a problem. Science policy can only have a relatively small influence on industrial innovation compared to other areas of government activity, such as robust competition policy.

23. The model suggests a different diagnosis of the UK economy. The main facts (all data from the OCED S&T indicators for 2005) are:

(a) Gross Expenditure on R&D as a percentage of GDP is much lower than the G7 average: 1.76 per cent v 2.41 per cent. This is below the US (2.6 per cent), Japan (3.3 per cent), Denmark (2.5 per cent) and Finland (3.4 per cent). The UK is even below the EU-27 average of 1.85 per cent and is closer to Slovenia (1.56 per cent) than Sweden (3.7 per cent). The high productivity of some parts of the R&D system hides the fact that it is small by international standards.

(b) Business R&D as a percentage of GDP is lower than the G7 average at 1.08 per cent v 1.71 per cent and declining. While part of this difference can be explained by differences in the sectoral composition of the economy, even correcting for this only makes a small difference. These UK figures hide sectoral diversity with extremely strong performance from the pharmaceutical industry and weaker performance elsewhere.

(c) Higher Education R&D is just over the G7 average -0.45 per cent of GDP v 0.41 per cent. As has been highlighted previously the quality of this research is generally high by international standards. Contrary to what is widely believed, the UK has more of this research funded by industry than the US (5.6 v 5.0 per cent).

(d) Government R&D expenditure (GOVERD) is also low at 0.18 per cent of GDP compared to the G7 average of 0.9 per cent.

(e) The UK has strong support for basic research from the charitable sector particularly in areas of biomedical research.

24. As far as R&D is concerned the UK situation is complex. On the one hand, in sectors such as pharmaceuticals the UK has highly competitive global firms with strong investment in R&D. They are able to take advantage of UK academic research and are forced to innovate by strong competitive pressures. On the other hand, there are also a large number of firms with weaker technical capabilities, lower levels of investment in innovation, who are less competitive and less able to take advantage of academic research. For the former high performance firms, the current system would seem to be working well. Research by Catherine Lyle at the University of Edinburgh suggests that the managers of these firms seek world class, blue sky research from the science system. For the later group of firms, who perform less well, it is unclear that changes in funding priorities alone can have much of an impact. Evaluations of R&D support programmes often find that public money simply displaces private investment and is a relatively poor policy instrument. Taking resources away from high quality research and making it “more industry focused” runs the risk of displacing already low levels of R&D spending further or directing scarce resources into areas that are marginal enough to firms that they would not invest anyway. Such activity would have a large opportunity cost by diverting scarce resources from the high-quality part of the academic research system. Hence, it would seem advantageous for public bodies allocating research to take into consideration the relative levels of industrial ability to use research findings.
Comparison with the US

25. When comparing the UK with the US the two innovation systems are very different. The US is characterised by much higher levels of investment in public research, particularly in cutting edge areas of research where money is distributed on the basis of scientific excellence through peer review. The US has a diverse and comprehensive funding system where funding bodies overlap and compete with each other. Interdisciplinary research that cuts across scientific boundaries is therefore generally easier to fund, and new disciplines emerge faster in the US academic system (e.g., chemical engineering in the early 20th century and bioinformatics in the late 1980s). Such interdisciplinary areas are often economically important. The US State also provides much more support for higher education generally, often indirectly through tax breaks and subsidies to students and firms. State governments also encourage universities to distribute technology widely, by licensing out technology very cheaply (often at a loss), rather than seeking to use technology as a means of generating additional funding. The high levels of investment in US universities have helped produced an academic research system that is the best in the world. Moreover, the large levels of investment have also produced a technologically sophisticated workforce who are better able to innovate in industry.

26. The US government also provides other routes for supporting innovation and technological development. These various programmes tend to be initially driven by technological excellence and then by commercial potential. This funding is almost exclusively directed through firms rather than universities. While many of these programmes, such as the Advanced Technology Programme, have been problematic, they collectively provide a major stream of public support for the development and particularly the diffusion of advanced technology in firms. The US model therefore involves strong investment in academic research, allocated by diverse mechanisms based on academic excellence, (which generates a technologically sophisticated workforce), and also a strong programme of support for technological development in industry. The UK is very different with much lower levels of government support for university research, a high quality but much smaller research system, lower levels of technical expertise in industry (thought not in all sectors), and less overall investment in R&D and innovation, with poorer performance. The increasing emphasis on universities undertaking more applied, economically applicable research in the UK, is therefore making it very different from the US system, where such support is given to firms, in the context of a strong and very large university research system focused on academic research. The part of the UK research system that is most successful is the bio-science area, which is also most like the US, with charities rather than the Federal State providing support, and strong US influenced firms stressing the importance of academic research addressing blue sky problems rather than attempting product development for which it has very limited capabilities compared to industry.

27. Conclusion

28. Since the 1993 Realising Our Potential white paper the overall objectives of publically funded science and technology research in the UK have explicitly been wealth creation and enhancing the quality of life of UK citizens. In practice however other goals have been addressed, for example, in relation to defence and national security. The main objectives of state-funded research can be divided into:

(a) Economic infrastructure for the nation, through the provision of highly skilled graduates and post-graduates capable of solving complex technical problems.

(b) Risk management: the State is “risk manager of last resort” and requires a considerable research capability to effectively manage risks that are not addressed by other institutions. Where that research capability is weak, as for example was the case with BSE, the costs of taking on the risk management role can be extremely high. The regulatory failures that produced the current credit crisis highlight the need for a research capability to manage the risks of modern economic and technical activity, and the extremely high costs of failure.

(c) Addressing key challenges such as climate change, the risks of new pandemics, improving public services etc, where the State needs its own R&D capability.

29. In this submission we have focused on the way in which publically funded research contributes towards economic development and industrial innovation. It therefore only provides a narrow focus on a range of complex issues. The evidence we have suggests that the academic research system in the UK is generally high quality and more focused towards industry than it was in the past. Its engagement with industry is at least comparable with the US and in some instances data suggests a higher level of interaction. However, some of this interaction may be taking place because of weaknesses on both sides. The issue isn’t just the quality of university research but the relative size of the research system and its ability to produce a technically
setting research and funding priorities: evidence

sophisticated workforce. The main innovation policy problem in the UK is not one of lack of engagement or an ivory tower academic system but weakness in some parts of industry. Where industry is technologically strong, such as we find in the pharmaceutical industry, then we have close and mutually supportive interactions between industry and academia. Where industry is weak, those interactions are fewer and sometimes look like attempts to displace research spending. Science policy that is based on a confused linear model of innovation has the potential to damage the strong parts of the system without strengthening the weaker parts.

7 January 2010

References:

Nightingale P et al (2009), “From Funding Gaps to Thin Markets” NESTA-BVCA.

Examination of Witnesses

Witnesses: Dr Paul Nightingale, Deputy Director, and Professor Andrew Stirling, Research Director, Science Policy Research Unit; Sir Richard Brook, Leverhulme Trust, gave evidence.

Q436 Chairman: May I welcome our three new witnesses. We thank you very much for what already has been submitted from your organisations. As you observed the last session, you will realise we do read them and that they are taken down and used in evidence. I just remind you formally that we are on the recording, if you would, please.

Dr Nightingale: I am Paul Nightingale. I am deputy director of the Science Policy Research Unit at the University of Sussex. My background is in science. I was originally a chemist who worked in industrial R&D before moving into academia. My research covers the boundary between social science and science. My main areas of research are innovation policy and science policy. I will say a little bit about SPRU. It is the largest science and technology policy research unit in the world. It relies on soft money and our main areas of research currently—they change rapidly—are energy, the environment, innovation, arms control and government policy related to science and technology. We are an interesting organisation in that we cut across both a big focus on supporting industry but also interacting with wider stakeholders. I am also a visiting professor of the strategy group at City Business School and I am involved in a number of research projects related to science policy. I wrote the NESTA Innovation Gap report and recently did some work with them and the British Venture Capital Association on supporting innovative policy.

Sir Richard Brook: My name is Richard Brook. I am currently director at the Leverhulme Trust. Earlier involvements have been at the Engineering and Physical Sciences Research Council where I worked for some seven years following the 1994 changes there. My discipline has been material science but, having worked in funding agencies now for the last 15 years, I feel somewhat distanced from that. Perhaps I can say a word or two about the Leverhulme Trust, though more can come later of course, if you wish. The Trust gives £50 million a year in support to universities predominantly in the UK. Its distinguishing feature is that it comes from a monoculture in that all of the trustees are from the senior management in the Unilever company, either now or formerly, so they have had a close association with the company which the first Viscount Leverhulme founded and a close association with the trust which he founded. It was once reported to me by a Secretary of State that there is almost a constitutional antagonism between the head of Unilever and the head of the DTI. I have to say that something of that cultural difference persists in the workings of the trustees. They are extremely loyal to the Government—I put it that way—but they prefer to work as an independent unit.

Professor Stirling: Hello. My name is Andy Stirling. I am the research director for the institute that Paul introduced, SPRU, at the University of Sussex. I am also formerly a natural scientist lapsed into a rather imperfect interdisciplinary social scientist working on questions of governance of science and technology. In addition, I co-direct a centre at Sussex University called the STEPS Centre, the ESRC STEPS Centre. That is a rather cheesy acronym for...
the Social, Technological and Environmental Pathways to Sustainability which addresses issues of co-ordination in science and technology in relation to large scale challenges. I have served on a variety of governmental advisory bodies, the DEFRA Science Advisory Council, the Sciencewise board and so forth.

Q437 Chairman: Thank you very much. Could I ask a general question which really is at the core of our inquiry and has to do with what improvements could or should be made to the current system of priority setting. The context, of course, is that we are in financially constrained circumstances and priorities are not necessarily for additional spend. There may be cuts where there should not be cuts. What are the current strengths and weaknesses in the UK’s system of priority setting? Are we any good at this? Could we be better? Very importantly, what criteria should apply in setting priorities? Are the various bodies that we have—and there are many who talk about setting priorities and co-ordinating activities—doing their job well? It is a broad spectrum, but I think it is a core issue that faces us.

Dr Nightingale: This is an area where there has not been much research over the last decade, so I am not talking from a very large evidence base. Over the last 10 years, there have been big improvements in UK science and technology funding and it is now a very large, complicated system. Having a systemic overview of what has happened is quite difficult. I can give you an anecdotal impression from talking to people internationally and that is that the UK science governance system is very sophisticated. It is recognised internationally as being very good. One issue where I think it could be improved is in relation to the evidence base, so quite a lot of priority is for research funding. It is unclear what the evidence base for those decisions is. Often, given the complexity of it, it is unclear how decisions are made, but there are aspects of it which are very good. It is very responsive. There are politically sophisticated organisations which engage with the government. There is a dedication to supporting industry and there has been a big culture change in the last 10 years. Overall we could probably say that in Europe, at least, it is one of the best.

Q438 Chairman: That sounds like the good news is that we are one of the best—and the bad news is that we are one of the best, but let us move on.

Sir Richard Brook: There is a certain difficulty here because I think the Trust’s position is that priority setting is not something which the trustees wish to do. It is perhaps an irony that the research support agency which is most strongly influenced by and most firmly from an industrial culture, in that the entire trustee body is a group of industrially senior people with a lot of experience, is reluctant to set priorities. They do insist that the function of the Trust is to operate in responsive mode, where the key responsibility for identifying the priorities, what is to be done, how it is to be done, is that of the applicant. This does make them somewhat orthogonal to many of the current government concerns. I can only say I have every respect for what the Government and the public sector are trying to do in this because that has to be done. I also have every respect for what the Trust is trying to do because I think that somewhere within the system it is absolutely crucial for there to be a unit which is capable of acting this way. Criteria for picking the projects? They are first the fascination of the theme and, secondly, the competence of the people putting forward the bid in undertaking it. They have the one instance of setting a research target in the year—about 10 per cent of the Trust’s budget goes that way, the so-called programmes—and there the objective is to excite the system without telling it what to do. The programme topic this year has been “Beauty”. We have had 50 bids in from a variety of departments. £2 million will be deployed upon that. The objective is to allow everybody to come in, but they must have thought about their subject in a slightly different way so that they are refreshed in the way in which they approach it. My other experience which derives more internationally would be with the Max Planck Society where I continue to sit on the senate of that body. Their criteria are remarkably similar to our own, namely they follow the old von Harnack principle that it must be the excellence of the competence of the applicant or of the person doing the research which decides the theme to be addressed. The priority setting is done by picking the right people and then everything else will look after itself.

Professor Stirling: You ask about strengths, weaknesses and criteria. Paul has just addressed some of the strengths. The Committee heard in the previous session about the challenges of co-ordination across UK Government public spending on research and development. In respect of weaknesses, I really wanted to add to that a consequence which very much follows from the picture that was painted earlier, which is that at the moment I believe we face a vulnerability to dangers of an unintended, undue concentration of effort in our research portfolio and a lock-in to particular trajectories for science and innovation which have not been sufficiently scrutinised. I would like to substantiate that if the Committee is at all interested. What I mean by “concentration” is that we have an insufficient degree of documentation and deliberation to assure ourselves that vested interests in the system are not able, under the conditions that were described earlier, to exercise undue influence on the kind of research that is conducted. There are very real challenges therefore of lock-in. We understand...
from work in the last few decades on science and technology how prone those systems are to path-dependent positive feedbacks in which efforts can get concentrated and then dynamically sustain themselves. Just to be concrete about it, I am not making a point here that we are in such a state. That would require a lot of evidence and the Committee probably would not be particularly interested in one particular view on that. My point is that we cannot assure ourselves that we are not in that condition. Simply to substantiate it a little bit with illustrations, military research compared to civilian research in areas like robotics, nanoscience and aerospace. Within the energy sector, the balance of research on areas, particularly renewable strategies compared to nuclear fission or fusion—again, this is not a partisan point—is under-deliberated as to how the priorities are set. In the medical area IP intensive strategies, particularly pharmaceuticals as distinct from research into other potentially highly effective applications of science in organisational and preventative public health, and in the agricultural sector transgenics as compared to other applications of advanced biotechnology in fields like syngensics and apomixis, which can be elaborated. The point is we can get locked into strategies which can have persistent effects without having fully deliberated them. I feel that there are questions about whether the existing UK systems are sufficiently robust, transparent and accountable about these patterns of concentration in resources and whether or not we are locked in. I would be very happy to elaborate on the particular reasons for that, but that is my basic point on weakness. Very quickly, I think that criteria of good practice in science, as for instance worked on by Robert Merton originally but now much more widely disseminated, (communalism, universalism, disinterestedness, organised scepticism), actually hold very practical implications for how we might have a more robust system for allocating public funding in research as well, but again that could be elaborated on if it is at all interesting.

Q439 Chairman: I do not dissent from the importance of response mode. Clearly the Leverhulme Trust are within their rights and they have a niche. It is a dramatically important role that they play, but equally if, for example, there was no one doing any research on CO₂ emissions because they just had not come up—we are not there—is there a long way to go to set that as a priority? Have you any positive suggestions about how we should go about debating this kind of question?

Dr Nightingale: What the science policy research has highlighted is in these big public policy concerns it is very important to have interdisciplinary research. That is an area where purely subjectively I would judge that the research councils in the UK provide some of the best support in the world. I speak as someone who has crossed over from being a natural scientist to a social scientist and back again several times. There is still probably a long way to go. The disciplines provide a lot of career support for people. If you are an interdisciplinary researcher crossing between research councils but also within disciplines in research councils, that career support often is not there. When funding does not come through, often these people have difficulty finding teaching jobs in traditional departments and they move off into industry. There is a lack of capacity in the kind of crossing over between science and social science in the UK that could probably be addressed.

Q440 Lord Broers: Dr Nightingale, you said that in talking to your international colleagues they all respect the UK for having a very sophisticated science policy system. Could you give us your view of what that same international community thinks about the efficiency with which we use our science base?

Dr Nightingale: I think it is considered to be very good. The international comparison is often from countries where the science system does not work well. It is no secret that there are some countries in Europe where there are rather feudal distributions of money within the science system and it does not go to research excellence. There are a lot of complaints there. Judging from the number of people who move from Europe to the UK, there is a recognition that we perform well compared to the German system. I think again it is a lot more entrepreneurial than the German system which is much more top down. In terms of interacting with industry, I think there are probably more constraints in the UK with interacting with industry and diffusing research out and making sure there is value for money. Quite a lot of those, I think, come from problems with the receptiveness of industry to academic research, because we do not seem to have much problem engaging with industry in Europe. It is much easier, for example, for my research, to talk to industrialists in Sweden or Switzerland sometimes than it is in the UK. There are exceptions there. There are some parts of the wide research system in industry which are extremely supportive of the science system. I have highlighted in my evidence the pharmaceutical industry. I think it is horses for courses.

Q441 Lord Broers: Have you made comparisons between the science and the development that takes place within industry between our systems—now I leave the universities out of it—comparing the science we do in industry with that of other countries?

Dr Nightingale: Drawing on the OECD data from 2005, the international comparisons would suggest that the UK is a large European country which
operates along the lines of Germany and France. It does not have the R&D intensity of the small, high tech European nations. It is very, very different from the US where there is a lot more high tech R&D research ongoing in industry. Having said that, the UK is a very innovative country. One of the points about the NESTA report was that sometimes these figures are not particularly informative about the nature of innovation that goes on. There is a lot of innovation ongoing in the UK that is not picked up in these figures. In that regard, I think there is a very healthy relationship between the research system in the universities and what goes on in industry and how industry relates to other parts of industry. Most of the innovation is ongoing in industry. To some extent the universities do not play a massive part in that. There are dangers, if we are going to try and make the university system more supportive for innovation, we end up damaging parts of the university system which are working very well.

Sir Richard Brook: There has been a sea change. I think, in attitudes in Germany recently as I have encountered them, again through the Max Planck Society. There was a tendency to look to Britain as a country which was trying out paths of support and analysis which might be of future value to them. Recently I have got the feeling that they look to Britain as providing a mildly entertaining form of example, but not one which they would wish to follow. This was emphasised, I think, by the “Impact” debates which took place recently there. Impact has become such a central code word in discussions within Britain related to research. They are pleased to be free from that. It is also an organisation where the industrial voice is quite strongly felt in the higher parts of the organisation. It is a strength that the links between industry and the state research sector are quite close. I think the last comment I made here was that such links had become enormously better in Britain than they were 10 or 20 years ago, so dramatic progress has been made. That is a journey which I wish we would continue.

Professor Stirling: It is clear that the UK performs very well in a number of areas. In Paul’s evidence from SPRU, he identified that the “bang for the buck” with scientific metrics of performance, imperfect though they are, is really rather high, but very innovative though often excluding areas which are not well measured: interdisciplinarity, creative areas and so forth. In respect of the co-ordination of research and technological trajectories especially, countries like Denmark and the Netherlands are particularly good but again the Committee heard earlier that in the US and other European countries more generally it is the case that one can identify where the decisions are made, hear a coherent rationale and challenge that rationale more readily. In the UK, although the Department for Business, Innovation and Skills, the Government Office of Science and the research councils all produce extremely rich data on the pattern of their portfolios in various dimensions, we do not have available information aggregated for the UK on how much is spent on these different pathways in key sectors like agriculture, energy and so forth. We do not have that data, let alone clear rationales for why the resources are distributed as they are. That would be an area I would identify as a particular weakness against some other areas of strength.

Q442 Chairman: Just to be plain, you head a very distinguished unit in the University of Sussex and you are telling us that you cannot co-ordinate the spend, say, in research and agriculture from government figures, just as one example?

Professor Stirling: It is not easy to determine the actual balance of resources spent on particular trajectories, such as the ones I mentioned earlier. They are not about the challenges for research; they are about the contending technological responses to those challenges, where often what the prioritisation should be is not self-evident. For instance, low carbon energy technologies. There are a variety of these technologies, all of which would benefit from greater funding. That is the kind of challenge where even, yes, in an institute such as SPRU dedicated to these kinds of issues—and the former Chief Scientist acknowledges also in his special group on energy report—we cannot identify exactly what the overall pattern is, let alone the rationale for that pattern.

Q443 Chairman: The follow on from that is: if you cannot identify the spending pattern, that presumably means perhaps that those government ministers who are responsible for seeing through grand challenges, as an example, do not have the capacity to measure the extent of public expenditure and co-ordination on this?

Professor Stirling: Precisely. We have a lot of documentation on other dimensions: the demographics of science and disciplinary mixes and so forth, where we are ahead of the curve but, in respect of the particular point I made, I think you are right, yes.

Dr Nightingale: In preparing for this, I was quite shocked by how little systemic evidence there was out there that I could find. I had expected much more. I think this relates in part to the fact that over the last 10 years the science budget has been expanding and there has not been this need, as much as perhaps there will be over the next five or 10 years, to decide how money is allocated and what the terms are coming from it. I think in the next five years we will see a change to that, but right now the evidence base is very weak.
Q444 Chairman: Do you think there is a number cruncher sitting somewhere in the depths of the Treasury who, if prompted and stimulated, could actually pull these numbers out or is the system so opaque that even there they do not know?
Professor Stirling: In an area like energy, it is arguably a field where this is more easy because of the existence of the UK energy research programme and international statistics are of a higher quality and more standardised. Let us look at that area specifically. When Sir David King convened a few years ago the Energy Research Review Group, they found it not possible with the specialist expertise they had available, to determine, in this privileged area, that information. I do think, though, that it would be possible in principle. At a low level of fine grain disaggregation within the various agencies and bodies—research councils and so forth—the information could be compiled. I am on the Defra Science Advisory Council and in the data that we see it would be possible, with quite a bit of input of time, to derive these numbers, but they are not derived with anything like the degree of visibility that would be required for a proper policy debate.

Q445 Chairman: As I think you have suggested, that might be especially important in a time where cuts mean priorities become even more important.
Professor Stirling: Quite so.

Q446 Lord Broers: This is along the lines of what I was alluding to before. How might the UK further encourage innovation and the development of scientific discoveries into new products or services? What is an appropriate proportion of effort and funding to devote to research versus encouraging innovation?
Dr Nightingale: There is an implicit part of that question which ties into a particular way of thinking about the value of the university system encouraging innovation and the idea that universities can come up with discoveries and they will be commercialised and therefore lead us to economic growth. While that is a very important role for the universities and it is something in which there has been a step change, as we have heard previously, in culture and support for that, the main way in which the university system supports innovation in the UK has been the provision of highly trained people who can solve complex problems. If we are thinking about ways in which the university system can support high tech manufacturing, we need to remember that is only three per cent of GDP and there is another 97 per cent where the universities play a very, very important role in providing skilled people. There has been a fair amount of research on what the interactions are between the university system and how it can support innovation. What they have tended to show is that the indirect forms of support for innovation tend to be much larger than the direct forms of support for innovation. Skilled people are more important than spin-out companies. There are limits to what science policy can do overall, but I think it can be improved. There has been, as we have heard, a big cultural change in the university system over the last 10 years and, forced through by the research councils very successfully, all the universities in the UK are much more receptive to engaging with industry in providing the support. My key issue in arguing for differences between the performance of the UK and, say, countries like the US and the high tech nations of Switzerland, Sweden and Finland is that our research base, while it is high quality, is relatively small compared to the US. It is not necessarily that we need more interactions between the university system and industry, as I pointed out, as a percentage of funding that is received. It is higher in the UK than it is in the US. The links are there. It is just whether or not there is a big enough mass of research. If we want to have a US-style innovation system, I am afraid we are going to have to pay for it and it is very, very expensive.

Q447 Lord Broers: I would like you to broaden your comments a bit, rather than just talking about the universities and their willingness to interact with industry. I declare my own colours, having worked many years in Cambridge to make sure it happened. I think it does happen and it is very positive in this country. I do not see the same positive trends in industry in this country. I would compare that with German industry as well as with British industry. We have seen more sophisticated developments and we have seen Germany sustain its export base better than we have through sophisticated products, not just in the high tech business but across the whole area of the automotive industry, machine tool industries and things that we have given up. I would like you to comment on the question as to what is the ratio of expenditures on encouraging industrial research—R&D tax credits, whatever they might be—compared to just looking at the research inside universities and how we distribute the funding there.
Sir Richard Brook: To consider the industrial aspect, there are all sorts of models for innovation and they are sector specific and so on. One which the trustees would back is that it is a matter of building almost the explosive mixture inside a container and then setting the spark to it and then something happens. The explosive mixture will consist of the skills, precisely the things that the SPRU group identified a long time ago with the six contributions which it identified from research. You want the skills there. You want the
knowledge economy. That has to be there, but I think the view of my trustees would be that the creative spark often comes from the industry, from someone who may be quite young and quite close to the user community, to the eventual final application, the customer, in short. The statement which you are making about the contribution of research thinking within industry seems to me to be an absolutely crucial one. Different companies will have different attitudes towards it, but making sure that that element of the innovation container is in good shape seems to me a very important notion.

Dr Nightingale: Could I come in on this element. As was pointed out, it is very, very sector specific. We can look to parts of the UK economy where it works very successfully. The pharmaceutical industry is extremely innovative. There is a huge amount of investment in R&D. They interact very, very closely with the university system and they actively engage in the science policy system in encouraging the direction of research towards areas that they believe are interesting. One of the lessons that we can learn there is the importance of competition and competition policy. It is a very, very competitive global industry where it is regulated and structured to encourage innovation. There is a worry if there are other sectors of industry which have different patterns of innovation that, if we try and support their innovation through a shift towards university research becoming more supportive of what they want to do, it will displace R&D. Rather than having a multiplier effect, we will end up with a decline in the amount of research that is ongoing and may decide that it is not worth doing. I do not think it is necessarily the case that the university system can support all sectors in changing innovation there. There are other levers of government policy which can be very, very effective. Education policy and competition policy are two.

Professor Stirling: I just wanted to pick up another implication of Lord Broers’s point on “pro-innovation” policies. There is no doubt at all about the scope in the UK for more effective deployment policies further “down” the “linear model” chain, as it were; in technology side. Tax breaks and so on are really crucial. But in the earliest stages, there is a sense in which the picture I painted earlier of the relative lack of authoritative information on the patterns of investment is reinforced and exacerbated by the way high-level politics tend to speak of these issues. We use the term “pro-innovation” probably more in the UK than even in other countries. We support “pro-innovation” policies. We talk about “science-based” decisions. When we confront scepticism about particular applications of technology, they are quite routinely critiqued as being “anti-science”, to which the response is, “Let’s be pro-science.” That kind of very generic debate at the highest political levels, working downwards through the civil service and industry, I think compounds this problem of a lack of sensitivity to the fact that the real question is not about innovation or not. It is about the direction of the innovation in these different sectors. With high-level political debate simply restricted to, “Well, we are pro-innovation”, we do not get to grips with which innovations and why, which is at the core of the dilemmas of prioritisation that the Committee is concerned with.

Q448 Lord Crickhowell: Dr Nightingale has referred several times to comparative mass between different countries. One of the issues that has come up in some of our sessions is the question of concentration, whether we would do better to concentrate our efforts on the really outstanding research universities rather than spread the resources very widely as perhaps we do at present. Would you like to comment on that?

Dr Nightingale: The issue directly relates to the overlap between science policy and education policy. The issue for the UK economy is that the high tech sectors which are directly feeding from the science system are quite small compared to the rest of the economy. There are marginal costs if we allocate resources towards particular areas. If we want to focus, as we may want to do, on biotech spin-out firms, then concentration might be a good idea. If we are concerned about the wider economy, then concentration probably is not a good idea. It is what outputs you want from the research system that will determine the answer to that question. Right now, as we have pointed out, it is not clear what the aims of the research system are and it is too broad just to say pro-innovation. There will be opportunity costs if we concentrate research resources in certain institutions. It is not at all clear from the science policy literature that I have read that there is a very good basis for a lot of the decisions about concentration resources in certain institutions. It is not necessarily the case that the best science is done in the best universities. It is not necessarily the case that the best science as judged by academic citations is the most useful research for industry. I will give you an empirical example. In the United States they have been extremely successful in producing biotech spin-out firms. If you look at the origins of the most successful biotech firms in California, they did not come from the elite institutions of Stamford and Berkeley, which were the Nobel Prize winners. More of them came from the University of California and San Francisco which would be a middle-range university, but that was much more focused on interdisciplinary, problem-based research which was easier to apply than the Nobel Prize winning research on the basis of cells which was ongoing in Stamford and Berkeley. Concentration assumes that there is a simple research excellence we can focus on and, unfortunately, I do
not think the data we have support that. It is a much more complicated question. To be able to answer that, we need a clearer understanding about what the aims of government policy are and also much better data and methods which will inform you about what the correct decision would be. I am sorry, but I cannot give you an evidence-based answer to that.

Sir Richard Brook: It depends, I think, on what criteria you are trying to establish. If you are wishing to come very high on the Jiaotong list, then of course you would concentrate very closely and you will do well as a consequence of that. But if you are wanting to ensure that communities around the country can be as productive and innovative as they wish, then I think you have to look much more widely. I do remember many, many years ago when I was at the EPSRC looking at *The Times* list of universities and a particular university, which I shall not mention, was at the bottom of the list. I went to look at it. The one conclusion to draw was that the community in which that university was placed was infinitely better because it existed.

Chairman: I have to say I share your belief in the civic responsibility of universities.

Q449 Baroness Perry of Southwark: There are two strands running here in what the three of you are saying. I must declare my own bias. I have a great deal of sympathy with Sir Richard’s view that you put your money where the good people are and trust them to come up with the most exciting and innovative things. I think from Professor Stirling we were hearing a plea for more denigration of innovation unless it happens to be the kind of innovation that somebody—government or some senior body—has decided that they really want. Is there a balance here? Is one all right and the other all wrong? If there is a balance, have we got it right at the present time? Have we got too much central direction or not enough central direction? Surely there is, I would say, passionately a need to have part of research funding simply to allow flowers to bloom where there is soil which will produce pretty good flowers, even if they may not be the ones that you first thought of?

Dr Nightingale: I would agree completely with you. I think there is a potential danger of trying to allocate research funding towards certain outcomes. It causes researchers to miss the opportunities that randomly come up. Serendipity plays a very important role in research. I can recall a discussion with Professor Weiss who has received huge amounts of research funding from the Medical Research Council and EPSRC and he has come up with lots of wonderful science, but often that science bore very little resemblance to what he originally bid for. There is an important role for serendipity. I think we should encourage people to undertake interesting research and I think that often is very valuable in that it informs teaching. A lot of the links that we have spoken about that create value for the country from research come from this. If you try and over-direct science, you can end up with poor quality science. One of the other elements which I think would be very important to stress which has not been stressed so far is the science policy research over the last 10 years has shown very clearly that academics are intelligent people who are able to market their research very effectively towards funders. There was a wonderful piece of research done by Jane Calvert, who is now at the University of Edinburgh, about whether or not research was basic or applied. The distinction between basic and applied research on research funding applications was dependent on what the researchers thought would be funded. If they thought applied research would be funded, it was applied research. If they thought basic research would be funded, they made it that. Also we are finding this to be the case with interdisciplinary research. There is an emphasis on, “Let’s have more interdisciplinary research”, and people now brand themselves as interdisciplinary researchers. It is not an easy system to change. We are dealing with people who are very clever and very good at marketing what they are doing, but I would stress that there is no support in the science policy literature for the idea that the research system can be managed effectively in a five-year plan essentially.

Q450 Baroness Perry of Southwark: I worry about what you say, that the scientists are clever, because that means that they are allowing themselves to be directed.

Dr Nightingale: Yes.

Sir Richard Brook: It is the big argument for the responsive mode. We have only to say what we want and they all come offering exactly what we want. We even get telephone calls about the responsive mode. “What is it you would like us to put right?” I am nervous about that but if I may answer your question, you used the phrase “part of research funding”. I think it is dangerous to expect the planning system to deal in one model with all the requirements placed upon it. Some research confronts a set of identified problems which society has, energy resource, the environment, all of these things, a particular disease, and there you can put a group of researchers together with some confidence in the target which they are going after; but you also want the system to deal with the exploration of unidentified opportunities. You have to let something happen even though you have not seen the target yet, but you know that something is going to arise there. You want a system which will satisfy both of those needs.


**12 January 2010  Dr Paul Nightingale, Professor Andrew Stirling and Sir Richard Brook**

**Professor Stirling:** If I may, in response to Baroness Perry’s question of too much overbearing, top-down prioritisation, my point about striking the right balance was not that the balance is wrong now. It is that it is difficult to determine whether or not it is wrong and whether that is the case will depend on different views. Which is why we need to have this debate under way. This does not mean there is a case for overbearing co-ordination to the exclusion of bottom-up, spontaneous, scientific ideas and creativity of the kind you are talking about. There, though, it is not just a question of sponsoring excellence when it arises. It is a question of nurturing seed beds of excellence from which these productive, unexpected ideas can come forward. Although we do have a wealth of universities of very high standing internationally which we should treasure, there is not a one-to-one correspondence between excellence in the areas of science we are talking about now and those particular institutions. The excellence from which these ideas come is distributed in a more fine-grain way than at the level of these institutions alone. Also, ideas of excellence are more multidimensional than is currently credited. In particular, we have talked a number of times here about interdisciplinarity and it came up in the previous session also. Actually, there is a real tension between the ways in which we think about scientific excellence in some respects and interdisciplinarity. There is an evidence base to show that the metrics of excellence in citation terms and so forth manifestly tend to emphasise disciplinary excellence. Interdisciplinary effectiveness and excellence in those terms tend to be less visible in those kinds of metrics. It is easy to get into a sour grapes discourse on this but there is a problem here, I think, in nurturing especially interdisciplinarity in an excellent way.

**Q451 Lord Krebs:** I would like to come back to something Sir Richard Brook mentioned earlier, namely the increasing threat that impact will be used to assess priorities for research funding particularly by HEFCE. I wondered what the three of you think of the role of impact and whether it is valuable in assessment of priorities. I just preface it by a quote from an article by Professor James Ladyman who says, “It is astonishing that ostensibly intelligent and knowledgeable people who are responsible for the higher education policy should evince the combination of philistinism and ignorance responsible for the ridiculous and deplorable ideology of impact now being foisted upon us”. Is this a view with which you would agree?

**Sir Richard Brook:** The trouble is that a quiet little word which is in itself quite reasonable has suddenly taken on all this baggage because it has become the central criterion by which research is to be judged. Then I think it is difficult. The funding councils and the research councils have reacted differently, I think. The Funding Council is making ex post use of impact. That is, you look back on the research you did 15 years ago and inform the Funding Council of the impact which it is currently having. There is a degree of legitimacy to that. There are facts involved. The research councils are making ex ante use of impact. That is, when you put in for a piece of research, you are supposed to say what the impact will be some 10 or 15 years afterwards. The opportunity for literary artistry there seems to me enormous and my worry, quite honestly, is that universities seeing this will set up departments of creative impact writing and things of this kind. It is potentially awkward there. The heads of the research councils have defended bravely the concept in trying to make it as reasonable as possible, but it is engendering a degree of scepticism among the applicant community: “Oh yes, we can write something there”. It is a distraction from the central research theme with which they should be concerned.

**Dr Nightingale:** The focus on impact has been a good thing in the past. I think it has been important in a cultural change in the university system which has been very positive. The level of interaction over the last 10 years, in my experience, has changed importantly, but I think it is very clear that diminishing returns have set in. It is very clear now—I speak anecdotally and from subjective, personal experience—that it is easier to fiddle impact measures than it is to do high-impact research. While on the one hand I think the science system very rightly should be responsive to the needs of the Government, should be responsive to the needs of the public, measuring impact is very, very difficult. Perhaps the focus should be less on measures which are so easy to fiddle and more on cultural change which seems to be working effectively. We have heard about how easy it is. An example is that universities were encouraged to form spin-out companies. It is very easy to form a company. I teach an entrepreneurship lecture in which I get on a mobile phone and I start a company in the middle of the lecture. Therefore, in a matter of hours I could produce 50 spin-out companies for my university which would go in government figures. Whether or not those spin-out companies will ever amount to anything is clearly questionable, to say the least. I think there is a need for some form of co-ordination, despite the problems of measuring impact. I think there is a need for some governance, some form of control. This is a very complicated system which needs to be understood and managed effectively. Managing by numbers has been an important part. I think we now need to move on to something else and recognise the severe limitations of it. One example I would give is on the interdisciplinary parts of it. I am an interdisciplinary
researcher and the sort of research I do is directly interactive with industry. About a third of the papers I have written in the last five years have been with people from industry. It used to be for me a unique selling point. I could say, “This is interdisciplinary research. It is engaging with industry”. That would give me something as an interdisciplinary researcher that I could use to support myself in a disciplined, focused research environment. Now everybody does that and I have nothing, so I think there needs to be a more sophisticated understanding of the sociology of the peer review process, informing the way research money is allocated and a recognition amongst everybody that there are limits to what these measures are. Sometimes these measures get institutionalised, as I think they have in the RAE and now the REF. There are diminishing returns but my overall view is that, for the science system, the social science system, the entire university research system, we take taxpayers’ money and we have a responsibility towards the taxpayer to maximise the benefit to the public from that. Off that, I think some form of governance is important.

Q452 Lord Oxburgh: I have two aspects really. Has your unit or have any of you observed changes in patterns of funding allocation in the progressively more stringent funding environment which has developed over the last year or 18 months? The second question is: given that things are not going to get better, as far as we can see, or at least not better quickly, are there particular pieces of advice that you wish to offer to funding authorities under those circumstances?

Dr Nightingale: I am not aware of any research that has been done on this so I can only speak from personal experience, but I think there has been a very clear change in the types of research proposals which are going in and, from my own experience, they have become a lot safer. People are retreating into their disciplinary areas, so interdisciplinary engaged research is becoming more risky. In my particular institution people are all on soft money, or most of us are on soft money, so if we do not get funded, we do not get paid. That has people worried about their future income and they have taken the safe path. The policy implication of that, I would guess—again, this is anecdotal evidence, I have no research base on this beyond what I have seen—would be that there probably is a need to support certain groups which are likely to have less support in the next three to five years, so young researchers, interdisciplinary researchers, people crossing disciplinary boundaries, people who are doing particularly novel research I think will need some support.

Professor Stirling: It is too early to say yet what will be the consequences of what is still largely a forthcoming stringency. I think, under those conditions, we are going to be particularly exposed to the dangers of this rather opaque process that I was alluding to earlier in that we have become particularly vulnerable under resource constraints to special interests, elite networks, dominant institutions and so forth: not to denigrate such things because there is usually a reason for privileged interest, but not usually to the degree that they exercise that influence. I think we are now particularly vulnerable, so my advice to policy makers would be that the increased stringency that is now on the horizon and beginning to happen is a particular argument for us to try to create a greater degree of transparency and accountability to the degree that priorities are being imposed on the research system, especially on the development system. We should be much more transparent and accountable about it without excluding more bottom-up, spontaneous, response mode ideas that come through the system.

Q453 Lord Oxburgh: The implication of what you say is that the Trust which Sir Richard directs is going to play potentially a much more important role.

Sir Richard Brook: That is the anticipation of the trustees. How has the atmosphere changed? I think the applicants send us bids which imply that they believe in a hidden agenda, that there is more to this than meets the eye. What is it they are really supposed to do? Which are the boxes they are really meant to tick? It does seem to me that, as the time of stringency comes, it is absolutely crucial to direct their attention back to the central research object, the need for quality in the research rather than sophistication in the box-filling. The trustees have enjoyed in these last few years a time when the income for the Trust has been greater than the money they have chosen to give out and, therefore, they have had special initiatives running over recent years, but they have said that now they must step back from that because they anticipate that in the next year or two demands upon the Trust will increase quite strikingly and they had better have something held in reserve.

Lord Oxburgh: I am glad to hear it.

Q454 Chairman: You referred to a caution on the part of those submitting proposals. Tying this in with what Sir Richard has just said, is this because the assumption is that award-givers will be more centrally focused in the money that they give out to the core disciplines that they represent? Are these correlated beliefs?

Dr Nightingale: It is subjective, anecdotal evidence but my impression from reading lots of proposals and talking to people before and after they are submitted is that there is a sense in which the amount of money
that is going to be given out is going to decline quite drastically and the university system will be putting more and more pressure on researchers to get that money, so there will be increased amounts of competition. There is anecdotal evidence that the award percentages are going down. Therefore, I think people will quite rationally become much more defensive in what they are doing. Speaking from personal experience, I have done it. I need money. I need to pay my salary, so I am not going to take risks.

Chairman: Quite understood. May I thank you very much indeed for giving us your written evidence and your time today. If there are follow-up points that you feel you could either clarify or extend, please do let us have a note. We will send you the transcript very shortly. Thank you very much.

Supplementary memorandum by Professor Andrew Stirling, Science Policy Research Unit (SPRU), University of Sussex

INTRODUCTION

1. I am Research Director for SPRU (“Science Policy Research Unit”) at the University of Sussex\(^1\) and co-direct the joint Institute of Development Studies/SPRU ESRC-funded “STEPS” Centre\(^2\). Among other bodies, I serve on the DEFRA Science Advisory Council\(^3\) and BIS Sciencewise Steering Group\(^4\) and, in the past, on the European Expert Group on Science and Governance.\(^5\) The present evidence was prepared in response to the specific questions circulated by the Committee Secretariat on Wednesday 6 January 2010 to witnesses for the oral evidence session on 12 January. It was not submitted in advance because it was regrettably not possible to meet the deadline of 7 January.

2. This evidence is a more specific complement to that by my SPRU colleague Dr Paul Nightingale. It focuses on the Committee’s first, most detailed and (I understand) highest priority query for the present session, concerning the rationales for—and possible natures of—possible improvements to the UK system for prioritising publicly funded research. As such, it reflects my own experience, both in researching and providing scientific advice in policy and policy advice on science in the UK and EU research systems.\(^6\) It is also grounded in a large body of interdisciplinary research arising in a dynamic international field concerning science, technology and society. However, since SPRU as an independent academic research institute does not take collective positions on specific policy issues, the details of this evidence should be regarded as the individual responsibility of the author.

What improvements could be made to the current system of priority setting for publicly funded research? In particular:

(a) What are the strengths and weaknesses of the UK’s system for setting priorities for publicly funded research?

3. In some ways, I believe that the UK presents a relatively rigorous, open and dynamic arena for setting priorities in publicly funded research. Positive features include an overarching climate of vigorous political attention—as exemplified (inter alia) by the present Committee and a number of other scrutinising parliamentary fora. There is a rich diversity of relevant statutory and non-statutory advisory bodies and mission-oriented agencies (see below). Policy deliberation and documentation is generally quite detailed and of a high quality. The UK enjoys a healthy news media and a plural civil society, engaging in active and (sometimes!) sophisticated ways on issues of science and innovation. Not least, the UK scientific community is among the more sensitive and attentive to its own responsibilities in public engagement.\(^7\)

4. In my view, the principal weaknesses of the UK’s systems for setting priorities for publicly funded research are twofold and inter-related. Despite the contextual diversity and variability over time, these are shared in common with many other comparable countries. Each involves different aspects of a vulnerability to unintended, undue concentration and “lock-in” in research.

5. Starting with the first aspect, there is in a number of areas a risk of concealed concentration in the power and influence exercised over prioritisation of different areas of scientific enquiry and support for alternative orientations for technological innovation. Principles of scientific excellence rightly and necessarily privilege specialist expertise and the procedures by which this is nurtured and accredited. Yet not all issues in the prioritising and orienting of research are readily or rightly reduced solely to matters for the directly-involved specialisms themselves. Indeed, there is a sense in which restricted disciplinary communities, elite expert networks and dominant scientific institutions may themselves represent strong vested interests. In this respect, exclusive or overly simplistic principles of “autonomy” and “excellence” may lead to significant deficits in transparency and accountability.
6. Second, there is in a number of areas an associated but distinct risk that prioritisation of scientific enquiry and orientation of technological innovation are becoming relatively locked-in to a restricted subset of possible pathways. This may foreclose a wider variety of (prima facie) similarly scientifically-reasonable, technically-feasible and economically-viable alternative directions. Much high quality analysis in many disciplines has documented the many ways in which directions for progress in science and technology are prone to path-dependency and “entrapment”. Insofar as is visible (see below), illustrative examples may include: the fact that roughly one third of all UK public expenditure on research is assigned to military (rather than civilian) applications (probably rather higher in fields like robotics, nanoscience and aerospace). In the OECD, renewable energy research receives only one quarter of the allocation to nuclear fission and fusion, with fusion research alone receiving more investment in the UK than any renewable energy technology. In the health sector, there is an evident (but poorly documented) emphasis on intellectual property-intensive medical products, rather than preventive or organisational approaches to public health. In agriculture, the focus tends to be stronger on transgenics than other applications of advanced biological science. In all these and other areas, there are at least grounds for considering the case for more balanced and diverse portfolios of trajectories in publicly funded scientific research and technological innovation.

7. The essential point in identifying these possible weaknesses is not to assert one particular view of undue concentration or lock-in, in these areas of UK publicly funded research. This would require more substantive documentation than is possible or appropriate in this evidence (see below). Any such position would in any case necessarily be value-laden in a fashion that might readily be contested from another reasonable but contrasting evaluative perspective. In making this diagnosis, I am instead addressing a more general issue (one that can be appreciated independently of positions concerning the merits or drawbacks of particular research trajectories). Here, the crucial question is: “do existing UK systems for setting research priorities provide a sufficiently robust, transparent or accountable basis to ensure avoidance of these dangers of concentration and lock-in?“

8. It is also important to clarify that this argument should not be taken to imply that prospects or applications for alternative research or technology trajectories is necessarily always clear. This is often far from the case. Nor is this a bad thing. An openness to creative “response mode” enquiry is a crucial feature of a healthy research system, which needs to be continually nurtured. However, this does not negate the importance of more open and explicit deliberation over the structuring of the institutional and (inter)disciplinary contexts within which such creativity is generated. In reality, the scientific grounding, technical feasibility and (especially) economic viability of contending avenues for public investment in research is typically highly uncertain. Indeed, the dynamics of concentration and lock-in themselves (operating in global knowledge and innovation systems) amplifies the uncertainties. Prospects that potentially feasible or viable innovation paths will actually prove realisable will depend not only on intrinsic merits in each case, but also (in part) on the extents to which each path is reinforced in parallel international commitments. As such, appropriate balancing of UK research priorities also depends on expectations over complementary commercial and non-UK public investments. This wider complexity, uncertainty and dynamism in the picture concerning relative merits of alternative research trajectories serves to underscore the central point here: that the UK system may presently be vulnerable to undue and opaque forms of concentration and lock-in.

9. Some further background and substantiation for this concern, can be conveyed by considering a number of general features of the ways in which contending scientific and technological priorities tend to be discussed in high-level policy making. Here, a frequently-heard phrase on all sides of debate from Prime Ministers downward, is that policymaking is (or should be) generically “pro innovation”. This kind of language treats technological progress as essentially homogeneous and one-directional. The underlying idea is that of a one-track “race to the future”. Those particular orientations for innovation that are favoured in decision making are thereby presented not only as self-evidently good, nor just as implicitly optimal, but as effectively synonymous with innovation itself. In similar vein, authoritative bodies in the UK research system tend to interpret critical public perspectives on particular technological trajectories (like synthetic chemicals, transgenic crops or nuclear power) as reflecting indiscriminately general “anti-science” or “anti-technology” positions. Senior figures defend commitments to particular innovation priorities in these areas as if they were uniquely expressive of “science based” decision making.

10. In all these ways, much conventional language in the politics of science and technology in the UK is routinely obscuring the reality of choices between contending—equally scientifically founded—positions. Alternatives to many contested trajectories typically involve similarly advanced applications of science and technology. To take the examples cited earlier, this is true for instance, of: civilian (as distinct from military) applications in robotics, nanotechnology and aerospace; a wide variety of renewable power and energy efficiency technologies (as distinct from nuclear fission and fusion); holistic, preventive and organisational (rather than IP-intensive) approaches to public health; and genetic marker-assist breeding, cisgenics, apomixis, ecological strategies and biological control (as distinct from transgenics) in agriculture. By representing matters of prioritisation and
orientation in these and other areas simply as matters of “pro-innovation” or “science based” decision making, much high level debate on science and technology policy is regrettably inadequate. Subtle evaluative issues around prioritisation of different innovation paths are lost in the false objectivity and misleading simplicity of the “pro”/“anti” dichotomy. This presents a serious inhibition to robust, transparent or accountable policy making concerning alternative directions for science and technology.

11. This routine lack of discrimination between alternative priorities and orientations in much conventional high level discussion of science and technology stands in stark contrast to many other areas of policy making. In fields like criminal justice, foreign relations and education policy, political debate often engages with highly complex matters of technical expertise. Yet—no matter how strongly asserted the position—we rarely find such a general climate of simplification and objectification as encountered in science and technology policy. It is almost as if defenders of incumbent positions in these other areas of policy were to refer to themselves as being simply “pro policy”, and their critics as being indiscriminately “anti policy” in general. The inherent absurdity of this image underscores the degree of idiosyncrasy exhibited by much present discussion over alternative priorities in science and technology.

12. More substantively, this weakness in general political debate is paralleled—and potentially exacerbated—by a significant characteristic of (in many ways otherwise exemplary) official documentation in UK science and technology policy. This is that, amidst the authoritative analysis, comprehensive scope and formidable detail, there is in this governmental literature virtually no routine systematic attention to the relative degrees of support provided for specific alternative scientific and technological trajectories in particular areas. It was partly for this reason, that the former Chief Scientists’ Energy Research Review Group criticised (even in this arguably best-documented of areas), the lack of transparency concerning comparisons between technology-specific spends. This is also why the above-cited concrete examples of other potential areas of concentration and lock-in in UK research portfolios may presently be sketched only in relatively incomplete or qualified ways.

13. It is important to be clear that this argument should in no way be taken to detract from the value or quality of that analysis and documentation which is available. The Government Office of Science produces valuable detailed, authoritative and regularly-updated statistics in wide a range of science, engineering and technology indicators as well as more focused in-depth surveys. The Department of Business Innovation and Skills publishes much comprehensive information concerning the scientometric, demographic, departmental and sectoral structures of UK research—often in revealing cross-national context. Individual departments and agencies intermittently address their own portfolios in similar ways, or focus on selective areas for application of particular trajectories in science and innovation. The Research Councils publish similar comprehensive figures concerning contrasting disciplinary spends. The National Audit Office conducts periodic reviews in many of these areas, as do independent and advisory bodies such as the Royal Society and Council on Science and Technology. The Parliamentary Office of Science and Technology provides Parliament with hundreds of reports concerning a wide range of topical issues in science and technology. Yet the point remains that it is very difficult to extract from this literature on any consistent basis, a reliable answer to the ostensibly simple questions: “What is the balance of total UK government spending on alternative trajectories for science and technology in selected specific sectors? What is the rationale for this?”

14. It is this kind of deceptively straightforward question that underlies concerns over possible concentration and lock-in in UK government spending in the prioritising of contending orientations for research and innovation. Concealed by the generic “pro”/“anti” rhetorics on science and technology, it is these issues that are central to debates over intrinsically political choices, like those exemplified earlier. With increasing attention to challenges of global climate change, food and energy security and poverty reduction—each requiring crucial choices in the balancing of contending scientific and technological trajectories—the stakes are indeed high. In the absence of routine, detailed, systematic, comprehensive and transparent attention to this basic dimension of science and technology policy, it is difficult to debate with any confidence whether or not the UK system of priority setting for publicly funded research is subject to unjustified influence by vested interests. Still less is it possible seriously, rigorously and openly to debate whether the resulting portfolios strike an appropriate balance between alternative possible pathways, or whether they are locked-in to particular single trajectories to the exclusion of others.

(b) What principles or criteria should apply in the process of setting priorities for publicly funded research? What changes, if any, do you suggest?

15. To recognise the weaknesses outlined above need not be taken to imply any compromise on the Haldane Principle, concerning the benefits of the independence of science from special interests. Concerns over possible concentration and lock-in need not raise any fundamental challenges to core principles of quality in science, such as those concerning experimental rigour, open publication of evidence or the conduct of peer
review. Issues of accountability and diversity arise more at the level of strategic prioritisation and resource allocation between fields, applications and orientations for enquiry, than in the judging of rigour or excellence within disciplines. In these terms, a robust interpretation of the Haldane Principle may be taken as an injunction that the prioritisation and orientation of research be as independent from vested interests operating within, as those intruding from outside, science. The Haldane Principle is not well respected simply by assuming that science displays no networks of privilege, disciplinary hierarchies or dominant institutions that might interfere with idealised notions of excellence. Nor is it reasonable simply to assume that these intrinsic and unavoidable features of the internal social relations of science are themselves somehow immune from dynamics of power, privilege and prejudice in wider politics and the economy.

16. In order to assist application of the spirit of the Haldane Principle in this broader and more robust fashion, I believe that a potentially important guide may be provided by some of the foundational principles of science itself. At least as normative aspirations (if not as routinely or universally achieved practices), these are perhaps most usefully articulated in the much-discussed “Mertonian Norms” proposed by the sociologist of science Robert Merton and subsequently developed in various ways. They are conventionally summarised by the acronym “CUDOS”—standing for “communalism,” “universalism,” “disinterestedness” and “organised scepticism”. In considering the implications of these norms for discussions over the Haldane Principle, it is necessary to extend the scope of application from relatively narrow issues in the practice of science itself, to wider procedures in the shaping of priorities and orientations for publicly funded research. In these terms, relevant principles for the mitigation of possible concentration and lock-in might be described as follows.

17. The principle characterised by Merton as “communalism”, suggests an injunction to treat issues of broad prioritisation among alternative orientations for scientific enquiry and technological innovation as a responsibility not just for the most directly-implicated specialist interests, but also for the wider social communities who stand to be affected. Among other things this enjoins a criterion of transparency in the full and clear provision of authoritative information to facilitate improved and extended policy debate over the appropriate values and interests to prioritise in the public funding of research.

18. An extension of Merton’s principle of “universalism” might be viewed as a requirement that social and political deliberation over priorities and orientations in science and technology should not only include, but also address, a full range of interests, irrespective of affiliation, race, class, nationality, culture, or gender. This implies, inter alia, a corresponding criterion of accountability in decision making over choices and trade-offs in provision of resources to alternative trajectories and their relationship to divergent social imperatives and concerns. In order to guard against lock-in to particular trajectories, a principle of universalism also suggests a criterion of diversity in research portfolios; ensuring accommodation of a wider array of contending interests and values in the prioritising of divergent orientations.

19. Merton’s principle of “disinterestedness” can also be extended beyond issues of independence from external influences on scientific enquiry itself, to the prioritisation and orientation of research more broadly. This should also be similarly independent, but in a sense that explicitly guards against undue concentration of power and influence favouring special interests operating within the social organisation of science (such as restricted disciplinary communities, elite expert networks and dominant scientific institutions). This need not imply any compromise on attention to scientific excellence; requiring instead the application of equally rigorous—but more robust and plural—quality criteria (see below).

20. Finally, there is the principle of “organised scepticism”, which in this broader context reminds us of the value of encouraging active critical scrutiny of scientific priorities and incumbent interests in wider social and political debate over research priorities. In these terms, public concerns over particular trajectories for research should not be treated as a generic “anti-science” pathology to be remedied by “public education”. Instead—if appropriately articulated in more open policy procedures—critical public debate over priorities for science and technology might be welcomed as an intrinsic matter of quality control in research policy (just as it is in science itself). This in turn might help to ensure a healthier degree of rigour and rationality in the determination of directions for progress in knowledge and innovation more generally.

(c) To what extent are the organisations and individuals currently involved in setting priorities for publicly funded research fulfilling their roles? What changes, if any do you suggest to their roles and/or remits?

21. Such is the scale, complexity, diversity and sophistication of existing UK systems for setting priorities for publicly funded research, that it would be invidious—in the absence of an exhaustive authoritative review of precisely the kind argued above not to be available—to assert a position on the extent to which different organisations or individuals are fulfilling their roles. However, there do follow from this evidence some fairly direct implications for the ways in which senior political figures engage with issues in the prioritisation and orientation of contending directions for science and technology. Most importantly, there is a clear responsibility—especially at the highest levels—to reject simplistic and misleading rhetorics around
supposedly indiscriminately “pro-innovation” policies; the branding of concerns over specific innovations as generically “anti-technology”; or claims to achieve decision-making that is uniquely and exclusively “science based”. Politicians, civil servants and scientists alike should be careful not to conceal in these ways the intrinsically value—and interest-laden dimensions in prioritising and orienting progress in science and technology.

22. Slightly more specifically (and recognising the reality of specialised remits and resource constraints), a few observations might be ventured concerning the terms of reference of some of the bodies referred to earlier. For instance, alongside the exemplary data already provided, the Government Office of Science might also examine the possibilities of publishing on a more regular basis, detailed figures (aggregated across all public research spending) concerning the overall balance of investment in alternative scientific and technological approaches in selected key sectors of the economy, such as those mentioned in this evidence (involving, for instance, specific contending research trajectories in energy, food, transport, security and public health). The Department of Business Innovation and Skills might periodically then relate this to complementary spending in other countries and the private sector—and address on this basis the rationales for the particular patterns of UK public investment in specific alternative trajectories on a sector by sector basis.

23. This might then help prompt individual departments and agencies to address their own portfolios in similar ways, focussing in more explicit detail on the implications of divergent values and interests for the prioritising of alternative trajectories in their own areas. There exists in the current burgeoning field of “public engagement in science”, a variety of potentially useful and effective approaches to providing this kind of broader-based and more robust evidence base for the orientation of research priorities. The present Select Committee has itself played a formative role in establishing these practices more widely in the UK science system. Yet much of this activity currently remains ambiguous in its rationale and motivations: as to whether it about fostering public trust and acceptance for existing priorities in science and technology, or eliciting guidance as to the appropriate balance to strike. Although addressing less mission-oriented areas of science, the Research Councils might also play a lead role by examining their own portfolios more systematically in relation to this wider evidence base and highlight any issues that arise. In particular, as already widely recognised, Research Councils also offer crucial inputs to development of more robust and plural criteria of scientific excellence, of the kind that might assist in extending the Mertonian principles referred to above. Other bodies might also play key roles in periodic interrogation and challenge in these wider dimensions in research governance, including the National Audit Office and the Parliamentary Office of Science and Technology.

24. I believe that it is only through broad-based (but reasonable and incremental) reforms of these kinds, that those with an interest in UK systems for setting priorities for publicly funded research might be able to obtain full or reliable answers to the simple questions: “What is the balance of total UK government spending on alternative trajectories for science and technology in selected specific sectors? What is the rationale for this?”

12 January 2010

NOTES AND REFERENCES

1 Details at (1/10): http://www.sussex.ac.uk/spru/.
2 Details at (1/10): http://www.steps-centre.org/.
6 Details at (1/10): http://www.sussex.ac.uk/spru/profile7513.html.


19 “We believe that the difficulties this group has experienced in data gathering, which echo those experienced by the Energy Group while putting together its own strategy document, demonstrate the lack of transparency of information in this area. The lack of information on industrial research may reflect the fact that energy utilities are now found far more often in the private sector than used to be the case. The difficulties of obtaining information on overseas activities may be as much a problem of comparability of data, as of accessibility. But some of the difficulties arise from the rather diffuse nature of the UK research effort, divided as it is between DTI, the Research Councils, the Carbon Trust, and, to a lesser degree, the involvement of other government departments, although we noted that these parties are working to co-ordinate their activities.” (para.72, Chief Scientific Adviser’s Energy Research Review Group, OST, 2002. At (1/10): http://www.dius.gov.uk/~media/publications/F/file25485.


Q455 Chairman: Good morning and welcome. We very much appreciate your willingness to join us and give oral evidence. We appreciate the written evidence we have had, thank you very much indeed. We will, of course, be asking you about the reports on which you separately are engaged. We do not expect you to tell us exactly what is in the report but we will do our best to find out. It is a matter of discretion on your part what you can share with us as we move further down the line on our report. The proceedings are recorded; they are, I think, directly webcast at the moment—yes, they are—so you will remember that you are on air. A transcript of the recording will be sent to you within about ten days for you to look at, but in the meantime I wonder if, for voice recognition purposes, you could simply identify yourself by saying who you are and the microphone will pick up your particular timbre of speech.

Professor Dame Janet Finch: Janet Finch, co-Chair of the Council of Science and Technology.

Professor Sir Martin Taylor: I am Martin Taylor and I am Chair of the Fruits of Curiosity study at the Royal Society.

Dr Wilson: James Wilson; I am Director of Science Policy at the Royal Society.

Q456 Chairman: Thank you very much indeed. Having said that, of course, you cannot tell us what is in your report, I wonder if you can tell us a little bit about the themes that have emerged as the key ones for you. What are the big issues that are coming in this area? Perhaps, at the same time, just say what the particular interest of your own organisation is in pursuing the questions that come up. In other words, what do the Royal Society and the CST see as their role in related areas. Who would like to start?

Professor Dame Janet Finch: I am happy to start, my Lord Chairman. The CST is currently engaged in a project on the science and research base which was commissioned by Number 10. So we were asked to do this and we are very happy to do it. Lord Drayson is the sponsor Minister for it and we are quite close to completing the report but we have not yet presented it to him, so that is the stage we are at. I can say a fair amount about our conclusions in general terms, but, obviously, not in detail yet. We were asked to advise the Government on how to ensure that the UK research base maintains its high level of performance and that its outputs are maximised in the context of the global competition in relation to research and the outputs of research, and a number of other sub-bullets, but that is the overview. In terms of the big themes that we have been developing as a result of that (and this is a short-term project; we have taken six months over it and we have had an enormous amount of help from a number of parties, including the Royal Society, where we kept in touch as they have been developing their slightly different study), the broad conclusions that we are reaching at the moment is that it is absolutely vital that the UK remains a leading global player in research and that we need to be able to build on our strengths to punch above our weight in terms of the size of this country and to have a strong research base that acts as a stimulus for new industries and new businesses and, also, a magnet for global investment. In order to do that, we believe that we need to maintain a strong capability across the whole research base and here we do need science, technology, social science and creative disciplines as well. We believe that in order to really position ourselves for the future, the key is people rather than topics. Certainly in terms of the research base itself, we do not think that it is the role of government to pick promising topics or areas for the future; we believe that it is much more important to ensure that we have a research base which really, in terms of both home-grown talent and the attraction to the best researchers from elsewhere in the world, attracts, retains and nurtures the best talent because the best people will then be able to produce the best research in the future, and the characteristics of the future in terms of the opportunities cannot be predicted right now. So we believe that the best people will adapt to future opportunities and produce
the best research. That is where we are putting our emphasis. We do believe that government does have a role, and should have a role, in making strategic choices about supporting the downstream elements of research where we need to ensure that at the demand-led end of the spectrum there should be support from government for the business pull-through for research to help to generate wealth in the future. In order to do that, we believe that government needs to develop a clear and clearly-articulated, long-term vision for research, for the research base and its relationship to the exploitation of research, and that that needs to be stable over time; it needs to be communicated effectively as a basis for encouraging others to invest in research, including the private sector. We recognise, particularly in the very difficult public funding climate that we are moving into, that having such a long-term vision is absolutely vital to encourage a range of investments in research. Finally, I guess, another thing I should say is that we spent quite a lot of time thinking about the language in which we talk about these matters, because we think that the traditional language that we all use of “basic” and “applied”, “pure” research, “curiosity-driven”—all of this and we all use it—gets in the way because all of it, we think, has a tendency to imply that there is a linear relationship between basic, discovery-oriented research and the application of research, whereas everybody involved in the research game (I am sure this is not an original point at all for your Committee, my Lord Chairman) understands that the most promising research ideas in terms of application can arise from a whole range of different types of research activity and are not necessarily planned in advance. So we use in the report a rather looser language of “upstream” and “downstream”, but we absolutely do not intend that to mean that there is a linear relationship; we think that the key is to ensure that there is excellence across the whole research base and that the research base should be driven by excellence in whatever areas it is found, and then harvesting the products of research, again, by a variety of different methods. I think that gives you a flavour of the sort of conclusions that we are drawing.

Q457 Chairman: Thank you very much. We will ask Sir Martin and then we will come back on one or two follow-up questions.

Professor Sir Martin Taylor: The very first thing I wish to say is to thank you for inviting us here to tell you a little bit about the Fruits of Curiosity study which has been a very lively study from which I have learnt a great deal. I also want to say that there is a great deal in common with what Janet has said, and this is not a complete accident because there have been a lot of lines of communication between the two of us. I would like to start with some of the points that you mentioned, my Lord Chairman. I am very happy to tell you about emerging themes from the study. Actually, I am probably happy to tell you a little bit more than you might have been expecting. I want to tell you about the structure of the report and how it will break up and I will tell you some lines of recommendation and some of the actions that are recommended as well. However, there were some contentious things that it is not really right to bring to you. This is because of the stage we are at and we are a little further up the line than Janet’s study at the moment. We have still one more advisory group meeting to go and then, in addition, it has to go to Council as well. I will therefore have to be reticent. Perhaps I should begin by telling you a little of the terms of reference, and the short version of this is to say that our terms are two-fold: firstly, to identify the different forms of value that science has—this might be economic, social and cultural, intellectual—and then, secondly, to think about how these forms of value could be enhanced and increased. I should also add, parenthetically, that we want to give some vision for science for the next 20–25 years as well. The likely structure of the report is some three chapters followed by six or so lines of recommendations. I want to tell you a little bit about each of the chapters, and there is great consonance with what Janet said, often times. We should begin, I think, by saying what an amazing asset science is in the United Kingdom. There are all sorts of measures one might go for and none of them are utterly trustworthy. The United Kingdom’s universities do very well in the Shanghai Jiao Tong rankings, and in the Times Higher index; I think we have four of the top six, but you might not wish to trust that entirely. We are about one per cent of the world’s population but we get something like 14 per cent of the top citations. Fifteen per cent of those that travel the world to do a PhD come to the United Kingdom, and in drug production, of the leading drugs, 25 per cent of them come from Britain. So there are a lot of parameters out there, and we would reckon that, at the moment, if we took a quick photo of where we are now, we are probably second in the world, but of course others are catching up fast. I want to tell you a little bit more about that. But, before I do, there are two further points in this first chapter. Science, then, we will maintain, is one of the jewels in the UK crown, and it was said at our Fruits of Curiosity study that there are not many other jewels left, so this is something that we really have to build on. In terms of building up science, we have received quite a substantial investment over the past ten years and we want to chart the good value that this has brought. It has been spent very wisely, we believe, and can tell you that science in the United Kingdom is now performing very strongly. So it was
a wise investment. I said beforehand that others are catching up fast. Well, we have a changing international landscape. Others are catching up. But in a time of recession, different countries are reacting differently. There are some countries now that see the recession, really, as a platform now for them to spring forward and do even better. I could, of course, try and tell you about the United States, China, India and Brazil and the amount that they are putting in.

Q458 Chairman: I think we will stick with Britain for now.

Professor Sir Martin Taylor: My Lord Chairman, if I could, I would like to say a little more about those who are like us. Germany is investing quite heavily; they will be increasing by €12 billion. I wanted to pick out France, if I could. France, to the amazement of French scientists, is going to invest another €35 billion in science to increase their knowledge economy, as they call it. President Sarkozy clearly has his eye on our spot. So I just wanted to bring into focus the challenge that lies out there on the international scene. Similarly, the Irish, who are in a terrible economic position, are going to invest a lot more. So science is changing; it is becoming much more collaborative. Something like just under half of the papers produced in this country are collaborative with scientists outside the country—and they are the high-impact papers. So we have to take account of this. The problems that the world faces, almost by definition, are often global problems and they will be solved, largely, by international collaboration of science. That is what I mean by our having a changing landscape. The United Kingdom, really, then, needs to formulate a much clearer international strategy that is going to take account of this changing landscape. There is another paragraph with which I will deal fairly quickly, although I will perhaps draw out one or two of the salient points. There will be a chapter on the 21st century science and innovation. In particular, this will consider what science is like, and this touches on some of the points that Janet was making. We spent a lot of time reflecting on the taxonomy of types of science research: basic versus applied—is this a helpful language or not? In the end, possibly slightly differently to you, it was agreed that when talking to policymakers, and when you speak to the public, then a certain amount of simplification of language is possibly in order—as long as you put the right caveats in. We discover, and we have charts and data to illustrate the fact, that there has actually been an increase in the amount of basic research as a proportion of the scientific research that has been done. I would agree entirely with what Janet said about science to innovation being a very complex business. Sometimes it can be fairly linear, as nuclear magnetic resonance turned to magnetic resonance imaging—so a fairly straightforward line. On the other hand one of my favourites might be the quantum theory which, as I recall, began as the study of trying to improve light bulbs and then led to the discovery of the quantum theory from this and, in due time, it will probably feed back to quantum computing. So you see the trajectories from applied to basic and back again, and these, surely, are fine instances of complex models of research. On the innovation front, there are things to applaud. The TSB, you will find the Fruits thinks, has done really rather well and that clusters of researchers and innovators around universities and have been a marked success and are a good indicator of success in knowledge transfer. On the negative side there seems to be a real problem with venture capital for the development of new ideas. Also, the amount of research and development done in private companies seems to be very much on the wane. So that very briefly gives you the main structure of the report, and this leads me to describe some of the recommendations. I will perhaps just give you the headlines for the recommendations, and I could say more then if questioned. One line of recommendations will be to put science/innovation at the heart of strategy for long-term growth. As Janet said, what is really needed is a fairly stable ten-year plan that will give scientists some confidence to do their research. The next line would be to invest in excellent people. This is very much a point that Janet made—more investment in investigator-led research. This has gone very well, we see, with the European Research Council, for instance, and we think that more of this should be done. The third recommendation will concern strengthening government's use of science. This might require some new chief scientific advisers and also the reviewing of the science spend outside the ring-fence by government. That is a very interesting area on which I would be happy to say more. We wish to strengthen the UK's position as the world changes. We also wish to increase government's use of science and to put science/innovation at the heart of strategy for long-term growth. As Janet said, what is really needed is a fairly stable ten-year plan that will give scientists some confidence to do their research. The next line would be to invest in excellent people. This is very much a point that Janet made—more investment in investigator-led research. This has gone very well, we see, with the European Research Council, for instance, and we think that more of this should be done. The third recommendation will concern strengthening government's use of science. This might require some new chief scientific advisers and also the reviewing of the science spend outside the ring-fence by government. That is a very interesting area on which I would be happy to say more. We wish to strengthen the UK's position as a hub for global science. I think I have made the case that, at the moment, we are very much at the centre of things in the world, but that we are going to have to work very hard to keep that kind of position as the world changes. We also wish to better align science/innovation with global challenges. That will be our fifth recommendation. The sixth recommendation was one of the hottest and liveliest topics in the Fruits of Curiosity study, where we noted the need to invigorate science and maths education. We thought that, for the future, what you really need to do is be enthusing young people at all stages, and then they will come through to a well-educated citizenry at all sorts of different points on the spectrum. I think those are the points I wanted to make, my Lord Chairman. I think James might want to add a few points to what I have said, if that is in order.
Q459 Chairman: If you have finished your comments, yes.
Dr Wilsdon: I think Martin has covered most of the territory. Just to answer your question as to why institutionally we embarked on this study now, I think there were three reasons from the Royal Society’s side: firstly, the unique economic circumstances that the UK finds itself in at this time, and this debate about the potential rebalancing of the UK economy and our interests as the national academy in identifying the enlarged role that science and innovation could play in any process of rebalancing. Secondly, where we are in the political cycle: the clear sense that the existing ten-year framework, whatever the outcome of the next election is, to some extent, up for renegotiation, and our desire to speak to whatever should follow in its place. Thirdly, more particularly to the Society, it will not have escaped your attention. I am sure, that it is our 350th anniversary this year, and we felt it was a timely moment in the Society’s life to revisit some of the fundamental arguments that we make, and that the science community more generally makes, about the value of science to the economy and society, and to do so in a way that complements and builds on some of the wider messages we are putting out into the wider world through our 350th year. I think, particularly—and this is, perhaps, where we complement the CST reports and other reports that are forthcoming—one of the unique things that the Society can do is to speak genuinely with a long-term perspective on these debates, and the flow through from ideas to application. This is all about the great wealth of history and experience that there is within the fellowship.

Chairman: Thank you very much.

Q460 Lord Broers: I would like to challenge you to be a little more specific about one particular issue. It is fine to say that we must maintain our pure science base, it is very strong and we must just deal with people; we must not set any strategies and we need to think of new topics. That is what we have been doing, that is fine. What else are we going to say? Everybody will love it and cheer from the sidelines. You then went on, Dame Janet, to say, however, that from the other end we might have to do something else. I am going to challenge you as to what that might be in more detail. Then, Sir Martin, you were saying that everything is fine and a similar sort of thing, and we have got this fantastic science base, etc; there are a couple of small problems such as the fact that there is a venture capital problem and there is, also, a problem that science has fallen away in private industry. They would strike me as absolutely catastrophic problems, not just some side issues. Then, Dame Janet, you said: “Well, we are going to work on the pull-through side and we will need to develop a clear, long-term strategy and vision and encourage the private sector to invest.” Is there anything specific you can say in those areas? Are we going to actually select some areas where we are going to establish large centres? I understand that the Prime Minister and Lord Mandelson have asked Hermann Hauser to look at that. Are we going to have some big institutes and Fraunhofer-type things? Is there going to be anything new in your reports, or are you going to be banging on the old drums all over again?

Professor Dame Janet Finch: I think it is quite difficult to say that any of us have any original thoughts that nobody has ever thought of before. Obviously, quite a lot of what our report is going to say will bring together thoughts that others have had, but we hope in a distinctive way. If I start with the question of the private sector and business pull-through, we certainly think that the large centres issues is something that government should explore a bit further. We are not taking an absolutely firm decision on it, at this stage, but we think it is something that does merit further exploration, which is already taking place, to some extent, through the work that the TSB has done, for example. I think that our view on private sector investment is that perhaps we have for too long simply exhorted the private sector to invest more. Everybody knows the ten-year science framework, for example, which has been mentioned, indicated that additional private sector investment was needed in order to deliver the aspiration of that framework. Exhortation to industry is probably not enough, and we feel that the government does have a role in actually creating the long-term stability of industrial policy which enables the private sector to know that it is worthwhile investing. I will give you an illustration of this which is actually not from this CST report but from another one that we published recently on the UK’s infrastructure—the infrastructure being the physical infrastructure that moves things around the country: transport, energy, water and the ICT infrastructure. The conclusions of that report, which I am happy to say the Government has accepted and acted on quite quickly, included a real, deep concern about the lack of R&D investment in any of those infrastructure areas. We believe that there is a huge opportunity for this country to encourage private sector investment in R&D which supports the development of a modernised infrastructure for the UK but which, also, would have international resonance for business. It is that kind of thinking, Lord Broers, which we are advocating that the Government’s role should not simply be to say: “We are putting in this amount of money, now, please, industry you get on and put some more in”, but could do more to create the environment where it would be a good business decision for industry to invest.
Q461 Lord Broers: They would do that through government-organised programmes?
Professor Dame Janet Finch: No, not necessarily. Possibly some of it would be, but, no, our recommendations in the infrastructure report were not linked to large new incentives at all but simply creating the right environment which made it a good business decision for industry to invest.

Q462 Lord Broers: Can you give us an example?
Professor Dame Janet Finch: An example would be the water industry, where the regulatory system within the water industry (and this is not a criticism of the regulatory system) is focused narrowly on regulation relating to financial issues and has, therefore, positively disincentivised the water companies to invest in R&D. So we have a water distribution system and waste management system which I think everybody in the industry recognises is in need of modernisation. We do not have the R&D capacity to assist that modernisation ourselves. If the regulatory system were to be changed to incentivise companies to invest in R&D for the longer term then we would have created an environment in which the private sector needed to and wanted to invest. That is an illustration.

Q463 Chairman: Do you think, on that, that in Scotland, where the water system is in public ownership, it is any different?
Professor Dame Janet Finch: I do not know, is the answer to that.

Q464 Lord Crickhowell: Can I probe a little further about what you have been finding out about venture capital? Years ago, in the early-1980s when I was Secretary of State for Wales and taking a keen interest in the linkage between universities, industry and venture capital, I found that in the United States venture capitalists were sitting absolutely there with the university and people on the ground and those who were developing things in the obvious centres—whether in Boston or California and so on. I found there was a detachment of the British financial world, generally, including the venture capitalists, from what was going on near the hotspots in this country. Since then, I suppose, the City of London has even more seen itself as a great world centre with everyone sitting in the City of London. I wonder whether the experience I was having in the 1980s of this detachment is a factor still, and there is some way we need to get the venture capitalists in the centres and knowing what is going on on a daily basis, as I found they were doing in the United States.

Professor Sir Martin Taylor: Can I have a chance to try and roll those two together? I think some of Lord Broers’ questions were directed at me as well. As regards the venture capital and what I said, really, also about the public R&D decline, I was not in any sense trying to underplay them; I was trying to say there was some good and some bad. I gave you six lines of recommendations that we will possible be making, and one of them will be pertaining to that topic. I think, Janet, you were going to say a little bit, also, about how this might interact with the thoughts that you were saying about Hermann Hauser. The cardinal point I want to make on this matter is that it is an issue that is not going to be underplayed in our report; it actually leads to one of the six main strands of the report. As I say, there is some, as yet, unplayed-out contention as regards what we might say and that is why I am being a little bit coy on that matter. On the other hand, there was something that I also wanted to address concerning what you were saying. I do not want to, as it were, mis-state what I think you are saying but you seem to be saying: do not overly-stress on the pure science in what you are going to say. I wanted to point out that this was not at all our intention; our intention is to stress the importance of the diversity of science; it is a whole spectrum of different sorts of science—and all of them are valued. We quite like the idea of an “ecosystem of science”—with different parts affecting other parts. If you let one part perish or get ill, that will affect other parts. So we take a very holistic view of science, in which all sorts of different things are valued. When it comes to the targeted or more thematic kind of research, I think you will find that we are probably going to be advocating a different stance there, if you were listening to the recommendation about grand challenges. We much prefer the idea of identifying problems, articulating the problems that are there and trying to, as it were, attract scientists into them in a more positive way rather than pushing them by means of funding mechanisms. The notion of grand challenges has played out really rather well in some other countries—there was the Lund conference and we were quite inspired by that. I do not want you to get the idea that this is all about basic research, and if I gave that impression that was wrong. Having said that, though, the call for evidence is up on the web and what you will find there is that many of the Fellows of the Royal Society who wrote in were very concerned that in this ecosystem the oxygen for intellectual, curiosity-driven research might be cut off; that if there were more cuts around, then that would be the area that would get targeted. So this is, perhaps, addresses that part of your question. Then, my Lord, what you asked to us what we have heard in our discussions on the differences concerning venture capital between the USA and the United Kingdom. We also noted that very often the leaders in innovation in the United States are actually of British origin. I do not want to give a sense of gloom and
doo. Some of the case histories in our report illustrate how well things can go as well; so for instance Richard Friends’ Plastic Logic is a very good story about how things can be picked up and developed. On the whole, I would say that our report is good news. I would like to think, not bad news. 

**Chairman:** There are three people very keen to come in.

**Q465 Lord Krebs:** I will be very brief, my Lord Chairman. Both of you stressed in your introductory statements the importance of investing in people as opposed to trying to pick winners, and I just wondered whether you saw any contradiction or incompatibility between your emerging conclusions and what the Government Chief Scientific Adviser told us in the memorandum that he submitted saying that research council budget allocations reflect strategic government priorities more strongly than before. In other words, he is saying that the Government is pushing research councils to fund areas of strategic significance. Is that, in any sense, in contradiction to your conclusions?

**Professor Dame Janet Finch:** I cannot answer for him but I do not think so. Our recommendations are not about the immediate decisions on next year’s funding allocations but about the general direction of travel. We do feel that there is, as Sir Martin has said, a sense of danger, at the moment, about the position of the UK’s research standing because of a different sort of much bigger potential global competition coming further down the line. Even the United States is worried about this. The excellent report entitled *Rising Above the Gathering Storm*, which the Committee will probably be familiar with, produced in 2007 for the US Congress, makes it very clear that the US sees its position as the global research leader, threatened not immediately but over a decade by the emergence of India and China, in particular, as being scientific players, and for the UK the scale of this threat is quite explicitly the worry: if you are going to be thinking about where we stand in the world you do not say things like: “We are number two to the US”; you ask about where you stand in relation to the size of the UK. If you do that, we are ahead of the US and neither of us are in the top half-dozen. I find that in itself was a slightly worrying thing. The essence is how you perform, not even how much is spent. The thing we can be number one in is what we get for what we spend, and we are drifting backwards as we spend more. My question is this: I worry that, at the same time as France, Germany and Japan (who were very low in the league for performance per capita and in spend) have looked to how we used to run things and improved, we are moving backward by increasingly adopting this turgid management battle stuff and setting priorities rather than just trusting the best people to do it. We have seen the fraction of responsive-mode grants drifting down from 50 per cent to 25 per cent. My question is: why do your reports not say more about this instead of going in the wrong direction?

**Professor Sir Martin Taylor:** Could I respond to both, because they do fit together quite nicely. Starting at the end and working backwards, maybe—

**Q467 Lord May of Oxford:** More crisply, if you could, than I just was.

**Professor Sir Martin Taylor:** Oh. Okay, I shall try and speak in little sound-bites. When I took on this study I was very fearful that it might just indeed be another report and that I would expend, probably, the best part of a year, it would go on a shelf and have no effect. That is always hanging over me as a fear. There are two things that I think argue that it will not do that. The first is timing: it is a very good time to bring out a report like this; a lot of things are in the air and we think that we can influence those things that are in the air now and, also, because these are ideas that, we hope, will be good for the next 20–25 years. So that is the way that we are hoping it will go. The other thing I would say is, if you look down the membership of the panel, it was said, when we got into the Council room of the Royal Society, that there has probably never been quite such a gathering of people there since World War 2. With your experience you may wish to deny that, but that is what was said. It is a very high-powered panel and we hope that this will also help it to have impact. As regards the parameters that I cited, I hope that it was implicit—it certainly is explicit in the report—that the way we have been performing is really enhanced by the fact that we have such a small population and we are doing so well. So the factor of size, as it were, will be very much brought out. I still do not think that we are number one; we are number one in some regards—
Q468 Lord May of Oxford: We were number one in what we got for what we spent, because we were spending less. It was as much because we were spending less than that we were producing more. However, as we have spent more we have seen others improving against us fast.

Professor Sir Martin Taylor: We have. I was holding that comparison.

Q469 Lord May of Oxford: We should not be doing what we usually do and focusing on not trying to second-guess where we are going and trying, on the other hand, just to—

Professor Sir Martin Taylor: Let me come to the other part, and possibly the major part, of the question. This is about funding people and what that might come to. I will begin with the way the RS began to see this. In the first instance the aspect that worried us most about people in research was young people and their career trajectories. Clearly, many people seem to be opting out of science for bad reasons, and that is because the right pathways did not seem to be there. I have not yet seen the final data on this so I am still being a little bit coy about this, but there will certainly be recommendations in there to invest in young people. We hope that there will be, more PhD students, if possible. But also that there will be better training for the PhD students. Our PhD students are beginning to look a little lacking in extra skills compared to students on the continent, for instance. I have seen this in the international reviews for the research councils. I hope, also, that there will be some more investment for the fellowships. So if you invest more in people like this, it may mean that, at the end of the day, there will be a little less money to go in projects. That is probably how we will have to go. But we seem to be very clear in our study that we wish to invest in people, and especially young people.

Q470 Lord Cunningham of Felling: There is nothing new about the complaint that there is an apparent dislocation between venture capital in this country and the performance of our scientists, engineers and technologists; in my early days in the House of Commons 40 years ago, the then Select Committee on Science and Technology carried out an inquiry on that very issue. We are hearing the same point being made now about this dislocation, this failure, to take as much advantage as we might from the excellent work being done in this country in science and technology. What are your respective reports going to say to the Government about this? What have you to tell us about what we should be saying to Government about it?

Professor Sir Martin Taylor: You never really got your chance to respond to the recommendation. Would that be all right, my Lord Chairman?

Q471 Chairman: On the topic?

Professor Sir Martin Taylor: Yes, it is that topic.

Dr Wilsdon: We have been looking hard at this. As you say, it is not a new debate—a lot has been said. With respect to the short, sharp review that Hermann Hauser is now undertaking for Lord Mandelson, we have taken great interest in that question, and the choice there is, really, whether one feels the system as is, the measures that were put in place following the Lambert review, to support knowledge transfer, the TSB and other transfer mechanisms, are sufficient and can be tweaked around the margins to improve the flow, with other mechanisms to encourage the flow of venture capital through the markets, or whether some kind of new intermediate structures are required. This debate about the Fraunhofer model and whether it is applicable to the UK is one that I would say is live within the advisory group of this project. We have not reached a resolution on it. The Hermann Hauser report is trying to report, I believe, in the first week of March, so we will know fairly quickly what conclusions he comes to.

Professor Dame Janet Finch: The report we have been discussing this morning, my Lord Chairman, does not have any recommendations about venture capital in it.

Q472 Lord Broers: What are the strengths and weaknesses of the UK’s system for setting priorities for publicly-funded research, including the principles and criteria applied? What changes, if any, are you suggesting?

Professor Dame Janet Finch: I think the strengths of the existing system are evident in the success relative to other countries’ research systems. We have a mature system, as far as setting research priorities are concerned; the Government works with other agencies, and scientists themselves have a good input into the programme. We have a good environment in which research takes place and we have a competitive culture that enables us to identify what are the most promising areas. So I think there is a great deal that is right about the system. Obviously, the increased funding over the last decade has helped. So I think there is a, basically, sound system for setting research priorities in this country. However, I think we see three weaknesses, two of which were probably referred to in an earlier answer to the question. The weak business pull-through on the research basis is one of the weaknesses that we see, and, associated with it, the lack of clarity in setting policy for government priorities for supporting business development. Those two areas we see as weakness; I am happy to say more about those but I have referred to them in an earlier answer. The third area we have not referred to. In our report we are likely to argue that one of the weaknesses at the present time is the
lack of incentive for collaborations within our research system—collaborations between researchers. That is collaborations within the UK and international collaborations. Of course, they happen—they happen all the time on an individual project basis—but we think that in the kind of rather more dangerous, global environment that we are moving into for competition with other new countries entering the arena, in terms of the leading science and the leading scientists, the UK has, perhaps, been too successful in setting up systems which are highly competitive between different groups and in different universities and research institutes and not had sufficient incentives for collaboration at the highest level and the leading edge of research at large-scale collaborations. We believe that that is something that needs now to have some attention paid to it and that government needs to think through quite carefully how to create new incentives for large-scale collaborations at the highest level of research without, of course, blunting the competitive edge of research that has served us so well.

Q473 Chairman: Is there an RS view on this?  
Professor Sir Martin Taylor: Oh yes, yes. It would come, typically, in four parts, but I will try and develop the first part a little bit and then be very quick on the three remaining parts, because I have really touched on those already. The thing that I have not touched on so far is interdisciplinary research in the United Kingdom, and the fact that the landscape of research councils does not necessarily favour interdisciplinary research that well. To give you a little idea of what I am talking about here, take the case of synthetic biology, which was something on which I have worked for EPSRC a little. This involves, in the first instance, some engineering; actually, also, some computer science and some mathematics and, of course, quite a lot of life science as well. I was able to see that you could only ever go at the speed of the slower of the research councils. It was quite a slow, painful business to get there but there was an awful lot of goodwill, I should say. But the way things are structured at the moment does not really favour interdisciplinary research that much. For instance, the sort of area in which some of our recommendations will go will be probably to enhance the role of that umbrella “RCUK”, with perhaps a little bit more money being held back by them for interdisciplinary research, so that they can act a little bit more quickly. If I could add, also, just parenthetically, my own experience, when I have been abroad speaking with people from the Deutsche Forschungsgemeinschaft in Germany and the Russian Foundation for Basic Science, they were always a little bit perplexed by our research councils’ structure: If there was an RCUK that was a lot more visible as an overarching, unifying structure that would help them greatly. They really are a little bit dismayed by the way things look sometimes. That then leads me to the other points, on which I shall be quite brief now. International strategy—again, you can see what I have just said there—means that it is quite difficult sometimes for other countries to interact with our science. Again, we foresee an enhanced role for RCUK there, but we are going to certainly need a proper international strategy. I think I said something about this in our chapter 2, and what Janet said has really covered it. So I do not feel that I need to labour that any more. Concerning the way we fund things, though, I would like to see, as I say, a greater use of the grand challenge approach to themes of science. I think that will probably be more attractive and productive with scientists. If you make it attractive then they might well be much more happy to go that way.

Q474 Lord Broers: Can I ask the two supplementaries here? The first is the standard question: how should a balance be struck between responsive-mode and targeted research, and what criteria and principles should be involved? To add to that: to what extent is research spend across government departments and research councils co-ordinated, and to what extent should it be? I would like to add a final comment on the responsive-mode. It has always struck me that we are sort of paranoid about this, and that a tiny increase in directed research means that the end is coming for pure science, which of course is a load of rubbish. I think there should be a balanced approach, but do you think there is a balanced approach in how we set the priorities?  
Professor Sir Martin Taylor: Can I start then with government science spend outside the ring-fence? A thing I did not tell you (but I did not tell you everything about the Fruits of Curiosity), was we had a number of extra meetings outside our advisory group meetings, and one of them was with the PSREs. I was really quite impressed, on the one hand, by the breadth of different kinds of applied science that were going on there. On the other hand, I was also mindful that there did not seem to be much co-ordination, and I thought things could be done quite a lot better. The science, I thought, was often quite inspiring. So, again, a probable line of recommendation will be that we would like to see some kind of government review of the way things are done. So that would be to respond to that part of your question. Now coming to the other part, which was really about responsive-mode, there are two things I would like to say. The first is that I think the level of responsive-mode actually is important. In
some of the research councils, for one reason and another, levels of success dipped to 9 and 8 per cent. Certainly in my community (I am a mathematician) there is not that much funding from anywhere else, and when it gets to that low level people really begin to lose confidence in the system. We then had a meeting at the Royal Society with the learned societies and with, in this case, the EPSRC. It was very productive, everyone understood each other’s problems and things got quite a lot better. But the level of responsive-mode funding does matter in some sectors of the community very much indeed. I think the chemists were particularly worried about this matter, too. However, your question was also about the role of responsive-mode funding and that fits in with some of the things I have been saying about the Fruits of Curiosity study. This is a very good way to fund excellence in individuals. When you see a good proposal coming from an excellent individual, that is a great way to fund winning people. So I think we like responsive-mode but, I would agree with you, it is part of a balanced package: projects of research or themed or targeted research would be very good ways of training young people as well. So I think we like the balance, but things dipped a little on the responsive-mode, and that worried us a lot.

Professor Dame Janet Finch: The CST report does not have a view on the balance between responsive and directive-mode. In a way it is a rather similar approach to the one that Lord Broers articulated. We think the language gets in the way here: responsive-mode equals basic science and directive equals applied is, quite clearly, not true. So we do not have anything particularly to say on that. We do have something to say on one of the other questions which was implicit in what you said, Lord Broers, which is the balance between funding for different research councils or a different spectrum in the research base. We do think it is a proper role for government and the agencies that act on behalf of the government, at the highest level of generality—not at a project level—to keep an eye on the balance of funding for different disciplines. The fact is there are some disciplines that can access funding from a variety of sources much more than others. The biomedical sciences and life sciences area has multiple sources of funding, that is fine, we are all delighted at that and this country has benefited hugely from it. However, it does mean that physical sciences, for example, and social sciences, which do not have a similar range of potential and large funders, in relative terms, have less access to research. It follows logically from the fact that we believe that the breadth of the research base should be preserved and developed in this country on a strong base that the proper role for government and its agents, in making sure that all disciplines are fully supported, may mean some rebalancing over time and, at different points in time, different sorts of rebalancing in favour of disciplines which have been relatively under-funded at a given point in time.

Q475 Lord Oxburgh: Do either of your groups feel that there is any scope in the UK for a DARPA-type approach, which has actually been rather successful in permitted areas in the United States? Are you familiar with that?

Professor Dame Janet Finch: No, I am not.

Professor Sir Martin Taylor: I am not.

Q476 Lord Oxburgh: I think, in that case, we will scrub the question! But I am shocked that you have not heard of it.

Professor Sir Martin Taylor: I have heard of DARPA.

Dr Wilsdon: Yes, we are aware, obviously, of DARPA and following with interest the ARPA-E initiative, using the new US stimulus money. Again, this is the debate that we have within the advisory group about the extent to which what is required at this point is a modest rebalancing of bits of the system that could work better, or whether what is required are new institutions. I think, looking at the wider funding climate and the context within which the next spending round is going to take place, we have thus far (although our recommendations are still pending) pulled back from calling for large, new institutional innovations within the system. This is a choice that, clearly, you will confront as a Committee.

Lord Oxburgh: ARPA and DARPA were large institutions.

Lord May of Oxford: DARPA is explicitly a defence department funding, and the answer why we do not have it is because the Ministry of Defence does not see the point.

Lord Oxburgh: But the style—

Lord May of Oxford: You are talking about the style.

Lord Oxburgh: I am talking about the style; that is why I said “ARPA or DARPA”.

Chairman: If we are all very disciplined we will not run too far over time with one more question.

Q477 Lord May of Oxford: Once again, it is a pretty pertinent question. Given that impact is coming in for consideration and driving the drift away from responsive-mode, to what extent, how, and at what stage of the process do you evaluate the impact of research? How do you evaluate its impact prospectively and retrospectively?

Professor Dame Janet Finch: I am sympathetic. The CST report does not specifically address the question that Lord May poses. Some of the other work that we have done is closer to it. I think if I put those things together we would see the impact of research as being quite broad, so we are not just talking about economic impact, we are talking about impact on...
public policy, for example. We are also talking about the impact of producing highly educated people who transfer knowledge and support various aspects of our society and the economy in different ways. So we think that any assessment of impact needs to take into account that breadth. On your question of whether impact should be assessed prospectively, I have already said that the view of the CST is that there should not be any principle other than excellence in the identification of research projects to be funded on the upstream level.

Professor Sir Martin Taylor: We did not consider the assessment of impact in Fruits of Curiosity but we did sort of consider the ways in which science has impacts. So I shall take that as my platform to reply to Lord May’s question. Of course, we think that the impact of science and innovation—

Q478 Lord May of Oxford: I hope I am right that it is proposed that impact be part of the assessment.

Professor Sir Martin Taylor: I know where you are coming from, but I am just talking about the Fruits of Curiosity. I am coming on to that. We think that the impact of science and innovation should be greatly valued, and you see that from our terms of reference actually, and it should be highly cherished. I think we will cite very early on Bacon’s quote that “science should be used for the relief of man’s estate”. Science, we believe, has all sorts of benefits that are often underestimated: iPods, cash machines, people even accept too easily the benefits of medical health. The understanding of the benefits of science are not really all that fully appreciated by the public and more should be made of that, and that will be in our report. In terms of the timing it can take for things to have impact: in my own rarefied world, I might say, of pure mathematics, things can take 50 or 100 years to have impact, and in the world of the medical science, I think, the MRC and Wellcome say it can take 20/25 years to have impact. So we note that there is a caution on time there. Another caution is that often, when you fill a grant out, they might ask you what you think the likely impact is going to be of your research, and I would say that scientists are often very poor judges of the likely impact that their research is going to have. One case that leaps to my mind is the case of Rutherford who was asked about his nuclear work and he said, “Oh, anyone who talks to you about the possibility of it having a use for energy manufactures is talking absolute moonshine”, and then there was also Faraday who, when asked about the value of his work on electro-magnetism by Gladstone, said, “Oh, I don’t see any application of it at the moment, but, when we do find one, you will surely wish to tax it”. So you do not really ask scientists, I do not think, or at least the purer kinds of scientists, what the benefits are necessarily going to be. In terms of the Fruits of Curiosity and their view of impact, I would want to stress that the breadth and variability. The REF kind of impact, which I think is where Lord May is coming from, looks rather prescriptive to us, and I have tried to stress the different kinds of impact that science has on people’s lives. Another caution would be that different subjects have a different kind of half-life in both to when things bear fruit, even to when they are read in journals. So the idea that you put some magic number, 25 per cent or something like that, across the board seems very, very strange. I would also say that there are some areas, pure mathematics, for instance, where often the benefits are to the secure exchange of information, and cryptography. So, if people know about the value of the impact, then it actually has not worked very well as it was not as secure as you had hoped. So again that is another caution about measuring impact. Value impact, yes, but prescriptive measurements of it is a bad idea, we think.

Q479 Lord May of Oxford: So this thing of how should the assessment affect the prioritisation of research, you are essentially saying that it should not?

Professor Sir Martin Taylor: Yes, I have tried to be diplomatic on that.

Q480 Chairman: Well, on a note of diplomacy, thank you very much indeed for giving us your time and your written evidence. Could I ask you to submit any other written comment you think appropriate perhaps on the topics that we were not able to cover and, if there are any issues that you feel you did want to raise which have not been raised, please let us have something in writing. Thank you very much.

Professor Dame Janet Finch: We are happy to do that.

Professor Sir Martin Taylor: Thank you very much.
MEMORANDUM

TUESDAY 19 JANUARY 2010

Present

Broers, L
Colwyn, L
Crickhowell, L
Cunningham of Felling, L
Krebs, L
May of Oxford, L

Neuberger, B
O’Neill of Clackmannan, L
Oxburgh, L
Sutherland of Houndwood, L (Chairman)
Warner, L

Memorandum by Professor John Beddington, Government Chief Scientific Adviser

This memorandum covers the role of the Government Chief Scientific Adviser (GCSA) and the cross-government network of CSAs in ensuring that government decisions are underpinned by robust evidence and in relation to cross-cutting issues. This is as set out in the document “Science and Engineering in Government” (forthcoming 2009), which details the Government’s approach to the management and use of science and engineering within government.

The GCSA is supported in his functions by the Government Office for Science which is based in BIS. The GCSA works closely with Professor Adrian Smith, Director General of Science and Research, BIS, who is responsible for the Science and Research Budget. A separate memorandum has been provided by BIS on spend in science and research, covering the allocation of the Science and Research budget.

The Minister for Science and Innovation, currently Lord Drayson, champions science and engineering in and across Government. He works closely with the Government Chief Scientific Adviser to ensure that Government decisions on strategy and resources are supported with evidence and research to demonstrate how these decisions best meet Government objectives. The Minister for Science and Innovation chairs the Cabinet Sub-Committee on Science and Innovation, ED(SI). Among other things, this Committee is examining the management and use of science within departments and across government, and is providing challenge to departments on progress and outputs.

The Committee includes Ministers from HM Treasury and all departments in which science plays a key role in the formation and delivery of policy. The Government Chief Scientific Adviser also attends, providing papers and advice to the Committee on key issues.

What governs the allocation of funding for Government policy-directed research through Government departmental and agency initiatives? Are existing mechanisms appropriate? What is the role of Departmental Chief Scientific Advisers?

Plans for research investment by government departments on policy-directed research are set as part of overall planning for delivery of relevant PSAs, other cross-cutting priorities and departmental strategic objectives. Departments produce research and analysis strategies that are closely linked to Public Service Agreements and to departmental objectives. Plans for research investment in departments are based on these strategies, as are budgets.

Government agencies can include executive agencies, executive and advisory non-departmental public bodies, Government-owned companies etc. The allocation of research funding to agency initiatives will vary depending on the particular arrangement and on the detail of its relationship with the sponsoring department.

The key mechanism for setting and monitoring cross-government delivery on its top priorities are the Public Service Agreements (PSA). Each PSA has a Senior Responsible Officer (SRO) and a Delivery Board. PSA Delivery Boards should include a senior professional analyst (who may be a relevant departmental Chief Scientific Adviser (GSA) or other senior analyst) who will take responsibility for ensuring that all aspects of the PSA and its delivery are evidence-based.

A senior analyst should sit on the Board of each government department to ensure that decisions on strategy and resources are fully evidence-based, and that departmental structures and processes promote good analysis and use of evidence. This may be the CSA, for example, as is the case in Defra, MoD and the Food Standards Agency, among others, or the senior economist, statistician, social researcher or operational researcher, depending on the particular requirements of the department. The Board member should draw upon the other analytical Heads of Profession within their department. Their role is to ensure that advice to ministers is evidence based and to represent and champion input to policy making from all analytical professions at Board level, ensuring that they have input at all levels of policy making.
Departmental chief analysts and CSAs should be consulted as a matter of course by departmental strategy and finance teams on strategy and budget proposals, to ensure that they are evidence-based and that sufficient resources are dedicated to evidence and research to underpin the achievement of departmental priorities including the department’s contribution to Public Service Agreements and other cross-cutting priorities.

Departmental CSAs should in turn keep the Government Chief Scientific Adviser (GCSA) in close touch with current and planned R&D investment in their departments, and alert him to any issues.

How are science and technology research priorities co-ordinated across Government, and between Government and the relevant funding organisations? Who is responsible for ensuring that research gaps to meet policy needs are filled?

Government departments are ultimately responsible for ensuring that research required to inform their policy areas is considered and if necessary commissioned. They also consider the most effective way to obtain this research, including from departmentally sponsored (and to varying extents funded) Public Sector Research Establishments (PSREs) (such as, LGC and the National Physical Laboratory).

In making proposals for and managing research investment, departments should adopt a joined-up approach on cross-cutting issues, consulting other government departments, as appropriate. Where cross-cutting issues of benefit to more than one government department, or to government as a whole, can not be resolved at departmental level, Departments should alert the GCSA so that he can consult colleagues on the Chief Scientific Advisers Committee (CSAC) and the Heads of Analysis group.

As appropriate the GCSA will bring issues to the attention of the Cabinet Sub-Committee on Science and Innovation (ED(SI)). ED(SI) provides a forum for relevant departments to contribute their perspective on the issue. The Committee may then propose a resolution, recognising that budgets remain with departments.

Looking to the future, GO-Science and HM Treasury, in consultation with the Heads of Analysis group, are exploring options for addressing R&D spend and budgets more effectively in the next Spending Review, including the approach to funding cross-cutting research priorities.

In ensuring that the best science and engineering evidence is taken into account by government, it is vital that departments also work closely with other organisations with a role in the management and delivery of research, particularly in relation to cross-cutting issues.

Close working and strategic relationships already exist between Research Councils (RCs) and government departments. Following the 2007 Comprehensive Spending Review, RC budget allocations reflected strategic government challenges and priorities more strongly than before.1 This is reflected in the five Cross-Council research programmes (Energy, Living with Environmental Change, Global Threats to Security, the Digital Economy and Ageing and one multi-disciplinary project (Nanoscience)).

To build on this approach, the CSAC Core Issues Group (CIG) is working with the RC Chief Executives to develop a set of strategic cross-cutting research priorities, working closely with departments, in preparation for the next Spending Review.

September 2009

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Examination of Witness

Witness: Professor John Beddington, Government Chief Scientific Adviser, examined.

Q481 Chairman: A very warm welcome indeed, and we thank you for the points you have already submitted in writing and clearly for the help that you have given to the Committee in a variety of ways. Perhaps we might simply move straight to the discussion and questions. I would like to talk a little bit, not necessarily in descriptive detail, about your role, as you see it, and clearly the role can be created anew each time there is a new Chief Scientific Adviser up to a point, but particularly your role in relation to setting priorities for publicly funding research and also perhaps the money that must follow such a set of priorities. Do you have a particular role in that or not?

Professor Beddington: Thank you, Chairman, and thank you for your kind remarks. I would probably divide this answer into two or three sectors. I think the first thing in terms of taking the research budget overall, and I know you are talking to Adrian Smith on a subsequent occasion and he will expand, but basically Adrian has decided that, in deciding on the allocation of the research budget in terms of broad, general areas, he will consult rather widely, and I sort of enter that consultation with two hats. One is that he is going to be consulting with the CSAC, the Chief Scientific Advisers Committee, and he will also be consulting with the Council for Science and Technology, and I know you have just seen Janet Finch, my co-Chair of that, so I probably will be wearing two hats in that consultation, as Chairman of CSAC and also as co-Chairman of CST, so, in terms of the way that those discussions will develop, I very much value that there is going to be very significant consultation. Obviously, Adrian will talk to you in more detail about this, but I understand he will be talking to the Royal Society, the Royal Academy of Engineering, the Academy of Medical Science, the British Academy and so on, so I think in that role I am fairly content. Also, at the informal level Adrian and I now have offices that are about 50 metres apart and that means that we actually do meet. We were friends when we were both at Imperial College together, so we do talk informally about a number of these matters as well as the formal position, so that is in terms of, I suppose, the research council budgets. In terms of departmental spend, there are sort of two issues there. One is that I have this science and assurance exercise in which we go into departments, and we are mandated to do so now, to actually do an assessment and a review of the quality of science they are doing, and part of that is obviously looking at the way they deal with research priorities. That programme has really just started. David King had a similar programme which was rather more extensive, and I will not go into the details of that, but we now have one and we are starting and we have almost finished the review of the Department for Transport. Now, part of that is actually “raising questions about research priorities”. The other thing is that obviously within departments the priorities will change and, to some extent, for some of the key departments I am involved. For example, within the Ministry of Defence, I sit on their R&D Board and attended a meeting with them last week when they were actually looking at changes in priorities. In terms of total changes in budget, I think you are aware, I think we put it in our submission, the Government has indicated that, in the event of a significant cutback in department R&D, I and the Treasury would be consulted well before that actually happened, so we could take that forward, so those are the first two areas I would comment on. I think the third area, which I think is really important, is, as you perhaps know, when I gave evidence to this
Committee the last time, I talked about the way in which I had got a community of the Chief Scientific Advisers meeting regularly with all the Chief Executives of the research councils and also the head of the TSB. We have been developing research priorities for co-operative programmes with the research councils and departments, the idea being to put those proposals into the new Spending Review. Just for completeness for the record, there is one, which was rather similar to the current programme, which is on living with environmental change; a second is on global security; a third is on a more resilient economy; the fourth is on health and wellbeing; and the fifth is on food security. The patterns of buy-ins from different government departments and different research councils obviously varies through those, so we are developing that, and indeed we have a meeting next week in which we are going to be discussing those further. Sorry, it is rather a long answer, Chairman, but it is quite a complicated question.

Q482 Chairman: I wondered the extent to which, for example, the Treasury would ask for your opinion or for the opinion of some scientifically-based group on what the total size of the package should be.
Professor Beddington: Yes, I have taken that up and wrote to the Treasury, pointing out to the Treasury, and I indeed wrote to the Prime Minister in a similar vein, pointing out in terms of the total science budget what our competitor economies were doing with very substantially increased budgets—and I do not have the figures at my fingertips—but very substantially increased budgets—and I do not have what the total size of the package should be.

Q483 Chairman: There are clearly a number of issues here. One is: what is the total size of the spend? You are suggesting that one of the criteria should be: what are other governments doing?
Professor Beddington: Yes.

Q484 Chairman: Is there a scientific question there as well about what our scientific needs are as a nation, and how does that kind of advice go in?
Professor Beddington: I think that the scientific needs of the nation are clearly there and they are essentially some of these grand challenges and programmes that we were setting out. Of course there are many others. I think I see that that as very much part of the consultation process that Adrian is putting in place in terms of the research budget. Within departments, departments will have particular research priorities which I would seek to discuss with their individual Chief Scientific Advisers in setting those priorities. In terms of saying how those priorities will be reflected in an overall budget: I think that is quite hard to do. In a sense, the more the better would be the position I was taking and, in a situation of financial constraint, then one is going to have problems of prioritisation, but I feel occasionally slightly wistful about my predecessors, Lord May and Sir David King, sitting there in a situation of very substantially expanding science budgets. I am not in that position at the moment.

Chairman: I think he would challenge that, but I would ask that he holds that challenge for a second!

Q485 Lord May of Oxford: As part of the question, do you still meet with the Budget Committee along with the Secretaries of State where the Secretaries of State meet with the Budget Sub-Committee of the Cabinet? Do you still do that?
Professor Beddington: I do not go to that.

Q486 Lord May of Oxford: Well, that is an important privilege lost because I always found it slightly anomalous. It was Secretaries of State and one or two other people, including the Chief Scientist, and I do not know at what stage that was lost, but that was an important loss. I think it happened in Dave King’s time.
Professor Beddington: It certainly was not a committee where it was even raised, the possibility of my attending when I took the job. It has not been discussed.

Q487 Lord May of Oxford: So it must have been lost in Dave King’s time.
Professor Beddington: I assume so, Lord May.
Lord May of Oxford: That is an important loss. I think we should note it in the Report.

Q488 Lord O'Neill of Clackmannan: One gets the impression that in the Treasury there is not really anybody who has any responsibility for science. Whether there would then become a struggle with yourself if there were a Chief Scientific Adviser to the Treasury appointed, but do you not find it a wee bit difficult that, amongst all the brilliant mandarins there, there may not be very many people who have more than GCSE science?
Professor Beddington: There are three parts to that question and I will answer them in order. I think the first part is that I do have senior-level contact in the Treasury. I obviously meet with Nick Macpherson,
who is the Permanent Secretary who chairs the Heads of Analysis Group, and we meet regularly in that and we meet obviously informally. Mr Schofield is the person within the Treasury who is formally charged with dealing with the science issues and I meet fairly regularly with him; in fact, we have a meeting planned some time in the next couple of weeks. The third question is slightly more difficult to answer in the sense that, when we deal at the Permanent Secretary level, as to which of those actually have scientific qualifications, I think the only Permanent Secretary rank who do are Mark Welland in the Ministry of Defence, myself and the Chief Medical Officer. I think that was not the case and I think Brian Bender was the last person who actually, so far as I am aware, had a PhD-level scientific qualification. I am not in a position to comment on quite how far the qualifications of the rest of the cadre of permanent secretaries reflects their O and A Levels though, I am afraid.

Chairman: I have to say, I did ask that question in the House of Lords’ Question Time one day and there was an interesting shuffling of feet and eventually a written answer.

Q489 Lord Krebs: Just briefly following up on a couple of the comments you made, you referred to these departmental science reviews that are carried out on a rolling basis, I guess, and I wanted to ask a specific question: have any of those reviews ever been critical of the Department that is being reviewed and, if so, what happened as a result of the criticism? That is question A. Question B is that you referred to the fact that we will see Adrian Smith who will tell us about question A, that, I think, is the answer. Would you mind repeating, Lord Krebs, question B as that was a long response to A. I want to make certain I answer it exactly.

Professor Beddington: Question A I could answer at great length, and perhaps one of the things that we could do is provide you with a written answer in terms of the reviews because they are reviews which were taken under Sir David King. I inherited, for example, a review of the Department of Health and the recommendations that were made there. In terms of calling them formal criticisms, I think that in some areas the reviews have been critical, but have made recommendation for improvement. In other areas, the reviews have actually indicated, in a sense, good practice and the reviews are then structured in the form of both their recommendations, which, arguably, are those that deal with room for improvement, and good practice. In terms of where we are, since my tenure of the job, I have inherited some reviews and we changed the pattern of the reviews, which I have spoken to this Committee about before. Transport is very soon to be finalised, and we did conduct a number of reviews under my tenure, one of which was of the Security Services, about which I think you are aware, and we made recommendations on that. In particular, one of the recommendations was that the Security Services needed to appoint a Chief Scientific Adviser and in fact that has happened, an appointment has been made, but, for obvious reasons, the individual has not been named. In terms of comments on reviews that I have, in part, inherited, we have a process following up to see whether departments have addressed issues and recommendations, and they vary a fair bit. I sat as a member of the review of Defra and the responses of the Department were then provided immediately, and I did a review subsequently about four or five months ago of how far they had actually taken up those recommendations. It is a long and slightly complicated answer, Lord Krebs. I can give you some examples and, if the Committee would like, we can give you some more detail on some of the reviews that essentially I have taken part in since I took over and also some that I inherited.

Q490 Chairman: That would be very useful, if you would, please.

Professor Beddington: Fine, we will do that. In terms of question A, that, I think, is the answer. Would you mind repeating, Lord Krebs, question B as that was a long response to A. I want to make certain I answer it exactly.

Q491 Lord Krebs: I just wondered what kinds of factors should be taken into account in the setting of priorities for research councils or public sector funding more generally? You mentioned the grand challenges, and we know that is the primary basis for prioritisation. What are perceived to be the needs of the nation at this particular moment in time?

Professor Beddington: I think there are some complex issues which is why I am pleased to see that there is going to be a substantial consultation. I think this is a thing where you can be glib about it, but I think I would prefer not to be; I think it needs some care. I think the first thing is that one has got to think quite hard about what challenges are going to be there for what length of time, and I think it would be extremely unwise to be focusing on challenges that are of relatively limited duration; but, by contrast, I think it is terrifically legitimate to be thinking about allocating some research budgets. For example, there are particular problems that the Ministry of Defence is facing in the current war in Afghanistan and which require some significant, immediate funding on a timescale of maybe something that is rather short, of the order of a year, so I think there is a mix and it will depend on those issues. I think the thing that I am really quite concerned about is that we preserve capacity. I think that we have got to recognise that
you cannot turn on and off science funding because individuals will either vote with their feet or indeed will take up different jobs and will take early retirement and so on, so I think that is one of the criteria that I would put fairly highly into the prioritisation. And there are some challenges which, I think we can recognise, are going to be with us for a while. Climate change, I believe, is quite clearly one and the ability to both model and think about mechanisms of adaptation to climate change have got to be recognised. I think the second issue, which I have talked about on various occasions, is that I do not think that the issues of food and water security are going to go away and I think that those are things that were there. There will be general issues, which I think we were pointed out in Lord Sainsbury’s report which I think the Government have accepted, in terms of increasing the knowledge base of the economy and increasing the focus of the knowledge base. These are the sorts of criteria, but, as I say, I hesitate to try and give you a definitive list because I think it would be slightly glib. The key is actually having a substantial consultation process and getting the views. For example, whether you spend more on medicine and less on climate change is an extraordinarily difficult question to answer in anything other than a rather complicated way, but I think that having this wider consultation is the only way that you can preserve a sensible answer to that.

Q492 Lord Warner: Really following on from that, we have seen in recent years politicians quite interested in the idea of nailing a commitment to a certain percentage of GDP going on overseas aid, and Tony Blair committed the Government to a percentage of GDP being increased to the European average for the NHS, so particular areas of government activity have been protected by these kinds of percentages of GDP. Do you think there is any case, given your concerns about continuity of people being committed to science and research in this country and given the long-term effects of science, for there being some kind of commitment to a percentage of GDP, for example, for science and research, and are there benchmarks in other countries that would actually help in that regard?

Professor Beddington: Yes, in terms of linking directly to GDP, I think that there are some inherent dangers in that, particularly if GDP falls, in the sense that phrasing it so that you follow a GDP path as a percentage if, and only if, GDP is rising is a slightly difficult case to make to, shall we say, my colleagues in the Treasury. I think there are some inherent dangers in actually linking it to GDP, but in terms of the general issue and the benchmarks from other countries, I think it an excellent guidance, but the situations will change. I think the thing that I find really important is that, once decisions on funding are made, there is some defence of that funding. The ring-fencing of the science budget has been really important, I believe, and the Prime Minister and Lord Mandelson have reiterated their commitment to that in this, and I hope that that ring-fence for the basic science budget will remain after the allocation is made. In a similar way, I think it is useful to have this agreement by Government that, in the event there is some erosion of the R&D budget in individual departments, that consultation occurs with myself and the Treasury. Those are the sorts of criteria that I would seek to have. In terms of saying, “Should it be one or two per cent of GDP and should we aim to be cashing up the norm?”, it is complicated because many of these figures are quoted in the context of both government spend, but also the overall R&D spending of the economy, and I think our economy is rather different from some of our competitors’ in the sense that we have a number of large industries which are very research-intensive, but, for example, even now, the financial services aspect, which is not particularly research-intensive, is a very substantial portion of our economy. It is therefore, not an easy question. In terms of my general views, yes, we should be looking at having some form of targeting of the research budget to meet both the economic circumstances and the challenges the country is facing and, second, that, once arrived at, we have some degree of confidence and continuity so that they are protected.

Q493 Lord Warner: It did look as though the Department of Health R&D budget did have its pocket pinched over the Free Personal Care at Home Bill. Were you involved in, or consulted about, that?

Professor Beddington: Yes, I raised it with the Department of Health and was essentially given an assurance that the reporting in The Times was incorrect. I have looked at it and I have talked to the Chief Scientific Adviser in the Department of Health about this and we have discussed it. As characterised, essentially what has happened is that the ring-fence has not been breached, but additional priorities have been put into that ring-fenced budget. Now, that is a thing that possibly needs a little bit of further exploration. The first thing I would say about it is that that is exactly what is happening with the Ministry of Defence and the change in the research prioritisation needs to be looked at, so I think that this is a thing which possibly needs further exploration. I think it would be very hard to imagine a situation in which we said that government departments had to consult with the Chief Scientific Adviser in all events when they reprioritise their science priorities. That seems to me to be not a sustainable position to take. On the other hand, what
one should be careful of is seeing whether in fact there is any sort of sleight of hand. For example, just being silly, buying wheelchairs as part of the research budget would be completely unacceptable, but actually changing priorities within the research base would not be.

Q494 Lord Oxburgh: Just for the record, insofar as it underlies the whole of our conversations that we have been having, what do you think the justification is for any government department doing scientific research as distinct from taking good science advice?
Professor Beddington: An interesting question, Lord Oxburgh. I think, first of all, we have an issue in terms of government departments and the role of people who have scientific and engineering qualifications in those departments, that we do need to be thinking about, as it were, an intelligent customer basis.

Q495 Lord Oxburgh: Absolutely.
Professor Beddington: I think it would be very hard to imagine, and I think I would be very against it, a situation in which all research was somehow contracted out from government departments. Now, the situation we see ourselves in at the moment is that there is a slightly complicated ecosystem of who does research to help the Government and government departments deal with key issues. Some of them are sort of PSREs, others have Gov-Cos or whatever and other research is actually done within departments, and I think that that mix is always challengeable in terms of detail. One of the key questions, and it is not directly relevant to your question, Lord Oxburgh, but I think it is important, which I would flag is that quite a lot of, as it were, within-government research actually goes beyond the government departments, particularly in the security area. For example, DSTL has enormous importance in terms of servicing not just the requirements of the Ministry of Defence, but actually dealing with the issues of security much more widely in government and particularly in the CONTEST arena, so there are reasons for having these research establishments. There are always going to be questions about individual entities, whether agencies could be better operated in the private sector or be better operated under different models, but the current, rather complicated ecosystem of those really needs thinking about because I do not think the co-ordination is as good as it should be.

Q496 Lord Oxburgh: In its submission to us, RCUK stated that, “there is still a lack of joined-up governance for public sector R&D funding in the UK”, and I am not entirely sure what that means.
Professor Beddington: I was going to ask you about that, Lord Oxburgh!

Q497 Lord Oxburgh: But publicly-funded expenditure does include that on research councils, government departments, HEFCE, TSB, the public sector research establishments, but who has oversight of the entire expenditure, and indeed should there be oversight and should there be a greater degree of co-ordination?
Professor Beddington: In terms of a greater degree of co-ordination, that is exactly what I sought to do when I pulled together the Committee of Chief Scientific Advisers, and we meet regularly with the chief executives of the research councils, so that body is the one body, I would argue, that actually does have that oversight, but it does not include the PSREs. One of the things that I have started recently is I have written to all the Chief Scientific Advisers to say, “Which of the entities”, not just defining PSREs, “which are outside government and perform activities which are really critically relevant to the delivery of your departmental issues?” So we are in that space at the moment, collecting that evidence, because it seems to me to be enormously important to pull together some degree of coherence. For example, thinking about something like the National Physical Laboratory, they provide information at lots and lots of different levels in lots and lots of different government departments, but are they overlapping with research that is being done elsewhere? Or are there gaps which, arguably, need filling and are not being filled by those? That is work in progress and I am happy to come back, once that work is finished, to talk to the Committee about the results which came in.

Q498 Lord Broers: Just as a supplementary on that, what you are doing, I think, is admirable and you have a chance of having an overview, but will you have any decision-making powers?
Professor Beddington: Well, I am a Chief Scientific Adviser, so I do not in the sense that I advise and it is ministers who decide, so I think that would continue, and that is the case for of course everyone in the group of Chief Scientific Advisers, including Adrian Smith who is the Director General of the Science and Research and sits on that group. In terms of executive powers, I suppose the Chief Scientific Advisers advise their ministers and they also advise permanent secretaries, and the penetration of those to departmental boards for decision-making and taking is mixed in that in some it is there and in some it is not. I think that actually having a community of all the Chief Scientific Advisers and the chief execs of research councils, if they are all advising in one direction, it is a powerful level of advice and I think that is really quite important and one of the reasons I try to pull together that community. I would not say that ministers have to take that advice, and
manifestly they do not, but I think that, if you get a continuity of voice in providing advice on these things, then it does not have executive power, but it has a significant force. That is all we have: we are advisers.

**Q499 Lord Browes:** This might be another line, and you perhaps will not have seen our little blue organisation chart, but it has you just reporting to the Prime Minister and Adrian Smith reporting to the Permanent Sec of DBIS, but you think there is enough of a lateral networking nature to all of this that, when you gather that committee together, if you really have something strong to say, it will be heard?

**Professor Beddington:** I think so, and I have got the organogram, although mine is not in the pleasant shade of blue that yours is! My reporting line is to the Prime Minister and Cabinet and I think that that reporting line is the thing to be used sparingly, but I think that, if we had a real issue coming from that community, I would have no hesitation whatsoever in raising that at the level of the Prime Minister and the Cabinet. Similarly, in terms of perhaps one level down from that, where there are issues that are arising, I have absolutely no hesitation in raising those issues with Gus O’Donnell or indeed with somebody like Jeremy Heywood, who is the Permanent Sec in Number Ten, so I am fairly confident that it does. In terms of the organogram, Adrian does sit on the departmental board of BIS, so he is there when decisions are actually taken and he also has this sort of lateral link into the rest of us and it is very important. While talking on that issue, I think it has been enormously helpful to be co-located with Adrian; it means we can talk daily if we need to, and certainly having our offices co-located on the same floor means that officials can also speak all the time. That, I think, is a big advantage.

**Q500 Lord Crickhowell:** Following on from these earlier questions, Professor Beddington, you have talked about mechanisms, you have talked about getting together the meeting of Chief Scientific Advisers, you have talked about conversations, exchange of letters and giving advice, but, if there has been one consistent theme that has run through much of the evidence that we have received, it is that there is a lack of co-ordination. What are you going to do about it?

**Professor Beddington:** I think I have described the process that is happening at the moment. Let me focus on one concern that is actively under discussion and that is the thing I think I gave evidence to this Committee about last time, which is serious cross-cutting issues where funding is, essentially, in silos. I think that has been raised, it has been raised by Gus O’Donnell as an issue and I think that is actively under consideration for the next Spending Review. For example, if there are a number of departments that are funding research into climate change, we need to be thinking about an overall way in which that is actually done rather than having problems that you can occasionally get where, for a particular element of research, we find it difficult to find money because the money has been already allocated in silos, and I think that needs eroding. Of course, it is a political decision, but I think it has got support at the highest level in the civil service from O’Donnell himself and I think that that is work that is going to be in progress. In terms of co-ordination, I do have sympathy that the research council structure is problematic for multidisciplinary research, but I would take issue with Martin Taylor that there is a fundamental problem. I would cite as an example the Living With Environmental Change Programme which actually has buy-in from all the individual research councils at a multidisciplinary level plus a number of key government departments, so I think there are counter examples to that being a ubiquitous problem. But I would not disagree that we could do this thing better, and part of these conversations, I hope, will lead to action and recommendations that will ultimately improve things still further. I would not take the position that we do not need these conversations to happen; I think that they are absolutely critical so that we understand each other’s positions. For example, if you take the research councils, they are, by statute, independent. The Haldane principle defends their activities and I think there is no potential to erode it. On the other hand, if we can actually think about ways in which government and research councils can develop programmes jointly together which enhances both and does not erode, I suppose, the sovereignty of the research councils, that seems to me wholly good. You are not going to do that unless you have these detailed conversations and regular conversations of the network of chief execs of the research councils and the chief scientists.
Lord Crickhowell: I thought that Martin Taylor’s evidence was pretty compelling on this particular point and he gave a good example. Clearly, the Committee he is presiding over in the Royal Society is going to provide quite strong evidence, as I think we have heard from a number of others, that, however good the research councils are individually, they do not always get down to this task of actually seeing how the work of other research councils can be got together effectively to get this interdisciplinary research. We did hear some fairly compelling evidence. I thought, that in the sort of complex world in which we live, interdisciplinary research is going to be pretty essential.

Professor Beddington: Let me answer, first of all, that I do not disagree whatever that interdisciplinary research is appropriate. All the major issues we face are likely to be interdisciplinary, including the social sciences as well as the natural sciences and economics. So I do not disagree with the premise that these are important. I think that that has been addressed, in part, in some of the programmes, but by no means in all. I have not heard or seen Martin’s evidence to this Committee, so I will look at it and see whether I would comment further, but I certainly think that the agenda of recognising that you need interdisciplinary research is absolutely accepted widely within the community that I lead, which is the chief scientific advisers, and in the community that Adrian Smith leads via the research council chief execs, I think, that is also accepted widely. We may not have gone far enough fast enough to satisfy some concerns, but the concerns are right on the table in terms of the discussions that we are having.

Lord Crickhowell: I think at this point, as a non-scientist, I will leave it with the scientists with the expertise in this field to follow up. As a Minister, I think, confronted by the evidence that I have heard this morning, I would be being pretty firm about wanting some fairly specific advice—with these many bits of evidence we have got from a whole string of people, and I will not waste time by quoting them all, that there is a lack of co-ordination—about what we are going to actually do about it in practice because I think it is going to emerge as a pretty central theme in our report.

Professor Beddington: Can I answer that by example. I gave you a list of the things that we are looking at and all of them are interdisciplinary. Living With Environmental Change, I have already quoted because it is actually extant and operating. We plan one on global security, which is clearly going to involve a whole range of interdisciplinary issues, a more resilient economy similarly, the health and wellbeing of the nation, a similar one, and food security; all of these are interdisciplinary and they will all involve funding from government departments and a mix of research councils, so this is work in progress. I do not disagree with the premise that we need more interdisciplinary work, but we are working on it, we have proposals and this is being taken forward.

Chairman: You will see in the transcript the specific cases that Martin Taylor raised with us.

Lord May of Oxford: Related to, but different from, the discussion we have just been having is an issue raised by the British Academy where they said that they worried about the way departments increasingly commission external consultants, who are paid very generously to produce stuff which not uncommonly is rubbish. I could give you chapter and verse that go back to my days when I was Chief Scientist through to last week where well-intentioned civil servants have sent out a tender, some bunch of operators have seemed to fulfil the terms of the tender and then we get something that really is not good. Does that worry you, and what, do you see, could be done better in ways of beaming up the capacity of people, not so much to be scientists, but to know who to ask who to ask?

Professor Beddington: You maybe raise an important point. Prior to taking up the position of Chief Scientist, I chaired the Science Advisory Council in Defra where this came up as very much an issue. First of all, we raised the question there, and I would reiterate and confirm that I would support that. We need to have in the policy-making process, the appropriate virtuous circle of posing questions that are researchable and that, when those questions are posed, there is some critique that, when tenders come in, there is an appropriate peer review of the tendering procedure with that expert peer review coming from outside, not simply within government, and that, when reports are received, they are similarly peer-reviewed for excellence. Now, that is, as it were, the standard that I think we should attempt. I am absolutely sure that this does not occur in all cases, and indeed, when I first went to the Defra Science Advisory Council, in some of the areas there was no peer review, and that has changed. They are following the science review and the advice of the Science Advisory Council that all projects now have these peer review processes. I think that we have an issue, and you have made the point very well, that we need the expertise to know who to ask and who to ask what to ask. I think that part of the area that I see that operating in is to do with the actual skills and the activities of scientists and engineers in government. I have developed from scratch a community by asking people to admit to being scientists or engineers, not just people working in labs, but scientists and engineers who work in the policy domain, and I think we are seeking to up that in a significant way. I am nervous that, for example, some sorts of research are called “research”, but they are sort of desk-based and
in fact the problems could, arguably, have been done rather better by, for example, civil servants who are reasonably briefed to do it. But the argument will be that somehow and in some sense, by using consultancies, they get a better response. Perhaps Janet Finch mentioned this, but the Council for Science and Technology raised the issue of a better liaison between the academic community providing advice on policy to government and how that could be improved. One of the things that was suggested in that Council for Science and Technology Report was actually, oddly enough, that academics and universities should act a little bit more like consultants in the sense that, if they failed to deliver, they did not get paid. I think this is the sort of thing that could always be improved and I am sure you can always find examples of idiocies, but I think that the review process that we have with each government department most certainly looks at the issues in the way in which research is commissioned and whether in fact that research, when commissioned, is properly assessed and solves the problem because quite often, if the problem is ill-posed, you get research that is not actually solving a problem that you want solved.

Q504 Lord Cunningham of Felling: Looking forward to a period of what is going to be pretty severe public expenditure restraint, have you given any thought to what areas of our science effort will be most at risk?

Professor Beddington: I think my answer to Lord Krebs is probably there, that some areas seem to be jumping out. The areas of security, the areas of defence, the areas of health and wellbeing of the nation, I think that these are the areas that I would see as being high priorities. With regard to the consultation process that we are talking about, there are difficult and quite complicated issues to deal with. The criteria of, for example, preserving the ability to solve questions in the scientific community, both in and outside government, are going to be important; but in terms of the key priorities, I would say there are some priorities that are over the relatively short-term—short-term in the world of science and technologies of the order of five years or so—and there are medium and there are long-term priorities. We need to make certain that we do not jump in and say that we are only funding research that is actually solving problems in the short-term. In terms of highlighting them, I can highlight some, but I would be missing others by doing so.

Q505 Lord Cunningham of Felling: So do you not want to say then?

Professor Beddington: Well, I have said some, but I would not say that was a complete list, Lord Cunningham, and I do not think it is really appropriate for me to single out and say, “The Chief Scientific Adviser thinks the following 19 areas of research are things that absolutely must be preserved”.

Q506 Lord Cunningham of Felling: Why not?

Professor Beddington: Because I do not think I have had a chance to think about it in sufficient detail and I want to be involved in the consultation process we have described and think of other people’s views rather than giving you my a priori views.

Q507 Lord Cunningham of Felling: Well, just as one little supplementary to that, who is going to flag up to ministers and Government that, if they are not careful, perhaps whole swathes of what is very important work in the national interest are going to be put at risk? Who is going to do that?

Professor Beddington: I think I will, I think Adrian Smith will and I think the community of chief scientific advisers and chief execs and chairmen of research councils will. I think we all have that responsibility. I am not trying to duck giving you where I believe that advice should be going, but I do think it is important that, as we are looking forward, we have a deliberative process in which we get views from all aspects of the community and that ultimately, when you make recommendations, it is on the basis of that careful deliberation rather than what might be first thoughts from myself. That is why I was uncomfy about answering in detail, Lord Cunningham.

Q508 Lord Krebs: Professor Beddington, we have heard various numbers about the cuts to the HEFCE budget, and I have in front of me an article from the THE on 15 January suggesting a number of £915 million over three years. I wondered to what extent you are able to look at the implications of that cut for the research base because it is not clear yet what the implications will be, but will you be consulted on that or will you be offering a view?

Professor Beddington: I think, as you say, it is work in progress. I think that figure is basically split between the science elements, and Government has not made a decision on how that is actually going to be ultimately allocated, but it is very much part of the discussions we are having. I will be talking to Adrian Smith and his team, we will be talking to other chief scientists and we will be talking to the research councils about it and also, clearly, to HEFCE itself. We have had some preliminary discussions and dinners, but at the moment that is not being taken forward in any detail yet, Lord Krebs.

Q509 Baroness Neuberger: Changing tack somewhat and to an area which we really have not looked at yet, to what extent, and at what stage in the process, should the impact of research be assessed, and how should that assessment affect the prioritisation of research in all that you have discussed so far?
Baroness Neuberger: a bad idea.

In the sense that, in the USA, the fiscal stimulus that might be a natural human characteristic, but also the degree of foresight to say that some particular development would actually prove to be enormously important some decades later. So it is difficult. I think I would recommend that you perhaps talk to Adrian Smith and raise that issue with him because I know his group has been looking at a historical study of the way in which particular research has had impact of an economic and social sort. I think it is, almost by definition, almost impossible to have a criterion on the basis of impact other than the fact that a particular piece of research is solving a problem that we can well identify. For example, in the military sphere, I think I feel very confident that some of the immediate questions posed in terms of the research that is prioritised to dealing with the problems we face in Afghanistan, I would very clearly say that would have immediate impact, but the medium and longer-term impacts are vastly more different. In terms of discriminating between different areas of research, that is difficult; but I think the historical study that Adrian and his team have been putting together is really important. Some work that I have seen is really interesting in the agricultural field, for example, where that historical work has been done and they have looked at the rates of return in economic terms. In agricultural research, the rates of return per annum are something of the order of 40 per cent once you actually follow through the full downtime part of that work. I have no reason to believe it would be similar in any other field, but that is the one area that I do know about.

Q510 Baroness Neuberger: But one of the things that scientists are increasingly being asked is to assess what the impact of their research might be. Are you worried about that? Martin Taylor suggested to us that scientists were not terribly good judges of that anyway and that the time-lag is too long.

Lord May of Oxford: I think he said he thought it was a bad idea.

Baroness Neuberger: Yes, he did. He was pretty clear, was he not?

Q511 Lord May of Oxford: He was prompted!

Professor Beddington: I think it is a reasonable question to pose to scientists if they are doing something and they wish to work on it—to actually have that question posed to them. I do not see any problem in posing the question. I think, as long as one recognises that their answers may, shall we say, be determined in part by their hope for research funding, which would be a natural human characteristic, but also the degree of uncertainty that is associated with it. It is interesting in the sense that, in the USA, the fiscal stimulus that went into R&D was accompanied by a very substantial quizzing of those who were the recipients of those additional funds—quizzing to do with the creation of jobs, and the NSF are dealing with it. Whether that exercise, which is very comprehensive, dealing with very large sums of money, comes up with anything that proves to be worthwhile, I would not judge at the moment. But I think it is so silly to think of somebody having, I do not know, a piece of research which they see solves a particular and interesting problem that they are excited by and saying, “Is this going to bring significant jobs to the economy in the next ten years?” The answer may be, “Don’t know”, but, on the other hand, if in fact certain pieces of research are actually fundamentally addressed at solving a particular problem and, if they do, that would clearly generate it, I think we need to explore it and get that out, but I think it is not going to be the case. I certainly would not agree with Martin Taylor that you should not ask the question.

Chairman: It would be interesting to have asked Karl Marx if he had applied for a grant, sitting in the British Library, reading his book, “Mr Marx, what is the impact likely to be?”

Baroness Neuberger: Economic or social?

Q512 Lord Broers: If one is going to look at impact, and of course a lot of the community likes to make jokes about the word “impact”, should “impact” be qualified by “impact to the UK” or would that be a stupid requirement?

Professor Beddington: No. First of all, I would not myself downgrade the idea of impact; it is absolutely critically important to assess it historically. I think it is difficult to assess, but it does not mean that one should not try to do so. In terms of impact, the much wider impact, I think yes, clearly it has to go further than the UK. The area that I would single out, which is one I know reasonably well, is research that is going to solve problems for international development where, quite clearly, the work could have significant impacts. The idea that someone, some applied genomics individual, is looking at saline conditions of plants that are resistant to those saline conditions, that is probably not going to be of direct benefit to the UK in any significant way, but it has enormous potential benefit in the developing world. I suppose the other aspect of it too is that, if a particular problem is being solved and leads to an industrial process, then the impact of that industrial process is in terms of exports and in the wider world. Thinking in terms of a global good, I think the sort of research that is being done at, say, the Hadley Centre, where you are looking at global climate modelling, has impact for the whole world community, and again I think these are all appropriate, so I certainly would not stop at the borders of the UK.
Q513 Lord Broers: I would certainly agree with that, but there is the sort of parochial issue if you look at what Sir Martin Taylor said. He quoted two long-term outcomes of science, the iPod and then Richard Friend’s Plastic Logic. Both of those technologies are in fact going to cost the UK money because our people want to buy these things and we do not make any of them ourselves, so it is going to cost, rather than contribute to, the UK economy. Now, perhaps that is a very narrow-minded view that, if expanded, would be detrimental, but it is an issue we have to face one way or the other, I think.

Professor Beddington: Well, I think that there is consumer element to the economy, and the issue of how much we import and how much we export are more complicated areas that I would be reticent to get into them. I am more than happy to comment on what Martin has said subsequently, but, not having had a chance to see it, I cannot.

Lord May of Oxford: He did not say it was a bad idea to ask about impact, but he said, in effect, that he agreed with the statement that it is a difficult criterion to implement.

Q514 Lord Oxburgh: Do you see the responses of government departments to reports from committees such as this on a regular basis, and is it something which you follow-up?

Professor Beddington: I certainly see them. I do not follow-up in every instance, but I certainly look at them. I think that one of the issues which has been addressed well now within the CSA community is that we raise particular issues that are raised either by this Committee or in the other place, and certainly I see that and have discussions about it. There was a particularly interesting discussion on the use of homeopathy in the National Health Service that I have commented to colleagues in the Department of Health about, following the discussions that were held in the other place.

Q515 Lord Warner: The failure to have impact from R&D may not be anything to do with the scientists at all. Do you think that the chief scientists and the CSAs in other departments should have more of a role in understanding why R&D has not been applied when it has been well-funded and well-done? Health is full of the failure to take up things and it is as good an example as anything where it is not the fault of the scientists, it is not the fault of the researchers, but it is the fault of the way organisations fail to take up discoveries.

Professor Beddington: Yes, I think that these are really important issues. For example, there has been a lot of discussion over the last four or five years about the different elements of the innovation chain that are required. The area that I know best, and really by accident, is that in the low-carbon energy area there is a set of institutions which are charged with moving the basic research forward. You have the Carbon Trust, which is really delivering right at the level of providing working solutions, and you have the intermediate between that, the Technology Strategy Board, and the Energy Technologies Institute and I think they operate in there. I think there is an interesting question which I posed to the Climate Change Committee, saying, “Is this ecosystem of the innovation chain in energy appropriate, or do we need to be thinking about other ways of dealing with that?” and I think that is activity which the Climate Change Committee will be coming back to us on. On the question about whether Chief Scientific Advisers should be concerning themselves with why particular pieces of research have not been funded, I think they probably should, but I think that it is organisations which are slightly wider in their brief that can look best at this, and I think the Council for Science and Technology has raised some of these issues already with Government about the impact and the take-up of research. We have an issue, for example, because of the recent downturn, that there is a significant shortfall in venture capital funding. Now, is that a job of the Chief Scientific Adviser? I think probably not, but I think it is to recognise that it is difficult to get venture capital funding into inventions which are potentially beneficial and that there are clear problems of funding. If you have something that is going to take five years before it produces a cashflow, I think we must recognise that and think about where Government needs to step in. Scientific advisers need to be party to that, though I do not think this can be a central role, but I think it is an important role in Government.

Chairman: We are now out of time, but I wonder if I can leave you with another question which means looking back at comments we had last week from the Director of SPRU who told us that he was unable to put a number to the total government spend on research, and that is his job, so to speak, to look at overall strategic decision-making. He rather doubted that anyone in Government could. I would like you to look at that and give a considered reaction to it because it is a very important point if that is the reality. If SPRU cannot do it and folks in your own organisation could or could not do it, that would be relevant. Equally, if either the Chancellor or the Prime Minister could not do it, it would be a very difficult situation.

Q516 Lord May of Oxford: If I may just say, that is a very interesting question because there are all sorts of formal statistics that are surrogates for it, but I was fortunate enough to have in the office somebody, Keith Root, and we tried to make assessments of the science base which is rather different from these other things. Maybe if you could find Keith, that would be helpful.
Professor Beddington: I could certainly answer your question, Chairman, but I would answer it quite quickly in one sense because we have been doing this exercise for Government through the EDSI Sub-Committee where I report quarterly on spend on R&D by government departments. One of the problems is that in some government departments R&D is not allocated at the start of the period, and the Home Office is a good example of this, and one can only post hoc deal with the R&D spend of the Home Office. By contrast, in the MoD they allocate the funding upfront, so that is a complication, but I will answer you in more detail.

Q517 Chairman: That is very helpful. Can I say thank you for your time this morning. If there are any points which we have not covered that we had hoped to or, alternatively, that you would want to have made, please do let us have a note.

Professor Beddington: Okay. Thank you, Chairman.

Supplementary memorandum by the Government Chief Scientific Adviser

The following memorandum is in response to the Committee’s request for supplementary evidence from Professor Beddington following the evidence session on 19 January 2010.

1. Please could you provide the Committee with a response to the first limb of Q489, about the outcome of departmental science reviews?

One of the key purposes of the SEA reviews is to provide a “critical friend” function for departments. Our purpose is to examine critically how departments carry out and use science, and indeed all, analytical, activity. Where necessary recommendations are made for improvement, typically development of current processes rather than full scale change. The feedback we give is intended to provide constructive feedback to enable the department to drive its own improvements. We also provide encouragement as well as criticism, clearly indicating areas seen as representative of good practice.

I give below examples of recommendations showing different kinds of follow-up:

DCMS—2004

Recommendation: DCMS should appoint a senior part-time Chief Scientific Adviser, preferably external to DCMS. This would be a respected scientist. Their role would be to ensure that the science needs of DCMS are strategically addressed and that science and scientific advice form an effective part of the evidence base for policy-making and delivery, dealing both with substance and processes.

The DCMS has now appointed Anita Charlesworth as Chief Analyst and Chief Scientific Adviser in September 2008 in response to the recommendation. The implementation of other recommendations had been on hold pending this appointment, and a mechanism for the Department to access advice from leading scientists across the DCMS Sectors has now been developed through a Science and Research Advisory Committee, the SRAC, which was launched in October 2009.

DEFRA—2006

Recommendation: Defra should continue to develop its social research resource, further develop contact with the wider social research community, and provide guidance to policy and implementation teams to ensure that social science considerations are fully integrated into science projects from the beginning.

In May 2009 Defra reported formally back to me that it has addressed the recommendation by on-going development of their social research capability and policy. Following the Science Review, the Defra Science Advisory Council made similar recommendations at their June 2009 meeting. Two new positions for social researcher mangers have now been created and as part of their Renew Programme, Defra has worked to ensure that its policy making and policy-focussed projects are linked in with evidence-based social research. They have also made training in the new policy cycle available to support staff in this area.

FOOD STANDARDS AGENCY—2009

Recommendation: The Agency should institute a more rigorous (independent and external) approach to peer review at all stages of commissioning and evaluation of research;

I see peer review as being a fundamental part of quality assurance in scientific research, and the FSA’s response to the recommendation above was positive and realistic. They recognised that they should apply a consistent approach to peer review across all of the Agency’s science and evidence. The Department also agreed that there
should be at least two external and independent assessors for significant pieces of work while noting that while they would “adopt a pragmatic approach to determine when internal peer review and/or one external assessor will be sufficient” they would also develop criteria to clearly set out when to follow this route. The FSA made a commitment to revise their peer review guidelines, making clear which aspects are mandatory, and to publish this guidance in the “Rules and Tools” section of their intranet. To complement these changes the Department will also be checking compliance in their regular internal audits. The Department has also recently set up a Register of Social Science Experts who could be called upon for peer review of social science research. In the one year follow-up later this year I will be asking about the implementation and subsequent impact of these changes.

CURRENT REVIEWS—2010

The first main departmental review using the new process is of the Department for Transport. I am currently discussing the implications of the recommendations with the Permanent Secretary, Robert Devereux and the CSA, Brian Collins. I will be able to provide further information to this committee at a later date. As the review of DCSF has just started and that of BIS is in development I could provide feedback on these in the summer.

2. To which consultation process did you refer in response to Q 491, 504 and 506?

The consultation process I referred to is the consultation that the Director General of Science and Research (DGSR), Professor Adrian Smith, has committed to in the run up to the next Spending Review.

The DGSR has asked the following bodies to provide formal advice:

— The Royal Society;
— The Royal Academy of Engineering;
— The British Academy;
— The Council for Science and Technology;
— The Chief Scientific Advisers Committee; and
— The Confederation for British Industry.

3. What is your response to the comments made by Professor Sir Martin Taylor, Vice President of the Royal Society, in the previous session, on

(i) the challenges the research council structure presents for interdisciplinary research projects (Q473; Q501)
(ii) impact (Q478 and 479; Q513)

I agree with Sir Martin that it is important to support interdisciplinary research.

The Cross-Council Funding Agreement (CCFA), in place since August 2006, is designed to avoid double jeopardy and ensure proposals that straddle Council remits are not left unfunded. This ensures equality of opportunity for proposals at the interface of traditional disciplines. Between March 2008 and February 2009 more than 100 proposals were processed through the CCFA; for the same period approximately £3 million was transferred between Councils to fund cross-disciplinary research. In addition to the CCFA for responsive mode applications, the RCUK cross-Council research themes have demonstrated effective funding across discipline boundaries in order to address major societal challenges. The present RCUK structure gives both an effective disciplinary focus when needed, combined with proven mechanisms to fund interdisciplinary work. I am working with RCUK and departmental CSAs to explore the extent to which such cross-cutting themes might usefully also extend to include departments.

I understand that the Research Councils are ready and keen to consider ideas for improving yet further their consideration of multidisciplinary research proposals, building on what they have done already, and I welcome that.

The Committee also asked for my views on assessing the impact of scientific research, and, in particular, on Sir Martin’s comments on this issue.

I agree with Sir Martin’s stressing of the different kinds of impact science has. It is right to try to maximise the benefits for the economy and society of research paid for by the public, and to recognise and reward the contribution that researchers are making through the impact of their work.

On the Research Excellence Framework (REF), I support in principle the inclusion of a component linked to impact. HEFCE is developing its proposals on impact assessment (in the light of inputs to its recent consultation), and a pilot exercise is due to be completed in mid-2010. Any specific questions the Committee
might have on this are best addressed to HEFCE. I can confirm, however, that the impacts considered under the proposals for the REF are broad and include social, economic, cultural, public policy, health, environmental, or other quality of life benefits.

4. **What is your response to the observation of Professor Andrew Stirling, Research Director, Science Policy Research Unit, about the difficulty for those both outside and within the Government to have an overview of, and provide figures on, total government spend on research? (Q515)?**

I agree that it is important that figures on total government expenditure on research and development should be published.

Each year, the Office for National Statistics (ONS) publishes data on the UK gross domestic expenditure on research and development (GERD). This includes total R&D funded by the Government (including Research Councils and Higher Education). The Government also publishes the Science, Engineering and Technology (SET) Statistics, which provides a more detailed breakdown of departmental spend on R&D and knowledge transfer.

This data is collected at departmental level and does not allow calculation of figures for specific subject areas across all Government spending, for example low carbon technologies.

**Extract from SET Statistics: Net Government Expenditure on R&D by Departments in Cash Terms**

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<tr>
<td>Home Office (HO)</td>
<td>42</td>
</tr>
<tr>
<td>Department for Culture, Media and Sport (DCMS)</td>
<td>39</td>
</tr>
<tr>
<td>Department for International Development (DFID)</td>
<td>134</td>
</tr>
<tr>
<td>Department of Business, Enterprise and Regulatory Reform (BERR) (excluding DIUS and Launch Investment) (2) (3)</td>
<td>1</td>
</tr>
<tr>
<td>Net Launch Investment (4)</td>
<td>−153.7</td>
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<td>Northern Ireland departments</td>
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<td>Scottish Government (SG)</td>
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<tr>
<td>Welsh Assembly Government (WAG)</td>
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<tr>
<td>Food Standards Agency (FSA)</td>
<td>14</td>
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<tr>
<td>Ministry of Justice (MoJ)</td>
<td>10</td>
</tr>
<tr>
<td>Other departments (5)</td>
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<tr>
<td>TOTAL CIVIL DEPARTMENTS R&amp;D</td>
<td>1,294</td>
</tr>
<tr>
<td>TOTAL DEFENCE R&amp;D (6)</td>
<td>2,139</td>
</tr>
<tr>
<td>TOTAL GOVERNMENT EXPENDITURE ON R&amp;D</td>
<td>9,191</td>
</tr>
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Notes:
1. This figure does not include R&D expenditure by Defra’s Non-Departmental Public Bodies (NDPBs).
2. From July 2007 DTI and OSI became Business Enterprise and regulatory Reform (BERR) and Department of Innovation, Universities and Skills (DIUS).
3. DIUS spend previously categorised in 2006–07 as civil department spend is reported under “Science Budget”.
4. Launch investment is a risk-sharing government investment in design and development of civil aerospace projects in the UK. The investment is repayable at the real rate of return, usually via levies on the sales of the product, and are reported here.
5. Includes £15 million attributed to the Forestry Commission in 2007–08.
6. Receipts are monies received by MOD & its Trading Funds for expenditure on R&D, for example from other government department & private industry. This money is not necessarily spend on defence-related R&D.

2 ONS: First Release: UK gross domestic expenditure on research and development, 2007 (20 March 2009). GERD includes estimates for R&D carried out by the following sectors of the economy: Business Enterprise; Higher Education; Government; Research Councils; and Private Non-Profit.
3 Published by BIS at: http://www.dius.gov.uk/science/science_funding/set_stats
5. What is the role of the Council for Science and Technology in
   (a) the process of setting priorities for publicly funded research within and across Government departments
   (b) the allocation of the science and research budget?

To what extent is it fulfilling those roles? What changes, if any, do you suggest?

The Council does not play a direct role in the process of setting priorities for publicly funded research within and across Government departments. This is the responsibility of individual departments. Nevertheless CST meets quarterly under my and Professor Dame Janet Finch’s co-Chairmanship and where issues and concerns relating to particular departments’ science and technology policies arise these are communicated to Government. CST reports on Nanotechnologies and How Government and academia can work together are examples of this. These reports have been influential with and appreciated by the Government.

The CST will be one of the bodies formally consulted in the next allocations process for the Science and Research Budget.

As with the other bodies being formally consulted, the process would involve the following steps:

— Early in the process, Professor Adrian Smith, the Director General of Science and Research (DGSR) would attend a CST meeting for a discussion around the core issues.
— CST would be asked to publicly submit advice to the DGSR at two stages in the process:
   1. before the departmental submission is sent to Treasury; and
   2. after the departmental allocation is received from Treasury but before the allocations to each Research Council are made.

At least twice during the process the DGSR will chair a meeting of the Chairs of all the consulted bodies to discuss the advice given in plenary.

February 2010
I think there is a terrific track record. The starting international R&D money for example. In all of these things that are more elusive. Attracting mobile, economic sense of the UK growth agenda; but also health and cultural capital and in the more narrow see as absolutely fundamental in generating social, excellence of the UK research base some of us would international positioning, competitiveness and foremost—although I can start in many places—the ect that world and are crucial to it. Perhaps

Maybe it would help if I set a few of the dimensions contributes to the activities in the research base. consultations and being close to the whole world that I very much see my own role as both at a formal and to give informed advice in relation to those matters. My role, to the best of my ability, would be decisions of size of budget ultimately are ministerial word “crisp”. Can I say first, for absolute clarity,

I will endeavour to do so. I note the different stages in the process? Professor Smith: I will endeavour to do so. I note the word “crisp”. Can I say first, for absolute clarity, decisions of size of budget ultimately are ministerial decisions. My role, to the best of my ability, would be to give informed advice in relation to those matters. I very much see my own role as both at a formal and an informal level, having eyes and ears and consultations and being close to the whole world that contributes to the activities in the research base. Maybe it would help if I set a few of the dimensions that affect that world and are crucial to it. Perhaps foremost—although I can start in many places—the international positioning, competitiveness and excellence of the UK research base some of us would see as absolutely fundamental in generating social, health and cultural capital and in the more narrow economic sense of the UK growth agenda; but also things that are more elusive. Attracting mobile, international R&D money for example. In all of these I think there is a terrific track record. The starting point for me in seeking evidence and advice is in pursuit of making sure that the Minister in his discussion with other ministers understands that fundamental role in all its dimensions. Let me just mention a few of the dimensions which will then explain why the particular forms of consultation that we intend to undertake are there. We need a range of capability. There is a wonderful letter by Sir Paul Nurse in The Times. Somebody had said how we need more and more medical research and he pointed out the interdisciplinary nature of many of the major advances in medicine; clinical trials, mathematics and statistics; the understanding of genomics through sequencing algorithms which are computer science, and scanners which are physics—and some of that physics has come from infrared astronomy and some of it has come from detectors in CERN. This is a complex landscape. There is not a tight piece of string between where you want to go and where you come from and what you find. The landscape that delivers this is itself complex. We have institutions, facilities, different disciplines. We need people and we do this in conjunction with a wide range of public and private partners. Again, in informing that landscape, all these dimensions are important. What is it about? Providing that social health and cultural and economic capital but also rising to challenges. I think the Research Councils UK have a rather pithy little mantra at the moment. If you unpick it, it can really all be seen as feeding into a productive economy, a healthy society and a sustainable world. Around those headings one can read the narratives and see how one wants to arrange the landscape. How one arrives at that advice and what it is—the importance of this is obviously crucial for arguing for the budget size. Then, what is the appropriate mix of the funding of disciplines, of institutions, of facilities, of people, the things we do with partners in the UK and internationally? At a personal level, I was 30 years at the academic coal face and ten years running a university, so I consult both informally, through the knowledge of that world and networking and more formally. When I first came into the job, John Denham made a public commitment that I would have formal consultations with six leading national
bodies: the Royal Society, the Royal Academy of Engineering, the British Academy, the Council of Science and Technology, the collection under John Beddington of the government chief scientific advisers and the CBI, to interact with them at a very high level, set an agenda, go to council meetings, get them to put in the public domain how they see prioritisation and this complicated set of issues that I have just tried to outline.

Q519 Chairman: There is no doubt about the complexity and the richness of the cake that in the end the Government and the Minister have to try to mix. What we are interested in, in part, is what happens at the stage before the Minister? Rightly, it is a job for the Minister to make decisions. Do they get uncontaminated advice? Do they get advice that says, “These are key priorities. Everybody is saying they are key priorities but X, Y and Z are particularly important”? How do you hone it down and do you have a role in that?

Professor Smith: Can I just note that some people have not liked this very much but deliberately I did not have in that list the Institute of Physics or the Royal Society of Chemistry for example. Because the Institute of Physics if it is worth its salt and they will be arguing for physics and the RSC will be arguing for chemistry. Remember, this is going to be in the public domain. Those bodies are going to put on paper how they see the big prioritisations or intentions within that landscape. At the same time of course at the more micro level the research councils themselves are producing what they would wish to be their aspiration delivery, delivery programmes, aspirations for the coming spending review. We have the track record of how they have performed. We have the evidence of how cross-cutting programmes have fared, how people have seen these, how we have adjusted as we have gone along. There is a mass of evidence that is in the public domain but at the end of the day, as I think my colleague Graham Reid said recently to a committee, there is not a formula and an algorithm. This has to be judgement. It is judgement against that list of things that I mentioned, preserving institutions, facilities, disciplines. In some sense you could posit it the other way round: what major shifts and what damage would cuts cause? Do we want that damage? It has to be judgement. I would see my role as making sure the way that is presented to ministers is maximally informative of what people out there have seen as the priorities, what we have delivered, what the challenges are going forward. I cannot think of a cleverer way of doing it.

Q520 Chairman: There are one or two other overarching bodies. For example, the Council for Science and Technology, which is a government body that covers a wide range of expertise. Does that have a role to play?

Professor Smith: That was one on my list. Maybe I did not say it clearly. In fact, I had a preliminary meeting with Janet Finch, who is the co-chair of that, this very morning. Yes, they are very much involved.

Q521 Lord Oxburgh: If I understand what you are saying, you make recommendations to ministers in the light of all this consultation that you have described, looking at the submissions of the research councils. Who are you able to discuss that with, because ultimately it is quite a big responsibility to say, “Well, in fact, this research council perhaps has not done as well as we had hoped and there is probably more possibility, more scope, here” or indeed should the total budget be raised. You cannot just make recommendations to ministers in vacuo. There have to be some numbers by them.

Professor Smith: Absolutely. I left out another major player in the conversation and that is the Treasury.

Lord Oxburgh: Exactly.

Q522 Chairman: We would like to hear your views on that.

Professor Smith: No views; I am just noting they are major players in this. One of my teams is in regular, almost weekly, conversation with the Treasury. The Treasury has a wider role of poking and prodding the whole of government spend and the spend on the research base is no exception. There is constant challenge from the Treasury who, as is their right, will use their own criteria and approaches and ways into the issue, many of which of course will be in terms of economic impact, which is why the narrative around that agenda, subtly and carefully done, is an important part of the dialogue. There are other bodies out there, of course. In the medical world we have the joint enterprise OSCHR with the Department of Health. I did mention also the gang of the chief scientific advisers. Many of you have been involved in government matters over the years. That landscape has changed dramatically in the last few years. John Beddington has now succeeded in getting a chief scientific adviser into virtually every government department. I am not sure I should say this but chief scientific advisers meet informally every Wednesday and more formally in a more public domain. Not only that; we now have joint meetings between the chief scientific advisers and the gang of the chief executives of the research councils. There is a very holistic overview of the whole landscape from that dimension, challenged from the Treasury, challenged from some specific other government departments. We have more major involvement perhaps with the MoD and the Department of Health than some of the others. If you look at the cross-cutting programmes—take Living with
Environmental Change as one of them, which has about six research councils, four government departments, umpteen industrial and other partners—there is a big world of stuff out there which is not backward in giving me its views and challenges to the landscape. I do not think there is a shortage of possibility for argument, discussion and probing of the issues.

Q523 Lord Oxburgh: To pursue that, ultimately a recommendation goes to ministers with some numbers. Is this quite separate from the main BIS bid for funding or is it set against other BIS priorities?

Professor Smith: I think the starting point is that the positioning of the science and research base will be done in its own right. I am getting into territory where I do not know. You might speculate that the Treasury might be looking in a wider domain and mentioning things in a wider domain, but my job primarily is to assemble the evidence, the case and the best possible advice to, currently, Lord Drayson, in pursuit of the science and research budget.

Q524 Lord O'Neill of Clackmannan: I am not quite clear. The Treasury is the allocating ministry and everybody else is a spending ministry, so there is a difference of interest there. You can say you have to consult the MoD or the Department of Health and what have you but at the end of the day you are all against the Treasury. How confident are you that the Treasury understands the significance of what you are putting forward to the ministers? Presumably what you give to Lord Drayson one way or another the Treasury will have sight of. One of the glaring omissions is that the one department which does not have a scientific adviser is the Treasury.

Professor Smith: That is something you should take up with John Beddington and the Treasury.

Q525 Lord O'Neill of Clackmannan: We have done and I am asking you.

Professor Smith: The reason I mention the Department of Health and the MoD is that part of the case—take health and the joint programmes around OSCHR and the translational medicine agenda and the rest of it—the evidence base, the argument and the evidence of how things are working does necessarily involve others.

Q526 Lord O'Neill of Clackmannan: I did not dispute that; it was the fact that at the end of the day it is the Treasury—

Professor Smith: It is the Treasury who decide on the total size of the science budget.

Q527 Lord Oxburgh: With what granularity will that decision be made? In other words, how much virement is there within that allocation?

Professor Smith: If I am incorrect I will write to you with a correction. My understanding is that the Treasury involvement is on the total size of the budget. My current understanding is that the research council allocation is then a matter for BIS within that budget, with advice coming from me.

Q528 Lord May of Oxford: If I can make a preamble, the way these things are being handled today, as I understand it, is really significantly different to how they were handled 15 years ago when the Office of Science and Technology was created, when that Labour manifesto of the Kinnock election was taken over by John Major in implementing it. The answer to the questions we have just been having, if we had been doing it then, would have been that the Cabinet sub-committee on the budget met with each of the Secretaries of State and with a couple of other people, one of whom was the chief scientific adviser, whose role was to present a paper and discuss with them each of the research budgets right across government, including the research councils but also MoD, Health and everything. That was with the Cabinet Committee, for them in a sense, aided by its secretariat, the Treasury, who made the decision. Specifically for the research council budgets, when OST was moved out of the Cabinet Office into DTI, it was none the less still moved in with a ring-fence and the manifestation of the ring-fence was that the rest of DTI presented a budget and the research council in the form of the DGRC, John Cadogan, was the negotiator. John Cadogan presented the research budget. It did not have to go for approval and, if I may tell an anecdote that some felt was a shocking violation of civil service procedure and others thought was good, there was one occasion on which the permanent secretary for what was then the DTI and John Cadogan went over together to get their budget from the Chancellor. The Chancellor came out with Mrs Beckett, who was then the Secretary of State, gave the DTI its budget and then it gave John Cadogan his budget. Characteristically—those who know John Cadogan can imagine this—he said, “Oh, that is not good enough.” He went back into the room with the Chancellor and Mrs Beckett and came out again about an hour later with an extra £80 million. This was described to me at the end of the summer when I next saw Michael Scholar, who was the permanent secretary in the DTI. He said, “This was absolutely dreadful, totally appalling.” I said, “I think it was great.” The point is it was a system that, as I understand it—I am not saying it was necessarily better—is different because it was one in which you would have been the person dealing with the Treasury. I do not think that is the case now. That is to say, for the research councils.
Professor Smith: There are two disclaimers. I was not part of the previous processes and of course we had a couple of machinery of government changes since I joined. I think now there would be a very clear view from the permanent secretary in BIS that there is a BIS budget that will be negotiated. I do believe within that there would be a considerable role for me in advising the Science Minister on the allocation among the research councils. There is nothing in current rhetoric or policy that goes against the concept of a ring-fenced budget, but I think the process of communication and dialogue probably has changed.

Lord May of Oxford: Who would have the prime responsibility? After all, you have all the departments each saying, “Cut the other people”, each of them represented by their specific titular interests, by their permanent secretaries. In that previous system—it has changed, as you say, so much with so many different changes—the research councils particularly were represented on an equal footing separate from the rest of the DTI, so it was not just that the budget was ring-fenced within it. The reason I pursue this, while not at all critical of any of the players, is the dynamics are different. In the system of the past the research councils’ science budget, at any rate, was there as a co-equal player with the other departments; whereas if it is to be important and indeed ring-fenced—we have had a pledge that the ring-fence is not going to be violated again as it was before you came on board—within BIS, it is one of several interests. It is possible for a cynic to feel that given the interests of various of the big chunks of BIS and the fact that cuts will fall on the civil servants in them against cuts falling perhaps on the research councils, it is not at the best advantage of the research councils to be represented this way rather than having a right proper bastard like John Cadogan carrying the ball co-equally.

Chairman: That was an Australian expression, I take it?

Q529 Lord May of Oxford: It is a technical expression of admiration.
Professor Smith: I can but note those comments. The landscape has changed.

Q530 Lord May of Oxford: It all happened before your time. Could we have perhaps from some source a time history of where, between 2000 and John Beddington who came on board to this system in that interregnum, and how the change occurred? It does not automatically follow directly from the psychotic reshuffling of departmental boundaries.
Professor Smith: I can ensure that that request is passed to the right knowledgeable person or persons, but it is certainly not me.

Q531 Lord May of Oxford: This also means that the Cabinet, in thinking collectively about the budget, if I have understood it correctly—I am certainly ignorant of it—no longer gets a paper that looks at all the R&D things. Of course the research councils in those days were separate but there was also the chance for the CSA, John Beddington’s analogue, to make a case in addition to the case made by the given departments of the expenditure on R&D in the MoD and in Health and so on which would not necessarily be congruent with the proposal made from their own Secretary of State. I take it that mechanism has also disappeared from the present arrangements?
Professor Smith: I cannot comment directly on that question as posed. I would just note that there is of course in recent times a new Cabinet Committee, the Science and Innovation Committee which Lord Drayson chairs, which does bring together ministers from many departments and John Beddington regularly attends. It is a focus for bringing together issues and information across the piece on science and government. I know not what role or what influence or drip through there will be from that, but I think it is worth noting that there is actually a formal body in that Cabinet Committee.

Lord May of Oxford: Lest I seem to be saying the world was better when I was young, I think some of the things you outlined and that John Beddington explained are a tremendous improvement. We have chief scientists everywhere and the fact that they all get together is really a big improvement.

Q532 Baroness Perry of Southwark: You said very firmly that the Treasury sets the total research budget. Does that include the research budgets of the spending departments, the NHS research budget, the Department of Health, the Department of Education and the defence budget? If the answer to that is either yes or no, when they get to those departments are they ring-fenced?
Professor Smith: Again, I am not really competent to answer that in complete detail. I do believe that the R&D budget within the Department of Health is formally ring-fenced but that is not the case uniformly across all departments.

Q533 Baroness Perry of Southwark: When you say the Treasury sets the overall envelope for science research, you really mean for BIS? It sets the BIS research budget?
Professor Smith: In the context of that question, I was talking about, let us call it, the money for the research councils.

Q534 Baroness Perry of Southwark: Not for HEFCE, not for the higher education funding councils?
Professor Smith: I can clarify that instantly. In general, when we talk within the department over the last 12 months of the science and research budget, it has two components. It is the QR component, the research component of the block grant to the universities, and the grant to the research councils. Most of what we have been focusing on—the history and the clarification—was in the context of the research councils. Separately, there will be a Treasury decision on the size of the higher education budget within which, as part of the case, a case will have been made for the QR component of that. That case, that evidence base and those arguments also belong to me in my role as director general. I oversee both those budgets, arguments, evidence bases and try and get them to fit together. What we were talking about specifically just now was the research council element.

Q535 Lord Oxburgh: Can we just summarise the range of areas in which you prepare advice for the Minister? We have the research councils; we have the research aspects of HEFCE?
Professor Smith: That is a different minister.

Q536 Lord Oxburgh: What else do you advise on in terms of finance for research?
Professor Smith: Those are the two. There is, of course, as part of the ring-fence vote, the money that we give to the Royal Society, the Royal Academy of Engineering and the British Academy.

Q537 Lord Oxburgh: Not the Technology Strategy Board?
Professor Smith: The Technology Strategy Board is now a separate heading in a separate part of BIS. In DIUS it was part of my province. In BIS it is in a new directorate.

Q538 Lord Methuen: To what extent does the Treasury query the content of the budget you are putting forward?
Professor Smith: I have never yet put forward a formal budget application to the Treasury. My time has not yet come, but in the dialogue and the regular meetings that we have—I am now paying a tribute to them—we are put through the wringer on the kind of evidence base of all aspects of how we use the money, what it is used for and both long-term and short-term evidence on the returns to society and the taxpayer from that investment. It is a constant dialogue.

Q539 Lord Krebs: I wanted to go into a little bit more detail on one aspect of your role. This is to do with the allocation of the overall envelope amongst the research councils. You alluded to the fact that, in thinking about that allocation pattern, you take into account the performance of the research councils as well as their delivery plans. Reflecting back on my own time as head of a research council, it was never very clear to me how the aforementioned Sir John Cadogan made those allocations. I do not know if it was clear to the other heads of research councils. Could you explain to us what metrics and other information you use and how transparent that process is for the heads of research councils and others who might be interested in looking at it?
Professor Smith: Let us unpick two separate things. I think you and others would expect, would you not, that in a future allocation process you might be influenced if a particular research council or a particular activity had not delivered, had been mishandled or whatever. That would be part of the landscape. In terms of more specific metrics, during the course of the expenditure in a spending review, we are in constant dialogue and monitoring activity. We have formal reports and six monthly meetings on the usage of the money voted in the last spending review. In that context, we are monitoring closely and getting not only each research council but each cross-council programme to regularly inform us of progress, of their given targets and milestones, so there is a managerial element during the course of the spending period. What would feed into the next spending period would be if there were clear lessons to be learned about delivery competencies or ideas that simply had not worked. It has not happened but let us suppose we tried an ambitious cross-council programme and it simply fell apart. I think you would hope that one would take note of that in what one did next time round. There is a constant interaction on the performance, the professionalism, the way that councils deal with their communities, the creative ways in which they invent new forms of funding PhD studentships, all that kind of stuff you would expect of an institution, of an organisation, behaving creatively and professionally. I suppose it would be by exception that you would make dramatic decisions in the next spending round if something went radically wrong.

Q540 Lord Krebs: Are there any cases of mismanagement that you have become aware of?
Professor Smith: No, not in the significant sense that I have just alluded to.

Q541 Lord May of Oxford: If you wished to, do you and for that matter perhaps a fortiori does John Beddington have direct access in the budgetary process to the Treasury secretary?
Professor Smith: The way the Treasury is structured, there are teams who interact with teams in the department. There are people who sit above those teams in a hierarchy I do not necessarily understand. I have not ever gone to whatever the permanent secretary in the Treasury is called.
Q542 Lord May of Oxford: Not the permanent secretary; the chap called the Treasury secretary. It was Waldegrave, for example, if you go back. 

Professor Smith: Not so far would be the answer.

Q543 Lord Warner: Can I just try to unpick this delivery issue? This question really relates to the research councils. To what extent do you look at whether what the research councils have done does end up with a translation of the research into what I would call its systemic application? By that, if you take medicine, I do not just mean that it is fit for human use but the NHS is actually using it in a widespread manner. Do you hold the research councils in any way responsible for that translation effort?

Professor Smith: For significant elements of it, yes. Perhaps I can just toss out a few facts and figures. The research councils collectively interact with around 3,000 businesses on joint enterprises of various kinds. In the specific case of the MRC, we have set up this body, OSCHR, chaired by John Bell, which brings them together with the DoH from the perspective of strategically trying to get a heavier hit on the translation of medicine precisely for that purpose, and the OSCHR board is constantly looking at what emerges from that process. When things mature from that, there are other vehicles. One of the things that the TSB is putting new funding into right now is so-called stratified medicine, getting away from the blockbuster drug that goes out to the whole population, yes or no, looking at things which are more tailored to men of my age with a bad left knee or whatever. That has big effects on the way that R&D is conducted in industry and all the rest. I would say that that is one of the dramatic changes over the last five years. It is that process of engagement with the pull through of the exploitation. There is a lot of mischievous parodying of this stuff, that all or even most aspects of the basic research process lend themselves to short term pull through of that kind. Systematically, we have tried to incentivise cultures where people look for ways of exploiting. They look for impact. They look for partners who are interested in that kind of exploitation. We specifically monitor that. Part of the annual report from the councils comes in an economic impact reporting framework so you systematically have that as part of the reporting process. In addition to that, the research councils collectively have a group that looks at knowledge and technology transfer and captures, in a narrative, the impacts, not just the short-term, forward impacts, because that is just the real time tip of the iceberg. The real impacts are when you go back 10, 15 or 20 years and you track through the original piece of research, how it was funded, what it led into. To anybody who has not seen them, I commend to you some wonderful A3 size time charts that the research councils have produced under those three headings of productive economy, healthy society, sustainable world, with an axis of six or eight original research breakthroughs and what they led to in terms of businesses or regulation or laws or policy. It is a fantastic narrative but you have to be willing to take it over 20 years and not two months at a time.

Q544 Chairman: We have these charts. It might be very helpful if someone from your office could give us a little more of a breakdown on the 3,000 businesses that you mentioned with whom the research councils interact, who they are and the level of interactive. That means more than a cup of tea occasionally.

Professor Smith: Certainly.

Lord Krebs: I just wanted to go back to my question. I found it was a little lacking in detail. Maybe you are able to detail it a bit more now but, if not, I wonder whether you could send in a note afterwards. To repeat it, it is about the process by which you and the consultees that you referred to come to a view about the allocation of money across the research councils. You talked in general terms about the fact that if they had been mismanaging programmes that would be a black mark, but none of them had in your experience so far, so what, in more detail, are these other factors, whether they are quantitative or qualitative, objective or subjective, to take into account. Perhaps it would be better to ask for that to be sent in a supplementary note.

Q545 Chairman: If you could, that would be useful.

Professor Smith: This is of course a process of consultation with those six groups that I mentioned. Part of the consultation is asking them to work with me to define those metrics and general headings, so I am not starting off sending a template—it would be rather presumptuous to the Council for Science and Technology—to say, “Here is your test question”. What do you think the test questions ought to be? If you would give me the space of a month or two or three, one of the things I am doing with them is to have a dialogue about what are the appropriate things to count, measure and assess.

Q546 Lord O'Neill of Clackmannan: You have in part begun to answer the question I was going to ask you. To what extent have you been able to anticipate the impact of the cuts or the severe funding constraints, to use a euphemism? Secondly, not just the impact over the next two or three years but the ratchet effect that that will have in other areas when the priorities begin to change because of the shortfall in anticipated moneys. Would this be a guesstimate or do you have evidence to back up what would be your view of the likely impact of the cutbacks in the immediate short to medium-term?
Setting Research and Funding Priorities: Evidence

4 February 2010

Professor Smith: I earlier mentioned the Paul Nurse letter which was in response to, “Let us bung lots more money into medicine”. What does that actually mean? The problem is not knowing what is the breadth of capability and excellence that you need as you go forward. It is not what some people would say, if you have X per cent funding you can surely look around and find the area of science and, lo and behold, in ten years’ time that would be the absolute crucial ingredient of something or other. I come back to the importance of this consultation with those six bodies because in some sense I am asking them, with all their breadth of knowledge, experience and the kind of people who are involved, to help me find a way to some of that foresight because whatever size the budget there is a implicit prioritisation. It is a nice world of prioritisation if you are spending extra money. It is a very unpleasant world if there is cutting. This again cannot be formulaic. The necessity to preserve national capability of various kinds, the necessity to maintain breadth of disciplines. And over-arching most of this is that, in many of these areas and the impact they will have on society and the economy, being second rate or mediocre does not do it. There is a set of tensions there that have to be bottomed out.

Q547 Lord O’Neill of Clackmannan: I hear what you are saying, but this is not an altogether novel experience, because you have been doing it for the last 12 months, perhaps not in quite as straightened circumstances as you are going to be doing it in the next 12 months, but how successful have you been in working in recent times with securing the 2009 efficiency savings? Does that in any way undermine the operation of the Haldane Principle?

Professor Smith: There has not been a cut to the research budget. I have not been operating in that space for the last 12 months. It is true that, at the end of the spectrum of the Haldane Principle where the research councils take the micro decisions, they are constantly in a position of having to prioritise against movements in exchange rate fluctuations or simply because new opportunities come and jostle out others. At that level you are right. That process of prioritisation takes place all the time. What would be a new arena, at least over the last decade, would be if you took a very large, significant chunk out of the system and you had to confront the issues of, do you slice and create mediocrity across the spectrum or focus, in order to maintain international competitiveness in what you care most about—that is where I keep coming back to the big consultation about the big picture priorities—and we are in somewhat new territory there, particularly against the background of most of our international competitors who are investing increasing sums in the science base. Again, tensioning our international competitiveness against that is something, one will have to keep an eye on if we end up in a scenario of that kind. You have to take that international dimension into account as well.

Q548 Lord O’Neill of Clackmannan: Do you think you could give us a note on the other elements of your spending on universities, on the infrastructure and capital investment?

Professor Smith: Yes. The issues in relation to the other bit of the budget that goes into the universities in the context of the block funding is sustaining departments and institutions, again coming back on the research side, to be internationally competitive. If you have less resource in that area, you may reluctantly get into the area of where do you spend it best. Those are difficult issues, because the university system is not just delivering research, obviously; it is delivering many other things. There, the policy imperatives have to be tensioned against other imperatives.

Lord May of Oxford: This is a very quick and unfair question which you may choose to duck. Realising the imprecision of it, what is your gut feeling? If you were supreme dictator, what proportion of the research council budget would you give in pure responsive mode in the sense of the only criterion being the best people with the best projects, as distinct from the things that came out of the elaborate process about need for special institutes which is justifiable or the measure of impact on society and the economy and so on? Just to confess, my gut feeling is I would do 50/50 and that is not what we do.

Q549 Chairman: That can be your answer if you want.

Professor Smith: I am going to duck the question because I think it is misleadingly over-simple to talk about fundamental and applied, directed and responsive. There is nothing more directed in the world than CERN and is it not about the most fundamental research questions there are?

Q550 Lord May of Oxford: CERN is pure responsive and of no conceivable use.

Professor Smith: Really? Nobody built it? Nobody spent the money on the engineering? This is organised science of the highest order. I am ducking the question because there would not be an adequate reply to the way it was posed. I think there are interesting questions there.

Q551 Lord Methuen: To what extent, how and at what stage in the process, if at all, should the impact of research be assessed and used to prioritise funding in the allocation of the science and research budget and within the research councils during the assessment of individual projects?
**Professor Smith:** This is a subject that has caused more heat than light, in my view. Because we earlier clarified that what I look after spans both the university, the QR element and the research council element, the impact question is different in the two domains, so I am taking it that I am answering the question in the research council context.

**Q552 Lord Methuen:** Yes.

**Professor Smith:** I think there is a need for a bit of myth busting here. There is a sort of mischievous view which is so nonsensical that, if you pause to reflect, it cannot possibly have been what anybody intended, that one should be able to predict at the beginning of a research project what the outcome will be. If you could, it would not be research. Everybody I work with, the research councils and I totally understand that. That is not what it is all about. What it is about is asking people to reflect. If they reflect and come to the conclusion that they cannot think of any impact at all, that is fine. The research councils have said it a million times, but there are huge swathes of research where there are right from the beginning quite plausibly routes of impact and things it might impact on. What we have been accused in the past of doing and being is fantastic at the research and then very bad at picking it up, doing stuff to exploit it. What the research councils are about is trying to get mechanisms, a culture, an awareness and a behaviour change so that all along the process we are constantly thinking: if there is an opportunity to exploit, if there is something to exploit, let us make sure that we flag it and if possible we put in place support systems to gather it. That is what it is about. It is not about some nonsensical idea that we can predict the outcomes of the impacts of research right from the very beginning. I think there is a lot of mischievous, either accidental or deliberate, misunderstanding. There is no evidence whatsoever that the research councils’ starting point, which is to assess excellence and fund the most excellent research, has been subverted in any way. Very interestingly, for those of you who are avid readers of *The Times* Higher Education Supplement, today there is actually an article where somebody has looked at this. There is no evidence at all that this is affecting decision-making at the level of excellence. As you move down, we all know you have lists of the most excellent and then you get to where the funding gets difficult. All things being equal at certain points in the process, particularly if you are running directed or managed programmes, a better case for impact might shade it. I will be absolutely adamant: the research councils are applying the test of excellence when they are awarding grants, and it is mischievous of people to say they are not.

**Q553 Lord May of Oxford:** It would not be unreasonable, as anecdotes suggest, that on occasion it is used as a tie-breaker.

**Professor Smith:** Absolutely. That is the context very explicitly where it may well be, but it is not the starting point. No crap grant application with high impact will get funded, full stop.

**Q554 Chairman:** That is one thing but, on the other hand, if you have a range of high quality applications and some of them might feed towards a grand challenge type of investigation, is that something that would—?

**Professor Smith:** That seems to me, in Lord May’s words, a very legitimate form of tie-breaker.

**Lord May of Oxford:** Do not think I like it. I just think it is fair.

**Chairman:** If he thinks it is fair, it must be. We have come to the end of our time. You have suggested there are one or two notes that you will have sent to us. Should there be any other matters that we have not covered that you would have liked to have made specific comment on, it would be very helpful to have a note of these. Thank you very much indeed. Sitting there in your solitary position, you have I think contended well. Thank you for spending time with us.
Chairman: Minister, welcome back. You have been a member of this Committee so you have seen both sides of the table. We appreciate your availability and also the evidence that has come from the department. I have to add we appreciate the way in which you have yourself raised some of the questions with which we are grappling in public speeches, because we agree with you that it is immensely important that we do think through some of the issues about priorities, not least in a time where everyone seems to be promising cuts. I remind you that we are on the record and indeed we are webcasting so every word goes out into the ether. A record will be kept and you will see a written copy of what we cover. To turn to the first question, would you confirm—we believe this to be the case—that the Secretary of State has designated to you full responsibility for science and innovation policy? This seems to be a new departure, in a way. Is this the reality?

Lord Drayson: Yes, that is true. Responsibility for within the department; that is correct.

Chairman: Can I ask you to talk a little bit more about how you exercise that responsibility in practice? Are you involved in setting priorities for research or simply in assessing the levels of budget that are appropriate for different areas for the research councils or more broadly?

Lord Drayson: I preface everything I say by stressing that the principle, as expressed in Haldane, of ministers not getting involved in decisions relating to specific priorities within research is one which I believe to be extremely important. I see my role as both being an advocate and a champion of science and innovation across the whole of government, so both within the department itself, where I have that policy responsibility, but also across government. It is the first time the Science Minister has had a seat in the Cabinet. Because of the new innovation of setting up the new Cabinet Sub-Committee for Science and Innovation which I chair, this I think provides the Science Minister with a greater ability than we have had previously to ensure that issues relating to science and innovation policy are better co-ordinated across government; but also that the way in which policy across government is devised and implemented is done on the basis of good practice in terms of scientific advice and so forth. The way in which I do this in practice is through contact with my fellow ministers within the department in terms of the discussion of policy areas.

Chairman: Within BIS?

Lord Drayson: Within BIS, and fellow ministers across other aspects of government where policies related to, and having a bearing upon, science become important. What I have also tried to do is, as we first entered the economic downturn and are now at a point, although fragile, of seeing a recovery from the downturn, raise the question of the role of science and innovation policy at different stages in the economic cycle. I am seeking to develop a debate, first of all, on the role of science and innovation policy and to communicate the central importance of science and innovation policy to wider government policy in response to the economic crisis that we had. I am also seeking to ensure that what information we have from previous recessions can teach us about what is effective policy at this time and, through stimulating that debate, to attempt to develop a consensus within the scientific community and across government as to which are regarded as the most effective policies. This has led to specific areas in terms of the balance between so-called pure and applied research, the role of the assessment of impact and so forth. I think I have been successful in part in terms of communicating these issues, raising their profile. I would not say that I have so far succeeded in generating a clear consensus across the community. I think the jury is still out. There are quite clear dividing lines I think in the community about what is effective.

Chairman: Can I ask specifically how you relate, for example, to the Treasury? Do you feel it is part of your responsibility to advise them on the size of the research budget for example? With whom do you liaise? Equally, looking in the other direction...
perhaps of the Chief Scientific Adviser, what are the relationships between that complex group?

**Lord Drayson:** I think the relationship is through regular interaction with Treasury ministers, which tends to relate to specific policy proposals or issues that we have faced: for example, the lack of venture capital to support the translation of scientific research into rationalisations of it, a clear area where we have worked very closely with the Treasury. Also, the new mechanism of the National Economic Council, which I sit on as the Science Minister, chaired by the Prime Minister, which has been very much a mechanism by which the Government has co-ordinated responses to the downturn and policies to deliver growth. We have also been working on addressing the clear need for better cross-departmental co-ordination of both research policies and coordination of activity through specific mechanisms like, in the case of life sciences, the Office for Life Sciences, which I chair, which has had the specific remit of working closely with both the Treasury and, in this case, the Department of Health to get better co-ordination of Department of Health policies, with Treasury policies, with BIS policies, to ensure the improvement of the United Kingdom as a location for life science research, development and manufacture. It is quite a complex matrix of different types of relationship. What is at the heart of it, though, is the clear need to argue the case for continued investment in science at this time in the economic cycle and making that case robustly through these various networks with which I interact.

**Q559 Chairman:** Can I move a little bit further out from that to the Chief Scientific Advisers in the departments? Do you have any direct role in relation to what they do, or is that done through the Chief Scientific Advisers or through their own relevant ministers?

**Lord Drayson:** I have a role, in the sense that I have a close working relationship with the Government’s Chief Scientific Adviser. I think having GO Science in BIS, the geographical proximity, is helpful in terms of the development of an expected relationship as opposed to being in the Cabinet Office. The primary relationship that the scientific advisers within each department have is with their relevant ministers and then with the network of scientific advisers through to the CSA. So I would not say that I have a particularly strong relationship and much face time with those advisers.

**Chairman:** One of the questions in which we are interested is where there is, or whether there is, an overall view of both the spend and the activity in science, but I think this takes us to a question that Lady Perry wants to raise.

**Q560 Baroness Perry of Southwark:** Minister, one of the things that we have been trying to pursue is who has, or where is there, an overall view. A lot of public money goes into research, not just the great big budgets of the research councils and the Higher Education Funding Council, but the regional development agencies are increasingly now investing in research, there is the Technology Strategy Board and, of course, the spending departments, which all have their own research budgets as well. Is there anywhere where knowledge of how much total public money spent on research rests, and is there anyone who takes an overall view? You mentioned the link in health sciences, but, overall, is there anyone who takes a view as to whether the direction of the research is what the Government would want or eventually what society outside would want?

**Lord Drayson:** Not specifically within the government machinery. There is not an individual you can point to and you can say that individual is the locus for an overview of all of the lines of investment, as you say—the ring-fenced science budget, the investment that goes through the Technology Strategy Board, the RDAs, HEFCE’s QR, departmental R&Ds—there is no one individual who does that, and, therefore, I think your Committee is right to look at this. I think that, going forward in an environment of tighter spending constraints, the prioritisation of investment is going to become increasingly important, and the visibility of the process by which that prioritisation is done and the transparency thereto is going to be important in terms of maintaining the confidence of the various communities. I think there is an argument that progress has been made—we certainly have made progress through things like the Science and Innovation Cabinet Sub-Committee, the network of Chief Scientific Advisers, having a Science Minister in the Cabinet. These all help—but we have not got as far as to having a clear point of accountability for that balance.

**Q561 Baroness Perry of Southwark:** Does anybody look at it, so speak, post hoc? In the long ago days when I was responsible for the research budget in the Department of Education and Science, we used to say, “The PAC will sort it out. If we have duplicated something that is happening elsewhere, we shall get told off by the PAC”, but that is post hoc. Does anybody now look at the whole thing and say, “Actually there was duplication going on”?

**Lord Drayson:** Yes, I think one of the recommendations which came out of Lord Sainsbury’s *Race to the Top* was the need for an annual innovation report, a yearly report of the progress which is being made and a benchmarking and an assessment of departmental R&D spend. This year’s report will be coming out shortly, and it will be
possible for us to look at that compared to last year’s innovation report and see that analysis. Of course, within individual government departments, in the budgeting process for those departments there is the discussion relating to the relative spend associated with R&D, but there is not an over-arching, cross-government structure to enable this. That has been highlighted as an issue in certain cross-departmental research projects whereby it has taken us some considerable time to get multiple departments to agree. A recent example is the Jason-3 satellite system; a previous example was GMES, Pirbright was another example. The nature of our government system, the sovereignty of individual departments with their own Secretary of State, does not lend itself to an easy process by which multiple departments can reach agreement on cross-cutting research themes.

Q562 Baroness Perry of Southwark: Would an advisory committee help? Would you see a role for an over-arching committee that would oversee this?

Lord Drayson: I think that there is more needed than just an advisory role. We are moving towards a stage whereby the increasing central importance of the science and innovation investment to this country’s future growth requires us to have, I think, additional structures to ensure that this co-ordination is taking place. We have got it at a sector level. The recent decision to create an Executive Agency for Space was partly in response to the recognition that the lack of this co-ordination body was holding Britain back from realising its potential in space. The Office for Life Sciences is another example in life sciences. We are doing it sector by sector, but the argument for something cross-government, I think, is a strong one.

Q563 Lord May of Oxford: As we discussed earlier, it is only in the recent past that we have moved away from what was the system in most of the 1990s where the overall budget was set by a Cabinet sub-committee that took a paper and had a meeting with the John Beddington of the day, as it were, that discussed all R&D spending across the board—the research councils, health, and so on. The reason why this is especially important in times of financial crunch, in my opinion (I declare an interest here, because I am a non-executive director of the Defence Science and Technology Laboratory, which is the remnants of research in MoD following the differential cuts that fell on it in the early 1990s), is the reason that QinetiQ was spun out: there is a general temptation, in my experience, in government departments in times of cuts to see research as a soft target. It is flexible, and that makes it all the more important that there is a powerful central voice that can speak often at what is against the interest of the Secretary of State and the permanent secretary for a given department to explain the need to protect it.

That is more in the nature of a statement than a question, but to my mind it would certainly be advisable to try and recapture that role, particularly at this time.

Lord Drayson: I think you have a very good point. I have seen, in my own experience as Defence Minister, the tendency that you describe. I think that the protection we have in place under the current system, whereby a department that wishes to change its level of investment in R&D has to inform both the Chief Scientific Adviser and the Treasury in advance, is a useful measure, but I believe that it does not go as far as you describe in terms of getting that cross-departmental co-ordination, and I am sure it is the nature of business as well. I have seen it in my own experience in business: there is a danger of short-termism when budgets are under pressure. We need to ensure that we make the case against that. Coming back to defence, I have made sure, and the Secretary of State for Defence has agreed, that there will be no further cuts to the defence R&D budget. I am not aware of any other departments looking at this time to make cuts to their R&D investment, but I think you are right to be worried about the future and we need to ensure that we have the necessary controls in place.

Q564 Lord Oxburgh: Would it be fair to say that we do not actually have a national research budget? What we have is a national research spend, which is the aggregate of a series of separately argued budgets.

Lord Drayson: Yes.

Q565 Lord Oxburgh: I think it is important that that be established. The second thing is, are not the departmental research budgets, apart from BIS, a little bit different, in the sense (I speak with MoD experience here) that there is strong competition within the department for expenditure and, fundamentally, you can only justify research spending within a department in so far as you can argue that that work would not be done in industry or by others outside, and, in that sense, it is quite difficult for an over-arching body to say that the department got it wrong?

Lord Drayson: I accept that point. I think, however, that it is still important to have a mechanism across government to ensure that there is a discussion about the balance of investment within a department towards R&D as part of a sense of national co-ordination. The mechanism should also ensure that, where investment is required across a number of different departments for particular areas of research—climate change is a key point—the research community feels supported within a specific department, it feels that it has a body that it can interface with apart from its own department when discussing these issues so that it is not just a
conversation which takes place inside the department but it takes place outside as well.

Q566 Lord Oxburgh: In my former role as CSA in the Ministry of Defence, I would have welcomed the existence of such a body, having fought, unsuccessfully at times, to protect the research budget, and it would have been quite comforting to have had some support.

Lord Drayson: We do have a mechanism. The mechanism of the ED(SI) Committee—John Beddington regularly attends that committee, you have ministers from many departments on that committee; it is chaired by the Science Minister—is a useful forum. The question is whether or not the powers of that committee can be changed to facilitate this in the future. This is something which has been discussed by the members of the committee. It is a question which I believe needs to be revisited.

Q567 Lord Oxburgh: Would you agree that you cannot simply externally overturn the department’s priorities, but it probably would be useful to have an external group commenting at the Treasury stage of evaluation that “it looks to us as if this particular department has put too much of their savings into the research budget area”? It seems to me that is about all that can be done, but I think it would be useful. Would you agree with that?

Lord Drayson: Yes, it would be useful.

Q568 Lord O’Neill of Clackmannan: Following up on this, would it also be helpful to have in the public domain quite clearly what the whole of the science spend was and, albeit retrospectively—I think it is the point that Lady Perry made by about the PAC—we could finger the departments which have used the research budget to fund other activities? If the figures could be obtained sufficiently quickly, it might mean that within 18 months the damage could be corrected, or that pressure could be put on them by saying, “Look, you are endangering areas of research because of the way in which you plundered this budget in order to finance something else”. Is there not a case for a clearer statistical statement, a quantitative statement, of the expenditure on research across the Government that we could get in our hands in a semi-intelligible form given that it is likely to be obfuscated by those who obfuscate?

Lord Drayson: I think it would be very helpful to do that. I also think that the Government has responded strongly to the downturn by making investments through, for example, the Strategic Investment Fund. That is another line of investment which is quite complex to analyse, because it has within it a number of different types of projects which are supported, but it is a significant amount of money (£950 million), the majority of which I think one would describe genuinely as investment in science and technology. Having a mechanism by which all of these lines are brought together to provide a clear sense across the UK piece would be of real value.

Chairman: We want to move to the issue of how you handle grand challenges.

Q569 Lord Oxburgh: Grand challenges are certainly there at the present. They cut across many of the disciplinary boundaries of the traditional disciplines, and clearly this has been recognised to some extent by the system so far. How should one actually identify these? Where should the decision be made that such-and-such is a grand challenge and how much should be spent on it? How do you see a process working for that?

Lord Drayson: The most clear experience that I have had as a minister of using this technique was within the Ministry of Defence. That was the Ministry of Defence identifying and calling it a grand challenge to leverage an awareness, first of all, of what it regarded as a very significant problem—providing soldiers patrolling urban environments in a war zone with information in real time. Defining that as a grand challenge and publicising it enabled the scientific community outside the normal defence sphere to, firstly, become aware of it—and, as I described it at the time, if you talk to scientists and engineers about a problem, they cannot help themselves thinking about solutions. We found this led to a really dramatic increase in the collaborations taking place between university departments. It got a new series of networks going. It got a higher profile of what was regarded as probably the single greatest problem that the MoD S&T community were tackling at that time, and it was very effective in the innovation that it delivered. We are considering running a second one. The answer as to where these things need to come from, I think they need to come up from either the research community itself, the development of a clear sense that there is a need for such a challenge to be identified, together with a sense from a wider community that defining it in this way—the other example is the X PRIZE in the United States—is likely to lead to a higher public profile of this problem, which is likely to engender further investment. I think it is where those two criteria meet.

Q570 Lord Oxburgh: That is a very welcome example. Within a single department, the problem is different from one which is interdepartmental, and it is the interdepartmental ones in particular that bother me. You have to get agreement from a group of disparate parties normally, but, secondly, within a single department there would normally be a champion, someone whose career depended on making this work. Do you think that is important for these interdepartmental challenges? Certainly when
major companies take on a massive collaboration, simply because the project which they are doing is too expensive or too risky for one of the companies to take it on alone, they would normally set up a joint venture company to tackle this, bringing together disparate parties, and the people who were in that joint venture and the leader of that joint venture would know that his or her career would be on the line for this to work or not. I have not so far been able to identify that within the inter-research council grand challenges or collaborations which I have seen so far, and I wonder what your observations are on this; whether something of that kind is needed, effectively, a champion for the project.

**Lord Drayson:** I do believe that it is necessary to have a so-called project champion, an individual who really owns the need and is prepared to invest the time to develop the relationships and, particularly where those relationships are cross-council or cross-departmental, to get a consensus behind the project. I think anything that we can do to facilitate the emergence of those champions rather than being top down and directed would be welcome.

**Q571 Lord Oxburgh:** You are familiar, I am sure, with the ARPA and DARPA model of doing things, which was, essentially, identifying a champion for the project and giving them an advisory council and a very large budget.

**Lord Drayson:** Yes.

**Q572 Lord Oxburgh:** Do you see any scope for that?

**Lord Drayson:** Yes, I do. I personally found the DARPA challenges really quite inspiring. That was the model that we used; we used the DARPA model as the model for the MoD grand challenge. We could also point to things that have been done within the Technology Strategy Board and the innovation platforms. The role of the Technology Strategy Board, in a way, is to have individuals who champion a particular area of innovation, but I think that encouraging this thinking within departments themselves, but with an expectation that where that area of challenge is cross-departmental, a person would build the links and then champion and then argue for the budgets. One of the greatest challenges that the head of the civil service is going to have to address in the future is how to make cross-departmental budgets work more effectively. That is not just a research requirement; I think that generally, in terms of the machinery of government for future efficiencies, is going to be important.

**Q573 Lord May of Oxford:** Are you saying that if it is DARPA, there is the fund of money and then people collaborate; whereas if it is cross-departmental, everybody can get together and agree to do it but, equally, they will agree that the other department should pay for it? That is my experience.

**Lord Drayson:** Precisely.

**Lord May of Oxford:** That is my experience.

**Chairman:** We look forward to the identification of those wizards who will actually carry this job forward!

**Q574 Lord Krebs:** Minister, may I come back to something you mentioned earlier on, which was the role of impact in prioritising research areas? I wonder if you could tell us about your position on the use of impact to prioritise within research councils for individual research grants, because we have heard from various witnesses that impact statements are requested by research councils on grant applications, and also at the macro level of the allocation of the science budget across areas?

**Lord Drayson:** Certainly. This issue of impact goes to the heart of the debate that we have been increasingly having in terms of the balance of funding defined by different parties—as to whether it is pure or applied, whether it is within the ring-fenced science budget or about investment outside. Often when people talk about impact they are talking about economic impact. My position on this is that the UK has benefited from a significant increase in investment in research over the past 10 years or so, which has led to a transformation in our science base that is reflected in the outputs that we are now achieving. I am sure the Committee agrees that the quality of science in the UK is extremely high, and the level of productivity from our science base is also extremely high, but that the funding from that is increasingly going to be under pressure in more difficult economic circumstances and, therefore, there is going to be a greater focus on how, in the future, the United Kingdom is going to be able to afford to pay for public spending in all of its forms. The science budget is going to be part of that. Therefore, there is a question as to how we can ensure that we maintain our investment in science whilst making sure that that clear success, the fantastically strong asset that we have within our science base, is better exploited to deliver economic growth in the future. I do believe that, although over the past 10 years or so there has been a transformation and improvement in our ability to translate leadership in science into commercial success, we have not gone far enough, and so, going forward, I believe we need an assessment of research impact, firstly, to ensure that we maintain the emphasis upon investment in excellence in science and we maintain the improvements that we have made in the translation of that science, but I believe we have to make a step-change improvement in the generation of economic growth. We still see too many occasions whereby we have funded excellent science from the public purse.
which has then gone on to be commercialised outside the United Kingdom. We are seeing it now even in some of the latest research which is taking place in terms of synthetic biology, for example, and really in the future we do need to fix this problem. When we try to fix the problem, what we find is that we have a lack of data because we have not collected in the past information relating to impact of scientific research. So, as Science Minister, I cannot go to civil servants within their department and ask them to provide me with a briefing which I can then take to the Treasury to make the case for continued and increased investment in science and research, because those data do not exist. Therefore, I believe there is a real value both in terms of ensuring that in future we do have such data but also in terms of addressing what I believe is the key challenge for us going forward—to maintain the emphasis on excellence in research and maintain our position in pure research but improve the translation of that into economic growth. Therefore, I do believe that assessment of research impact is key to that.

Q575 Lord Krebs: Could I follow up on that and check that I have understood your position? The involvement of impact, whether it is assessing retrospectively or prospectively, is not so much about picking winners, I think I understood you to be saying, but it is about both raising awareness of a possible application of research amongst the scientific community but also, retrospectively, making the case to the Treasury that past investment, even with a very long time lag—because we know the time lags are in the range of 10 to 25 years—has led to economic benefits. That is what I understand you to be saying.

Lord Drayson: Yes, that is correct. As Lord May described, history teaches us that under tighter financial circumstances people are going to raise questions about whether or not they can trade investment in long-term areas of expenditure, like science and research, for more short-term priorities which may be regarded by some as having greater urgency. We need to be able robustly to prove, in so far as the data enable us to do that, that investment in science delivers fundamentally important strength to this nation. I believe that the fact that, in common with many other countries, we have not been recording that information in a coherent way means that we are not in a position to do that. You cannot just evangelise about this; you do need to be able to point to some hard figures where necessary. I also think culturally we have to ask ourselves what more we can do to encourage the scientific community, when thinking about the research which it is undertaking, so that we are doing everything we can to ensure that science leads to economic growth and jobs here in the United Kingdom.

Q576 Chairman: Presumably part of the measurement of previous impact will include, in the light of what you said earlier, the fact that the impact was sometimes in another country.

Lord Drayson: Yes.

Chairman: I could give you some classic examples of that. That then leads to questions of diagnoses of why. But the measurement of impact is not simply on the British economy, it is that there has been knowledge transfer, sadly, sometimes elsewhere.

Q577 Baroness Perry of Southwark: Minister, you have answered the question from Lord Krebs entirely in terms of what government can do, and it is right in your position that you should, but would you not accept that the translation of research into entrepreneurial activity generating wealth for this country is much more to do with what universities do inside themselves, within their own incentives and climate—what some people called the Hermann Hauser argument? Stanford in the United States has generated trillions, I think, in terms of its spin-off research, and that is much more the way in which the university itself decided to structure itself. No government, either at state or federal level, intervened in that: it was an internal matter for the university. Presumably, as government, you should stimulate and encourage, but it was not done with government diktat or government policy or government money: it was done entirely, as I said, within the university’s own climate.

Lord Drayson: I can remember the environment in this country in the early 1990s still at that stage not being particularly conducive to the commercialisation of science, and it is absolutely transformed now. I think that we have really seen a change here in the United Kingdom, but what is the challenge for us now? We are seeing very good numbers of spin-offs being created for our universities. The challenge for us now is that recent research tells us, for example, carried out by NESTA, that a small number of companies deliver a disproportionately large impact on economic growth, and what we need our universities to be able to do is effectively to gestate the businesses with the greatest potential further such that they have the ability to grow to have a bigger effect. The difference between what we are seeing in the United Kingdom and what the best universities, particularly associated with the Silicon Valley in the United States, are achieving is that we are not getting enough blockbuster businesses developing here in the United Kingdom. We are getting good numbers of spin-outs coming out of our universities; we need to see a larger proportion of those growing to be very significant companies and, as we need to rebalance our economy because of the credit crunch, this is quite an urgent policy shift which we need to achieve.
**Q578 Lord Krebs:** Minister, could I come back on this. We heard from one witness in an earlier session that the real impact on the economy of funding basic research in universities is the people rather than the particular projects and that that is where wealth and well-being in the country will start—from well-trained and well-educated, talented and innovative people. Is that a key part of impact—the production of people—or is this about the production of results in a particular area?

**Lord Drayson:** Yes, it is extremely important. We have a situation where the UK is number two in the world in terms of Nobel Prize winners. I think that for us to continue to be a world leader in science we have to have an environment where the United Kingdom is seen as a very attractive place to be a scientist, to carry out scientific research. We need to pay attention to policies which ensure that that know-how embodied in individuals is recycled within the United Kingdom. That requires us to have a facility for people to collaborate internationally, to be seen as an open part of the global scientific community, but to make sure that we have got measures which encourage people to develop their careers as scientists and science entrepreneurs here in the United Kingdom. It is not just about the projects; it is about the people. You need measures which ensure the healthy development of both. It is those two together which creates a positive ecosystem for science and innovation.

**Q579 Chairman:** There are clearly different points at which impact can be measured, and one of the signs that we see is that HEFCE are going to start measuring impact. Are they getting right the level at which they will do that, the proportion of funding they will put into it, and do they have the machinery to do it adequately?

**Lord Drayson:** The feedback that HEFCE has had from its consultation, given that this is early days in the process, has been positive—there has been broad support from the learned societies, for example—but I think it is fair to say that people are nervous about this issue. What seems to be the underlying worry is that any assessment of impact prejudices against pure research and that it will lead to an increasing valuation of applied research. There is then an assumption that there is a fixed pot of research money: any more money spent on applied research leads to a reduction in pure research. There is then an assumption that the changes being introduced by HEFCE are important, but it is important for us to make the point to the community that those two budgets I do not believe as being part of a fixed pot. We need to maintain, and if possible grow, our investment in pure research within the science ring-fence. At the same time we need to increase the investment that we are making in the translation of that science through to economic impact.

**Q580 Lord Krebs:** But that does not square with the fact that HEFCE is being cut by a billion over the next three years. Their pot is shrinking, so if they are going to start using impact as one of the allocation mechanisms out of a shrinking pot, surely the consequence is that basic research will suffer in universities through QR funding?

**Lord Drayson:** Whatever the decisions that are made relating to future funding in the next Comprehensive Spending Review, the case that needs to be made, and won, is the case for maintenance of research across the breadth of the research community and, at the same time, an improvement in the pull-through of that research in terms of economic impact. Under proposals from the Treasury in terms of the overall savings that need to be made in the future, the allocation of that has not been decided, so that is an argument which is still to take place in the future CSR. But the important point, I believe, is that we clearly have real strength in our science base in this country. Over the last 10 to 12 years it has been hard fought to achieve that. It is delicate, so the investment must be maintained, but we have got to do better and go further relating to the pull-through to economic impact. Therefore, I believe strongly that the scientific community should not see that emphasis on the pull-through towards economic impact as an attack on the investment in pure science. The two are not related, in my view. They need to be argued separately.

**Q581 Lord Warner:** At the beginning of last year I think you initiated a debate about whether research funding should be more strategic, in particular in relation to areas which in the UK has a competitive advantage. Could you tell us a little about how you see the response to this debate and how it has gone, and what do you think will be the effects of attempts to concentrate research efforts in particular areas further?

**Lord Drayson:** I would say that it certainly raised my profile as Science Minister, because it was not universally seen as a good thing that the Science Minister was raising this question. I believe that it was important to do so, because I do believe that the country is already embarking on the need to make some very important decisions about its future and the prioritisation and allocation of resources to deliver that future. Post the credit crunch, the growing importance of science to future economic prosperity is not as well understood as it needs to be. That is why raising that over a year ago I believe was important then. I still believe it needs to be raised, because I think that it is still not clear to people how we are going to be able to ensure that this fantastic strength which we have in science is translated into jobs and economic
growth to compensate for the loss of GDP growth from financial services which we are going to see in the future. The question about how those decisions are made is about clarity over what the country’s future overall strategic policy is, and within that its industrial policy, and whether or not we are getting the best out of the alignment of that policy to our investment in science and research. A clear example of that, I would say, is in the two areas of life science research and alternative energy. If you take life sciences, for example, it is about us being clear about how we can use the competitive advantage that the National Health Service offers us in terms of being able to undertake certain types of medical research, particularly into stratified medicine, about using that properly and getting an alignment between that and the Health Department budgets. Seeing the Department of Health, the NHS, as an engine of economic growth as well as a deliverer of better healthcare, is a cultural change for that department. Similarly, in terms of energy, getting an alignment between the budgets that DECC has in terms of achieving energy policy and seeing the way in which that budget is deployed as an engine for economic growth is a cultural change for that department. Therefore, I believe that asking the research community to consider these themes and provide feedback to the Government is important. The debate was not about me saying, “I believe these are the priorities. Please allocate your research funding to those priorities”. It was me saying to the research community, “What does the research community believe to be the likely future scenarios the country faces? Where do we believe we have certain strategic competitive advantages and what is the advice from the research community to government about the choices that the Government may make?”

Q582 Lord Warner: Can you say a bit more about mechanisms? What do you see, as a Science Minister, are the sort of mechanisms? You need to do two things really: one is to identify the areas that are strategically economically important for this country; and, second, going back to what you have just said, for example, in the Department of Health, this kind of Leviathan, getting it held to account to deliver in some of those areas which the Government has identified as strategically important.

Lord Drayson: Firstly, it is, essentially, important to have good data for civil servants and ministers to be able to see the facts relating to the trajectory of change within a particular area. For example, it has been very interesting to see the way the attitude to space research, both pure research and more applied research, has changed as a result of a recognition that for the space industry the recession did not happen; it has been growing at something like nine per cent a year over the last ten years; it is forecast to grow at five per cent a year for the next 20 years; satellite manufacturing capacity is sold out for the next five years. That is a recognition of the scientific strength that we have in that particular area of research, and the industrial strength and the numbers behind that have led to a clarity about the inefficient way in which we have hitherto been able to make decisions about research and science projects in space. Effectively, the Science Minister goes around with the cap and argues with each ministry in turn as to why they should contribute, for example, to a new global monitoring satellite for sea-level change (Jason-3)—being unsatisfactory, that is what got the consensus to change to an Executive Agency for Space. In the case of moving the dial in the Department of Health, in the NHS, the recognition there that, under future tougher economic environments, to be able to manage the demographic change that the Department of Health is going to have to face in terms of the ageing population, the expectation that healthcare will continue to improve in terms of standards, the only way to achieve both of those things in that environment is to have a greater degree of innovation, and that means better co-ordination of the research, both public and private. That has led to mechanisms like OSCHR, but OSCHR did not have a specific budget to deploy. The reason the Office for Life Sciences has been able to achieve as much as it has through the last year in the co-ordination of public and private research in health is because the Chief Executive of the NHS absolutely sees that he has to achieve a greater degree of innovation across the NHS system and therefore sees this as part of the answer to the problem that he has. I actually think that the economic pressure in some way is a lever to the Science Minister to help ensure that science innovation policy is more central to the departments’ agenda in the future, because they are going to have to be able to deliver more with what they have.

Q583 Lord Warner: That sounds almost like trying to put the Science Minister in the Treasury to drive some of the change.

Lord Drayson: I think having a Science Minister who has the ability to influence decisions across government is central to this. One of the things I have noticed is the difference in my ability to be able to influence departments. For example, being a joint minister with the Ministry of Defence makes it easier to convince civil servants within the Ministry of Defence about the importance of maintaining science investment in the Ministry of Defence than it would be in a department for which I am not a minister. The way in which ministers are able to effect change across multiple departments, I believe, is absolutely key to solving this, finding a way of achieving that.

Chairman: Lord Oxburgh has a supplementary, and then we have one last question from Lord O’Neill.
Q584 Lord Oxburgh: Let us say that you are successful in all these initiatives to make the UK an ideal place for industry of various kinds to do its research. How in this globalised world do we actually ensure that the benefits of that research are captured for the UK economy? Take pharmaceuticals for example. Let us say that this is where the research is done, where the clinical trials are carried out maybe. Ultimately, the money is going to come in sales of the drug worldwide. But if the company is off-shore, the taxation benefits and some of the employment benefits will simply be somewhere else.

Lord Drayson: The answer is to be intelligent as a government as to where we can intervene with taxation policy in the innovation process and use our strength. I believe that the new proposal of the patent box is just such a policy, because our strength is, first of all, world-class leadership in so many disciplines of science. An ability to translate that through to commercial product is often where another government comes in and offers a significant grant to set up the prototype manufacturing facility in another country—Plastic Electronics being, unfortunately, an example of that. The idea of the patent box is that where a patent is filed and located in the United Kingdom and then a product is developed and then manufactured in the United Kingdom, the taxation on that product will be 10 per cent, ie significantly less than the normal corporation tax. The feedback that we have had from companies that patent products—is of course, not all business do do that—is that that is a very effective way of generating stickiness of the innovation to the United Kingdom. What we have learnt with, for example, carbon composite formed wings is that once you have built a prototype manufacturing facility you probably do not want to move it. What is important is that the first manufacturing facility is located here in the United Kingdom, and we develop that expertise, that supply chain, in support of that facility. That is a recent change of taxation policy specifically designed to do that. The other is to make the UK a great place for science entrepreneurs to be based and to want to stay, and I think that is the other side to the coin. It is not just about projects, it is also about people.

Q585 Lord O’Neill of Clackmannan: Can I ask a couple of questions about public service agreements? How do you feel about the department’s capability to show that, in the first instance, the policies are evidence-based and that they are able to monitor them with sufficient rigor to ensure that they are actually delivering on them? Indeed, are you satisfied that the delivery boards themselves have sufficiently well-qualified personnel with the analytical skills to assess properly the level of performance at the end of the day?

Lord Drayson: I think that the introduction of PSAs is to be welcomed. I think that the implementation of the policy of departments having Chief Scientific Advisers—I would like to see the Treasury having a chief scientific adviser as well—is to be welcomed: it is an improvement, but we are also seeing a need to go further, and we are prototyping, so to speak, an approach within my department, the Department for Business, the concept of technology and scientific assessment of the projects alongside their economic analysis. I would like to see this rolled out into other departments. I would like us to get to the position whereby when a minister has a submission within a government department relating to particular investment, relating to a PSA target, as well as it having an economic assessment from the economist as to its value for money, which it does have to do, it also has an assessment from the science and engineering group within that department as to its effectiveness from a scientific and engineering standpoint. I believe that raising the quality of assessment on the science and engineering side to match the assessment which is done economically is key to taking a further leap.

Q586 Lord O’Neill of Clackmannan: Do I take it from that that at the moment not all departments are doing that with sufficient rigor and with the appropriate personnel to get the proper scientific and economic analysis done?

Lord Drayson: Yes, we have made a lot of progress. We have agreed that we need to do this within BIS: we need to set the example within BIS of this prototype approach, but I would certainly like to see this rolled out within other departments.

Q587 Lord O’Neill of Clackmannan: Could you tell us, perhaps in writing, which departments you consider are doing that and other ones where there is still something requiring to be done?

Lord Drayson: I am happy to do that.

Q588 Chairman: I think we have used our time, and, with your help, we have used it very well. Thank you very much for your time and for your answers, including a one-word answer of “Yes”, which we are quite inexperienced with dealing with, especially from a minister, so thank you very much for that. If there are any points you feel you want to amplify or that we have not covered properly, do please let us have a note, and the transcript will be with you shortly. Thank you very much indeed.

Lord Drayson: Thank you very much, Lord Chairman.
Written Evidence

Letter from the Academy of Medical Sciences

SETTING OF SCIENCE AND TECHNOLOGY RESEARCH FUNDING PRIORITIES

The Committee’s inquiry is particularly timely given the expected pressure on research budgets in the next spending review. Rather than respond in detail we have taken the opportunity to highlight examples from the medical science and health arena that might inform your inquiry and provide useful case studies. We would be happy to provide additional information or suggest appropriate witnesses as your inquiry progresses. The Academy is currently developing its priorities for an incoming Government. I think that you will find elements of this document useful for your inquiry and I will ensure that you are sent a copy when it is published later this year.

The proposal in the 2006 Budget statement to create a single, ring-fenced budget to support UK health research prompted much discussion about: the balance between targeted versus response-mode funding; how to maximise the translational benefits of response-mode funding; and how to improve the value of research being commissioned by Government Departments (in this case the Department of Health). Many of the issues raised during this debate apply to other science areas and are still relevant. The establishment of the National Institute for Health Research (NIHR) and the Office for the Strategic Coordination of Health Research (OSCHR) (which brings together NIHR and the Medical Research Council (MRC)) is generally regarded as having strengthened the research environment for medical science in the UK. This model would be worthy of examination by the Committee. The recent emphasis on quality and innovation in Lord Darzi’s NHS Next Stage Review also puts science at the forefront of the health service: the proposed Health Education and Innovation Clusters (HEICs) and Academic Health Science Centres will provide opportunities to establish regional policies around health science which both harness regional expertise and address local needs.

While we support these recent developments, we emphasise that OSCHR, NIHR and MRC (and indeed all research councils and science funders) must defend the Haldane principle to protect the independence of the research agenda from short-term political pressures. The balance of funding for different research areas will vary over time and should be influenced by societal need and determined by scientific opportunity—creative ideas, talented researchers, and advances in technology. We have always stressed the need for continued basic research to fuel the pipeline for translational exploitation. We caution against too great a reliance on a top-down approach to setting research priorities. No amount of “consumer desire” will overcome the practical reality that important health problems are often very difficult, or impossible, to address with existing approaches. Furthermore, some of the most significant medical advances have emerged from research on low incidence conditions with widely applicable mechanisms.

We welcome the Committee’s interest in how publicly funded research is aligned and co-ordinated with non-publicly funded research. The charity sector is a major funder of medical research in the UK. We would like to draw the Committee’s attention to the work of the UK Clinical Research Collaboration (UKCRC) that brings together the NHS, research funders, industry, regulatory bodies, Royal Colleges, patient groups and academia. UKCRC provides a forum to coordinate the activities of funding bodies and seeks to develop an evidence base to inform strategic planning.

Sir Gus O’Donnell, the Cabinet Secretary, recently suggested that cross-departmental issues will increasingly have their own budgets. A number of these are likely to be health related, such as obesity or ageing. The Committee might like to consider the implications of developments in this direction as it investigates how research is commissioned and coordinated within and across Government.

I hope that this short submission is helpful. Please do not hesitate to contact the Academy’s Director of Medical Science Policy, Dr Rachel Quinn (rachel.quinn@acmedsci.ac.uk; 020 79695305), if you require additional information or suggestions of suitable witnesses.

I wish you the best with this important inquiry.

September 2009
Memorandum by the Advisory Committee on the Safety of Blood, Tissue and Organs (SaBTO)

RESPONSE TO HOUSE OF LORDS SCIENCE AND TECHNOLOGY COMMITTEE

CALL FOR EVIDENCE

The Advisory Committee on the Safety of Blood, Tissues and Organs (SaBTO) advises Ministers of the UK Government and the Devolved Administrations as well as UK Health Departments on the most appropriate ways to ensure the safety of blood, cells, tissues and organs for transfusion/transplantation. Its remit includes providing independent advice on the microbiological safety of gametes and stem cells, in liaison with the relevant regulatory authorities, and risk management options for Ministers and UK Health Departments to consider.

SaBTO does not fund research; however, we are actively interested in research with a direct relevance to the work of the committee, and to the safety of recipients of blood, tissues, organs and cells. As such, we have asked for preliminary and final results of research from government agencies such as NHSBT and HPA as well as relevant research from major academic institutions that are involved in relevant research. This information forms the basis of our decision-making platform.

Much of SaBTO’s focus over the first two years of its existence has been on protecting the blood supply from vCJD. Nearly three million units of blood components are issued annually in the UK, and it is well established that vCJD can be transmitted through blood transfusion if the donor is infected.

The challenges of protecting the blood supply for vCJD are many and complex.

1. We do not know the prevalence of vCJD in the population;
2. We do not know if carriers of the disease who may be pre- or sub-clinical can pass it on through blood donations;
3. We do not know if different people have different susceptibility to developing vCJD following exposure to the abnormal prion;
4. We do not know how much of the abnormal prion the recipient would have to receive in order to develop clinical vCJD.

These uncertainties make management of this potential problem very challenging. For any intervention, SaBTO must consider its scientific basis, its potential clinical benefits, the effect the measure may have on blood supplies, and the cost-effectiveness of such an approach. With so many unknowns, decision-making can be very difficult. Many of the recommendations on vCJD and blood, taken by SaBTO and its predecessor committees, have therefore been on a precautionary basis. It may be that some measures are unnecessary; however, while so many uncertainties exist, it is unlikely that any will be relaxed. This of course has a high financial cost. SaBTO may therefore be making hugely complex recommendations on public health without having complete fundamental information.

The HoL STC intends to focus on:

— How decisions are made to fund research to meet societal needs
— The balance of funding for targeted versus unsolicited response-mode curiosity-driven research and
— How research is commissioned in Government departments and agencies

On these points:

— SaBTO, as a scientific advisory committee, must be seen to be making decisions based on robust scientific information whenever possible. Departments asking for advice from scientific advisory committees must, where possible, identify and provide information to aid the committee’s deliberations. This requires sourcing and assessment of the information in relation to the questions asked by the scientific committee;

— “Societal needs” must be clearly defined. The make-up and terms of reference of advisory committees should dovetail with these needs and therefore the research that is being prioritised. In SaBTO’s case, the committee’s priority is the safety of those receiving blood, tissues and organs, not least as such treatment is generally necessitated by illness. Beyond this, general public safety (for example, in relation to a disease such as vCJD) must be taken into account by a committee where an intervention recommended for a small number of individuals has an impact on the whole community;

— Direct research into patient safety is challenging;

— Identifying areas of economic importance for research may not be straightforward. For example, a lack of knowledge on the various aspects of vCJD may result in precautionary measures that divert money from other important areas of healthcare;
— Certain aspects of research relevant to SaBTO have been developed by the private sector; as such the research may need full independent verification before implementation of an intervention. Private companies have a legitimate interest in the outcomes of advisory committee deliberations but decisions should lie with the committee alone;

— Government agencies (such as NHS Blood & Transplant and Health Protection Agency) must have the resource to carry out research at the behest of advisory committees if those committees are to base their decisions on a sound scientific platform;

— SaBTO’s terms of reference states that the committee will “identify where research to reduce uncertainty is most urgently required, and where possible identify specific research needs”. It is quite right that independent advisory committees are empowered to do this, but it is important that there is a mechanism in place to monitor progress.

In summary, independent advisory committees are important stakeholders for research. Their involvement at an early stage of commissioning research is important in ensuring that such research is relevant to areas of interest as identified by such committees. This approach would ensure that the advice from such committees is based on the best possible evidence. Committees like SaBTO are well-placed to comment on research needs. Departments often seek advice from such expert committees on research needs and in turn feedback to committees on progress with studies should be an important part of the process.

September 2009

Letter from the Alzheimer’s Society

SETTING SCIENCE AND TECHNOLOGY RESEARCH FUNDING PRIORITIES

The Society is pleased to respond to the Committee’s call for evidence. We believe that dementia must be given higher priority when allocating funds for science and technology research because of the extremely high costs attached to the condition in terms of resources and quality of life. Our response focuses on the current issues around research into dementia.

ABOUT THE SOCIETY

1. Alzheimer’s Society is the leading care and research charity for people with dementia, their families and carers. It is a national membership organisation and works through nearly 300 branches and support groups. It provides helplines and support for carers, runs quality day and home care, funds medical and scientific research and gives financial help to families in need. It campaigns for improved health and social services and greater public understanding of all aspects of dementia.

WHY DEMENTIA NEEDS TO BE A UK RESEARCH PRIORITY

2. There are 700,000 people living with dementia in the UK alone. This number is expected to rise to over one million in 2025.¹ The human and economic cost of dementia is vast and will only continue to grow. The cost to the UK of dementia is £17 billion per annum, and the King’s Fund estimates this will rise to over £25 billion by 2018.²³ This is greater than the cost of stroke, cancer and heart disease combined.

3. As one of the biggest health issues of the 21st Century, research funding priorities must change to ensure that dementia is given the necessary focus within medical research. The burden of illness created by dementia is huge compared to the amount of money that currently goes into researching the condition. Research into effective care practices can help ensure resources are effectively targeted. Research into cause and cure is essential to make effective treatments or preventative measures a reality.

NATIONAL DEMENTIA STRATEGY AND RESEARCH

4. England’s recently launched National Dementia Strategy Living Well With Dementia is momentous opportunity to change the lives of people with dementia. We welcome the reference to “a clear picture of research evidence and needs” in objective 16, but await to see how this will be delivered in practice.⁴

5. The Medical Research Council (MRC) and Department of Health held a National Dementia Research Summit in July 2009. The Society welcomed this, but it must lead to appropriate co-ordination, prioritisation and investment to drive forward the dementia research that will improve treatment and care for people with dementia over the next five years and beyond.

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¹ Alzheimer’s Society (2007) Dementia UK, a report to the Alzheimer’s Society by King’s College London and the London School of Economics, London.
² Ibid.
BETTER PUBLIC INVESTMENT IN DEMENTIA RESEARCH

6. Currently, government only invests 2.5 per cent of its medical research budget on dementia, compared to a third on cancer. Alzheimer’s Society and Alzheimer’s Research Trust released a joint statement on dementia research “Defeating dementia through research” in June 2009—the statement called on the government to commit to a national strategy on dementia research and triple annual investment to £96 million within five years. In the current financial context this would be best achieved by reprioritising the current government research spend. I have attached a copy of the briefing to this submission. (Submitted but not printed)

MORE FOCUS ON TRANSLATIONAL RESEARCH

7. Alzheimer’s Society is dedicated to research into the underlying causes of dementia with the goal of developing new treatments. This process relies on the translation of basic scientific research into design of new drugs followed by rigorous testing through clinical trials. It is essential that we invest in this “bench to bedside” approach to dementia research in the hope of finding a cure for the future. This can also be applied to research into care practice to allow us to provide the best quality of life for people with dementia today.

CONSUMER INVOLVEMENT IN RESEARCH

8. We firmly believe that there must be input from consumers in the setting of research priorities. Quality Research in Dementia (QRD) is the award winning research grants programme of the Alzheimer’s Society. The programme concentrates on three key areas of research—cause, cure and care. The heart of the QRD is the QRD consumer network: a network of 170 carers, former carers and people with dementia who play a full role in the research programme and help set priorities for our research programme. They are supported by a team of specialist staff at the Society, who have wide-ranging expertise in the field of dementia research. We believe that the involvement of people with dementia and their carers will lead to better quality research.

THE CHARITY PERSPECTIVE

9. In addition to this submission, the Society has also responded to a survey by Association of Medical Research Charities (AMRC) on research funding priorities. We fully endorse AMRC’s submission. We would urge this inquiry to focus on issues such as full Economic Costs (fEC) and Charity Research Support Fund (CRSF), which has implications for research funding into dementia and other conditions.

I hope these comments are helpful. I would be pleased to answer any questions or offer any further advice.

September 2009

Memorandum by Aporia

SUMMARY

The goal of setting possible funding priorities is recognised as fundamentally problematic because in order to do the work of prioritising, we would require a standardised a priori sense of timing. Given that we do not know what may turn out to be useful—and when, and where—in advance of it actually being used, doing the work of prioritising what should be useful a priori for funding purposes becomes, literally, a waste of time. On the other hand, being seen to do the work of prioritising—and being credibly (or even incredibly) depended upon to do so as a result—has given rise to its own derivative set of problems. It is here where Aporia’s approach to such research is for research to be conducted for public good. In particular, Aporia’s pro bono approach to such research does not demand funding prior to the work being done. Aporia itself takes on the risk of getting the timing of its research “wrong” according to the status quo, and carrying the cost of that research until such a time when it may become useful. Note that the “cost” of doing that research may or may not be financially defined, or even financially relevant, depending on how Aporia manages to sustain itself in the intervening period. Here, it is important to distinguish between the term “sustainability” as linked to labour standards and originating in development economics, and the more recent use of the term with regards a perceived goal of financial sustainability. In this sense, public funds for science and technology are being increasing allocated on the basis of financial sustainability. Unfortunately, a goal of financial sustainability renders scholarly impartiality potentially unsustainable—in the development economic sense—and here lies the root of one of our current inefficiencies in research funding allocation. The Haldane Principle and its (missed) understanding is a case in
point. In order for the Bills that pass through both Houses to be researched by the Parliamentary Library and Research Clerks of each House, before individual Members and/or Peers have a chance to take their own politically informed stances on the same, it is critical that the research produced by said Parliamentary Clerks is as scholarly impartial as humanly possible. If the Haldane distinction between “research work of general use” and “research work supervised by administrative departments” is not appreciated, we run the constant risk that public funding may be administrated in ways that systematically support only the incumbent administration’s body politic without any known cause for redress. Over time, the corpus of publicly funded research available for Parliamentary Clerks to draw upon, with a due eye for scholarly impartiality, begins to contract. It is Aporia’s understanding that we have been in the midst of such a contraction and can only now hope to be on the verge of reversing this trend, perhaps, by means of this very inquiry.

3. As such, existing objectives and mechanisms for the allocation of public funds for research are not entirely appropriate, and some changes may well be necessary. Aporia has been actively drawing on the emerging findings of its WHiSPeRING GaLLeRY—openly and anonymously accessible at http://aprioriasofar.wordpress.com—in order to sound out the sorts of tweaking that may serve us in transition⁹.

4. In particular, the WHiSPeRING GaLLeRY serves to document some of the tensions that have arisen around what is currently governing the allocation of funding for Government policy-directed research through Government departmental and agency initiatives. For example, incidents of pro bono research data being intentionally hidden from public access using existing mechanisms without realising that such mechanisms are no longer appropriate for covertly enforcing the same. Aporia welcomes the opportunity to give oral evidence on this and related “practices-in-transition” in due course. In addition, Aporia has come to appreciate the role of Departmental Chief Scientific Advisors in principle, as the fact of their existence provides a timely channel for concerns of scholarly impartiality to begin to be addressed, both domestically and/or internationally as the case may turn out to be⁸.

5. Arguably, the responsibility for ensuring research gaps to meet policy needs are filled falls on each and every one of us, including the need for adequate scrutiny of precisely those policies in the first place. Aporia needs no more incentive to do this other than for public good—what other incentive can there possibly be? (And this is not a rhetorical question). Conversely, filling those gaps pose a constant challenge, including the mechanisms available for conveying the intelligence gathered as a submittable form of evidence. For example, this present inquiry has called for written evidence “preferably by email (as a Word document)”. Although Aporia is aware that the House has been experimenting with video-based submissions, it would have been helpful to have had this option at this stage. This is because the intelligence currently being maintained in the form of Aporia’s WHiSPeRING GaLLeRY is interactive and cannot be translated into written text without losing the necessary phenomena of the evidence-in-use. A video-based submission format would have permitted us to have at least provided an introductory tour to the GaLLeRY by way of “screencasting”, as an intermediate step perhaps, with regards assessing the possible value of an associated oral evidence session in due course. As it stands, the technological innovation being used to work through the sorts of tensions that have arisen in practice over the past 33-months—and for which the present inquiry calls for evidence of—remains somewhat hidden from immediate Parliamentary archival view. In this sense, Aporia would be happy to help take the relevant pilot studies forward, either by way of widening forms of participating in this present inquiry or under separate, albeit related, cover at the earliest opportunity. 

September 2009

References

i Standardising timing is a non trivial problem, and perhaps an aside may help here, which originally arose during a discussion of a colleague’s paper given at the conference of “Mind and Society 16—Ethnography and New Technology: Current Debates”, Manchester, 4–5 September 2009. When the technology of the telegraph was first used to support a desired co-ordination of the running of trains across the UK, a problem arose around the fact that the local time that a train would pull into a station would be significantly different from the time showing at the station from whence the train had departed. So, it was agreed that time across the country would be standardised to London time so that a train timetable could be used to consistently co-ordinate trains arriving and departing at various stations throughout the land. Apparently the difference between London and Bristol can be up to seven minutes, and this has more recently been posing its own set of problems with regards our attempting to co-ordinate our activities online and across broader dimensions of co-operative working in general.

ii Aporia was incorporated in 1998 to support scholarly research and development activity for social purpose.

iv Aporia’s WHiSPeRING GaLLeRY has been curated over the past 33-months involving participation across a range of specialist communities and their respective UK Higher Education and research funding bodies. As a result, the research dataset underpinning the GaLLeRY has so far been used to inform responses to UK Government consultations on the topics of: good complaints handling; science and society; the patent research exception; and the governance of good research conduct. Amongst other things, the GaLLeRY and dataset are currently being prepared for re-use at the request of other research communities, and for re-purposing as a teaching resource for courses at postgraduate level.

v This became warmly apparent amongst the delegation, which included both scientists and diplomats from across the continents in the same room for a first time, during the Royal Society discussion meeting on “New Frontiers in Science Diplomacy” in London, 1–2 June 2009.

Memorandum by the Biosciences Federation and Institute of Biology

INTRODUCTION

The Biosciences Federation (BSF) is a single authority representing the UK’s biological expertise, providing independent opinion to inform public policy and promoting the advancement of the biosciences. The Federation was established in 2002, and is actively working to influence policy and strategy in biology-based research—including funding and the interface with other disciplines—and in school and university teaching. It is also concerned about the translation of research into benefits for society, and about the impact of legislation and regulations on the ability of those working in teaching and research to deliver effectively. The Federation brings together the strengths of 45 member organisations (plus nine associate members), including the Institute of Biology (IoB).

The Institute of Biology is an independent and charitable body charged by Royal Charter to further the study and application of the UK’s biology and allied biosciences. It has 12,000 individual members and represents 36 additional affiliated societies. This represents a cumulative membership of over 65,000 individuals, covering the full spectrum of biosciences from physiology and neuroscience, biochemistry and microbiology, to ecology, taxonomy and environmental science.

In October 2009, IoB and BSF will come together as a single organisation, the Society of Biology.

This response was developed through consultation with our science policy committees, representatives of BSF’s member organisations and IoB’s affiliated societies and branches.

What is the overall objective of publicly-funded science and technology research?

1. Science underpins much of what we value but take for granted in society. It is essential for advanced societies competing in a globalised world and is too important to be left to short-term market interests alone. Long-term public sector investment is necessary to generate new knowledge, some of which may have commercial potential; to provide ideas and inspiration for all; to support strategic and innovative research that the market doesn’t provide; to train a skilled workforce; to sustain a critical mass of activity and expertise in key areas (eg taxonomy) which the private sector does not supply; to nurture multi- and inter-disciplinary research; to inform public policy and risk assessments; to meet our international obligations; and to create and maintain long-term datasets.

2. Even in areas well supported by commercial companies, for example in drug development, public research is often also needed.

How are public funds for science and technology research allocated? Who is involved at each level and what principles apply? Where appropriate, is the Haldane Principle being upheld?

3. The main mechanism, which has proven its value over many years, is the dual funding mechanism of Research Councils (RCs) and Higher Education Funding Councils. There have been many discussions in the past over whether these should be merged into one mechanism. But the current system, although not perfect, provides flexibility for researchers and institutions in accessing funds. However the Haldane Principle which has been core to RCs has come under significant pressure in the last few decades as the economic value of science has been recognised, with the funding bodies being under pressure by Government to allocate funding through directed modes.

4. A disproportionate amount of funding for science is being held by centralised Government departments, where it is perceived (in UK academia and in the commercial sector and overseas) as being allocated in a directed mode by non-scientists, and without transparent peer review processes, thus potentially further undermining the Haldane Principle and potentially limiting the value of the UK science base.
Are existing objectives and mechanisms for the allocation of public funds for research appropriate? If not, what changes are necessary?

5. Our long running concerns over the replacement for the Research Assessment Exercise (RAE) may be relevant here. The old system was very labour intensive for universities and we would welcome a less time-consuming but nonetheless rigorous assessment of Universities for research and other activities eg teaching. However, although increased use of bibliometrics has often been touted as a solution, these have inherent biases, and should be used to inform the assessment process, not drive it. Peer review remains essential and should be as transparent as possible. The system should be as unbureaucratic as possible.

What governs the allocation of funding for Government policy-directed research through Government departmental and agency initiatives? Are existing mechanisms appropriate? What is the role of Departmental Chief Scientific Advisers?

6. We have serious concerns that the civil service has a reputation, whether deserved or not, of not hiring or deploying enough excellent science graduates and science experts to inform this process.

7. Departmental Chief Scientific Advisors (CSAs) generally have a good reputation and have helped in the process. But how much influence and backing do they really have in large Government Departments? Departments managed by CSAs are often under resourced, and employ temporary or casual staff. Employment of and engagement with competent and respected scientists is essential, as is maintaining the expertise of employed scientists through formal schemes of continuous professional development.

8. The Economic and Social Research Council has for many years done sterling work in supporting independent policy research, and in working with relevant natural scientists, Government Departments and other agencies. Stronger links should be forged between natural and social scientists and Government Departments on common policy research interests, as there is still a perception that Government Departments tend to make these decisions from their own internal political drivers. Within each Government Department, R&D funding is delegated to policy customers. Often this is inadequate to provide scientifically robust solutions.

9. Government has supported the concept of applying a levy on industry. For example the developers of offshore wind farms through licensing arrangements provide R&D funds in addition to the evidence they have to provide on their environmental impacts. This levy, the so-called COWRIE fund (Collaborative Offshore Wind Research Into the Environment), has been managed in collaboration with government departments, industry and nature conservation organisations. Similarly, a levy on primary aggregate extraction has also been applied. The Aggregate Levy Sustainability Fund has terrestrial and marine components. The latter is highly respected for the quality of R&D supported.

10. Government Departments and Chief Scientific Advisors could engage more with the Learned Societies (and vice versa) to access relevant grass-roots academics and strategic thinking in defined areas. Government should maintain a published, up-to-date list of the departmental chief scientists, chief social scientists etc and their contact details, to facilitate this.

How are science and technology research priorities co-ordinated across Government, and between Government and the relevant funding organisations? Who is responsible for ensuring that research gaps to meet policy needs are filled?

11. There is a fear, with such large monolithic structures involved, that gaps and duplication will inevitably appear and thus limit UK global competitiveness. Some organisations keep this under review in specific areas, eg the UK Collaborative on Development Sciences, but it is difficult to see how an organisation for every area could be resourced. At a more general level, RCUK, the Research Councils and the relevant Government Departments and their Chief Scientific Advisors have to be committed to dealing with this and providing a helicopter view.

As an illustration of a funding gap affecting a strategic area of research, we quote this comment relevant to systematics research: “NERC routinely rejects applications for undertaking fundamental alpha taxonomy”. Such research is fundamental in answering policy and research questions for the major scientific and social challenges of this century: preserving biodiversity; maintaining ecosystem services and adapting to climate change; underpinning many other areas of bioscience; supporting economically important trade activities; and enabling the UK to comply with its legal and moral obligations to protect the environment and its natural resources. (See our response to this committee’s inquiries on systematics and taxonomy for detailed examples).

See www.offshorewind.co.uk
See www.alsf-mepf.org.uk
http://www.iob.org/consultations2008
12. It is also essential to maintain the appropriate balance of funding for research carried out in universities, public sector research establishments, specialist centres and agencies. Research establishments and specialist centres, such as those run by the Research Councils, have an essential role—distinct from universities—for example in the collection and stewardship of long term research, collections and datasets which inform current and future policy. Their funding must be maintained.

**Is the balance of Government funding for targeted versus response-mode research appropriate? What mechanisms are required to ensure that an appropriate and flexible balance is achieved? Should the funding of science and technology research be protected within the Research Councils or Government departments?**

13. A study to assess the success of major directed programmes in meeting their objectives would help to inform Government and other funding bodies of their value, alongside a comparative study of the costs and (long term) benefits of directed and responsive mode research. NERC has funded several years of Knowledge Exchange R&D and is currently (September 2009) reviewing the effectiveness of this initiative.

14. Directed modes of funding are important to tackle known strategic priorities in eg disease control, renewable energy technologies, but their effectiveness is unproven and needs to be tested. For example, there is a widely held view that an initiative on e-science was launched at a time when there was little agreement or understanding of what constituted e-science. It will be important to assess outcomes.

15. Responsive funding mechanisms that allow researchers to come up with new ideas which don’t readily fit into established organisational agendas are essential, but we accept may not be sufficient. Blue skies research is not a luxury, but the foundation of intellectual and societal wealth. It is often the source of long term innovative ideas (eg DNA fingerprinting and magnetic resonance imaging (MRI)) and should be adequately funded.

16. We commend funding schemes that support excellent researchers rather than defined projects. The Royal Society’s university research fellowships and professorships are a very successful example. Such schemes deserve more government funding.

17. Young people are often inspired into a research career by choosing to target their research towards useful and applied objectives. Others are inspired by areas of research where the benefit to mankind appears to be less direct at first sight. It is important to support that work, recognising that benefits cannot always be clarified at the outset. The ability to convert research success into commercial gain is not often within the skill set or time budget of active researchers focused on tackling fundamental questions. It is important not only to create an environment which supports these processes which are of societal importance in a way that is sympathetic to researchers and funders in terms of property but also in terms of the assessment of success.

18. One possibility for the administration of directed mode funding could be to set a general list of questions to be addressed, invite applications in a responsive mode, and then fill any important gaps with commissioned research. The final specification for the directed programme can then be informed by the applications received, rather than being pre-determined by funding body assumptions.

19. Government, through a Treasury-lead initiative, should consider the costs of not investing in research. This should include recognition that understanding the value of fundamental ecosystem services such as pollination by bees—see www.naturalcapitalinitiative.org.uk—is crucial in setting long-term priorities. The decline in funding for fundamental agricultural research and training over many years has long been a concern of ours. Foot and mouth disease (FMD) has cost the UK approximately £8bn illustrating the need for solutions to this problem yet extra funding for research in this area has not been forthcoming.

**How will the current economic climate change the way that funds are allocated in the future?**

20. It is important to maintain a high level of funding for response-mode and curiosity-driven research, irrespective of the economic climate, if the UK is to remain competitive in the long term. The committee should avoid a conclusion that basic curiosity-driven research is, in some sense, a “luxury” that the UK will be forced to cut back on in difficult economic circumstances.

21. It would be wrong to conclude that such research differs from targeted research in that the former does not solve societal problems. The history of science and medicine offers numerous examples of basic research leading to solutions to human problems. The difference between basic and applied research is, typically, that the specific problems that basic research will solve cannot always be identified until the research has been carried out—for example the discoveries of monoclonal antibodies and DNA fingerprinting.
How is publicly-funded science and technology research aligned and co-ordinated with non-publicly funded research (for example, industrial and charitable research collaborations)? How can industry be encouraged to participate in research efforts seeking to answer societal needs?

22. There are a number of initiatives relevant to fundamental public science which are funded by groups of public, trust-based and corporate bodies (eg the Structural Genomics Consortium (www.thesgc.org) and the Single Nucleotide Polymorphism (SNP) Consortium of the International HapMap Project (www.snp.cshl.org)). The output of research into proteins and genes funded under these schemes is publicly accessible. Even part-funding large-scale enterprises of this nature is beyond the capacity of most medium-sized companies or independent charities. However, opportunities for engagement may well exist and the willingness of industry to fund external pre-competitive research should not be overlooked in designing public science-focused funding schemes.

23. Industry can also be engaged where a commercial benefit may derive from publicly-funded research outputs, perhaps as a partner in knowledge transfer to help deliver innovative products or services. Many businesses are also well aware of the benefit in terms of customer loyalty of supporting forward-looking initiatives eg building on environmental or health research, and also report economic benefit of research involvement. From the point of view of public funders effective management of intellectual property (IP) is key here and this area has seen great improvement. There is an appetite for greater accessibility to information on funded programmes of societal importance and this may raise challenges to standard notions of IP.

To what extent should privately-funded science and technology research be focused on areas of potential economic importance? How should these areas be identified?

24. As effective crystal balls don’t exist, this is always going to be an ad hoc process. The Foresight Programme provides some useful insights into mechanisms. The system needs to be flexible enough to respond to issues as they are identified in discussions with scientists, policy makers, media and general public.

25. Economic value should not be the only criterion under consideration. Benefits to public policy, health, education, well-being, quality of life and the natural environment are also legitimate and very important outcomes of publicly funded research.

How does the UK’s science and technology research funding strategy and spend compare with that in other countries and what lessons can be learned? In this regard, how does England compare with the devolved administrations?

26. In general, the UK looks good and has provided models for other countries to follow. However very close attention needs to be paid to developments in the Far East, particularly the evolving science policies of Singapore, India, China, and the radical developments occurring in the US under the Obama administration, if we are not to be left behind.

27. The EU has supported the concept of pan-government agreements to identify good policy practice. These so-called ERANETs (European Research Area–NET) work on a partnership basis often involving core departments linked to the R&D community. An example is the ERANET for Accidental Marine Pollution, AMPERA www.ampera-net.info which has a large UK component.

September 2009

APPENDIX

Member Societies of the Biosciences Federation

Association for the Study of Animal Behaviour
Association of the British Pharmaceutical Industry
AstraZeneca
Biochemical Society
Bioscience Network
British Andrology Society
British Association for Psychopharmacology
British Biophysical Society

9 See http://cordis.europa.eu/coordination/era-net.htm
setting research and funding priorities: evidence

British Ecological Society
British Lichen Society
British Mycological Society
British Neuroscience Association
British Pharmacological Society
British Phycological Society
British Society of Animal Science
British Society for Developmental Biology
British Society for Immunology
British Society for Matrix Biology
British Society for Medical Mycology
British Society for Neuroendocrinology
British Society for Plant Pathology
British Society for Proteome Research
British Toxicology Society
Experimental Psychology Society
Genetics Society
Heads of University Biological Sciences
Heads of University Centres for Biomedical Science
Institute of Animal Technology
Institute of Biology
Institute of Horticulture
Laboratory Animal Science Association
Linnean Society
Nutrition Society
Physiological Society
Royal Microscopical Society
Royal Society of Chemistry
Society for Applied Microbiology
Society for Endocrinology
Society for Experimental Biology
Society for General Microbiology
Society for Reproduction and Fertility
Syngenta
Universities Bioscience Managers Association
UK Environmental Mutagen Society
Zoological Society of London

Associate Member Societies
Association of Medical Research Charities
BioIndustry Association
Biotechnology & Biological Sciences Research Council
GlaxoSmithKline
Medical Research Council
Merck, Sharp & Dohme
Pfizer
Royal Society
Wellcome Trust

Additional Societies represented by the Institute of Biology
Anatomical Society of Great Britain & Ireland
Association for Radiation Research
Association of Applied Biologists
Association of Clinical Microbiologists
Association of Veterinary Teaching & Research Work
British Association for Cancer Research
British Association for Lung Research
British Crop Production Council
British Microcirculation Society
British Society for Ecological Medicine
British Society for Research on Ageing
British Society of Soil Science
Fisheries Society of the British Isles
Freshwater Biological Association
Galton Institute
International Biometric Society
Marine Biological Association of the UK
Royal Entomological Society
Scottish Association for Marine Science
Society of Cosmetic Scientists
Society of Pharmaceutical Medicine

Additional Societies represented by the Linnean Society
Botanical Society of the British Isles
Systematics Association

Memorandum by Professor Donald W Braben

1. This submission is primarily about academic research.

2. Science is the source of prosperity. Such unexpected scientific discoveries as DNA structure, the genetic code, holography, the laser, magnetic resonance imaging, and nuclear power have transformed our lives and created huge economic stimuli. Initially, society had no need of them. Now they are indispensable. Several hundred of these transformative discoveries were made during the 20th century by researchers working mainly at academic institutions (including Research Council institutes, for example) at home or abroad. They are evidence of science’s originality and unpredictability, and hence, of the fact that the advance of scientific knowledge cannot be centrally directed. Indeed, had academic research always been directed to meeting society’s needs, it is likely that few of these discoveries would ever have been made.

3. Up to about 1970, it was widely acknowledged that the best academic research policy was to create environments that foster diversity and creativity. Nowadays, academics cannot escape the constraints imposed by priorities and orchestration. As a result, science is losing its vitality and industry is being deprived of valuable intellectual feedstock. These are global problems but they are particularly acute in the UK where research funding has become more fragmented and processes of researcher assessment such as peer review have been taken further than elsewhere.

4. The world has changed since the 1970s, of course, but the constituents of good science have not. Public investment in academic research today is higher than ever, but it is being increasingly directed towards the achievement of national objectives. The Haldane Principle as originally formulated has thus been abandoned.
Indeed, governments, supported by many senior scientists, now maintain that rising investments can only be justified if academics take national benefit into account when formulating their proposals. These new academic research policies undermine science’s potential. The benefits that followed the discovery of the laser, for example, took decades to be realised.

5. The policy changes were introduced gradually and progressively over the last few decades, and consequently perhaps, have escaped the rigorous scrutiny that characterise scientific enterprise itself. Social and political pressures increased the numbers of universities, but full account was not taken of the effects the changes would have on research. As there are now far more applicants than can be supported from public purses, funding agencies have developed fairness-based policies for selecting the best of them—typically about 25 per cent of those submitted, on average. But science is not democratic. One doubtful researcher can be right, and a thousand convinced colleagues can be wrong. While the new policies might be effective for mainstream research, they discourage the new thinking that leads to new and unpredictable advances.

6. Funding agencies recognise these problems, but concentrate their efforts on amelioration rather than reappraisal (peer review with a light touch, etc). But originality cannot be moulded no matter how we may bend the mould. For example, many scientists greeted Peter Mitchell’s 1961 discovery of chemiosmosis, one of the most important biological advances of the 20th century, with hostility sustained over many years before it was eventually accepted; indeed Mitchell won the 1978 Nobel Prize for Chemistry.

7. These factors point to an urgent need for a fundamental reappraisal of the roles and functions of the academic sector. Some steps that could be taken include:

(i) Set up initiatives that specifically foster transformative scientific discoveries. Such discoveries are inspirational, and provide the foundations of a healthy scientific enterprise. The 20th century was characterized by a steady stream of them but its flow has diminished in recent years, probably because transformative research proposals are likely to be rejected by today’s virtually inescapable peer review. Other methods must be used, such as those pioneered by the Venture Research initiative sponsored by BP during the 1980s. A national scheme along similar lines would cost less than 1 per cent of the academic research budget. Such an initiative was set up last December by the Provost of University College London for researchers within UCL and is making excellent progress.

(ii) Create a Cabinet post dedicated to overseeing the academic sector, thus acknowledging that sector’s vital roles in economic stimulation, education, and as valuable sources of independent advice on national affairs.

(iii) Re-examine the role of universities. The UK’s polytechnic colleges once offered wide ranges of excellent vocational training. In 1992, however, government abolished the binary system, and reclassified the former polytechnics as universities thus blurring the distinction between training and teaching. Anyone who can benefit from a university education should of course be entitled to one. But in expanding the universities account was apparently not taken of the effects that massive rises in student numbers would have on the concept of the university. Now that some 50 per cent of the student cohort attends university, how can its once automatic association with excellence continue unquestioned when 50 per cent is the proportion usually associated with average? One possible way of satisfying society’s understandable wish to extend higher education would be to regard secondary education as being complete only after say three or four year’s study at a university or similar institute. Higher or tertiary education for suitably qualified students might then begin at a newly created class of Research University after this extended secondary phase had been completed.

(iv) Re-examine the question of university autonomy. Not so long ago, it was widely assumed that universities should be autonomous, and some nations took deliberate steps to ensure that their autonomy was protected. Unfortunately, these steps have become deeply eroded. Government seems to believe that there is nothing special about the university, and subjects its performance to the same processes of optimisation and assessment other institutions must endure. However, protecting this last bastion of intellectual freedom from the tides of homogenisation would be nationally beneficial.

(v) Clearly separate the roles of the academic sector from those of industry. The Research Councils are now required to support the research that meets the needs of users and beneficiaries, but this mission clearly overlaps with that of industry. However, academics often lack the commercial acumen required to identify the advances that might be beneficial to others. Its new mission is also a major departure for the academic sector, which hitherto was charged with the disinterested advance of knowledge. It was conspicuously successful in this. An effective relationship between the two sectors would clearly be nationally beneficial. However, this relationship will be most effective if it is a partnership of equals.
* In 1988, the heads of over 500 universities worldwide signed the European Magna Charta marking the 900th anniversary of the founding of the University of Bologna, the oldest in the world. Its Fundamental Principles were:

— The university is an autonomous institution at the heart of societies differently organised because of geography and historical heritage; it produces, examines appraises and hands down culture by research and teaching.

— To meet the needs of the world around it, its research and teaching must be morally and intellectually independent of all political authority and economic power.

— Teaching and research in universities must be inseparable if their tuition is not to lag behind changing needs, the demands of society, and advances in scientific knowledge.

— Freedom in research and teaching is the fundamental principle of university life, and governments and universities, each as far as in them lies, must ensure respect for this fundamental requirement.

These uncompromising statements would be the founding principles of a new class of Research University. New institutions are not necessary. A Research University could be a current university that can make a credible case for incorporation under the new status. The UK might have some 20–30 such research universities. They could be funded along similar lines to those used successfully by the erstwhile University Grants Committee for many decades.

September 2009

Memorandum by the Breast Cancer Campaign

ABOUT US

Breast Cancer Campaign specialises in funding innovative world-class research to understand how breast cancer develops, leading to improved diagnosis, treatment, prevention and cure. We aim to be the leading specialist in breast cancer research across the UK and the Republic of Ireland, making a significant impact on breast cancer for the benefit of patients. We currently support 101 research projects, worth over £14.1 million in 41 centres of excellence across the UK and Ireland.

BREAST CANCER RESEARCH IN THE UK

Around 45,500 new cases of breast cancer are diagnosed in women and around 300 in men each year. One woman in nine will be diagnosed with breast cancer in her lifetime. Breast cancer research is responsible for better understanding of the disease. Research and the resulting benefits to patients have accelerated in the past two decades. It has made it possible to tailor better treatments, which in turn have increased survival rates. The evolution of research from the laboratory to the bedside has taken time. Innovative treatments of today started in the laboratory 20 years ago and, as a result, breast cancer mortality rates have gone down and the positive prognoses for those living with breast cancer have gone up. It is therefore imperative that medical research receives adequate funding and that scientists are allowed to work in an environment that encourages innovative work rather than stifling progress through bureaucracy. It is only through high quality peer reviewed research that we can continue to develop new breast cancer treatments, improved methods of diagnosis, and a better understanding of it. As well as investment in research, this is also critically dependent on the availability and abilities of scientists and researchers with appropriate skills.

Breast Cancer Campaign published “Evaluation of the current knowledge limitations in breast cancer research: A gap analysis” in March 2008 to determine which areas of breast cancer research, if targeted by researchers and funding bodies, could produce the greatest impact on patients.

Among the recommendations for future research priorities identified in the report were:

— Identify new ways to predict and prevent breast cancer
— Predict who will develop advanced or secondary disease
— Determine how and why breast cancer spreads to other parts of the body
— Devise a suitable method to determine the effectiveness of a treatment at an early stage
— Understand more about the psychosocial and psychological impacts of breast cancer

SETTING SCIENCE AND TECHNOLOGY RESEARCH FUNDING PRIORITIES

This response focuses on two reports that Breast Cancer Campaign has produced that are relevant in the context of this inquiry. These reports are “Science for Life” and “Full Economic Costing: the effects on charity-funded research”.

They highlight the significance of ensuring that the necessary funding is in place to ensure that vital research continues, but in addition to funding they also show the importance of addressing the needs of researchers in order to ensure that we have the scientists and researchers with the appropriate skills.

Science for Life

In order to gain an understanding of the environment in which scientists work, Breast Cancer Campaign conducted a survey of its own medical researchers. We asked for their thoughts on the reality of working in medical research today. Conducted in 2006, 62 scientists funded by Breast Cancer Campaign were asked for their views and experiences of working in medical research and highlighted their key priorities for science, research and health in the UK.

We asked our researchers what factors are important to keep them in the research field.

— 81 per cent indicated having access to appropriate facilities
— 70 per cent of respondents cited funding prospects
— 48 per cent career progression opportunities
— 47 per cent cited work life balance

The recommendations in Science for Life included the following:

— More attractive career prospects should be on offer for scientists embarking on a medical research career. This should include post-doctoral open-ended contracts for those who wish to remain as medical researchers where they believe their talents are best placed, rather than feeling that the only way to progress their careers is to become a principal investigator
— Medical researchers’ salaries must be increased to reflect their training and experience, the contribution that medical research makes to the community and the responsibilities a medical research career entails in comparison to other professions
— University student fees for science subjects should be decreased to encourage more take-up of these subject areas. Interest free loans for qualified researchers should be introduced to allow them to stay and work in more expensive areas, such as London
— All medical researchers should continue to have access to the appropriate research facilities to achieve their research goals
— Current investment in research infrastructure should be maintained
— Increasing the length of funding for research grants from the most commonly awarded grant of three years should be considered
— The Government needs to commit more funding to medical research and into supporting university infrastructures to take into account the anticipated increases in the amount and cost of research
— Future regulations and initiatives should be widely consulted upon so that public confidence in medical research and in the accountability of research can be maintained
— PhD students should be provided with adequate education and training to allow them to progress in their careers and add value to their working environment while also competing favourably with international students
— Training of researchers should continue once they enter the post-doctoral stage of their career

The Charity Research Support Fund

In June 2009, Breast Cancer Campaign published “Full Economic Costing: the effects on charity-funded research”. This highlighted how significant charity funded research is in the development of new treatments and technologies. With charities spending around £936 million on medical research in the UK each year, it is essential that the potential of this investment is maximised—this relies on the continued investment in, and effectiveness of, the Charity Research Support Fund (CRSF).

12 Science for life: why the UK needs to nurture its researchers or risk losing the saviours of tomorrow, 2007.
The CRSF is designed to cover the general running costs of charity-funded research, such as lighting, heating, telephones, use of library facilities or general laboratory equipment. In 2009–10, the CRSF will stand at £194 million. Similar funding streams exist in Scotland, Wales and Northern Ireland. The Government has committed to continue the Fund through to 2010–11.

As funding for charity research relies on the goodwill of the public, charities have a duty to ensure that funds are spent, wherever possible, directly on research. By providing a partnership between charities and the Government, the CRSF enables vital world-class research to take place that ultimately benefits patients and ensures that charity funding is used to its greatest effect. Without the CRSF, charities or universities would have to fund these costs, reducing the amount of funding available for research, resulting in less research being funded.

Evidence from Campaign’s “Full Economic Costing” report has shown that it is critical that the following areas in relation to the fund are addressed: funding, awareness and the long term future of the fund.

(a) Efficacy of the current level of funding
— Campaign found that only a tiny minority of researchers are confident that the current amount of CRSF is sufficient to fully support charity-funded research
— The lack of confidence among researchers is worsened due to the way CRSF is allocated, providing poor visibility as to how the indirect costs are covered
— A significant number of researchers are also being discouraged by their universities from applying to charities for funding, due to the fact that the CRSF is not completely covering the gap in funding
— Evidence from medical research charities also indicates that the CRSF is too small to ensure that the indirect costs of charity-funded research are met.\(^{13}\)
— We believe that a full review should be carried out by the Government and HEFCE, in collaboration with charities, to ensure the sufficiency of current and future levels of the fund

(b) Awareness of the Fund
— There is a poor level of awareness of the CRSF, with nearly three-quarters of the researchers surveyed in Campaign’s report being unaware of its existence
— Researchers are not being provided with enough information within their university about the support available for charity research, and that this should cover the gap in the full costs

(c) Future of the CRSF
— The Government has committed to continue the CRSF through to 2010–11. However, there is currently no commitment to extend this crucial stream of funding past 2011
— This uncertainty is fostering alarm within both the charity sector and universities. Without a strong commitment to continue the CRSF, charities will encounter difficulties in attracting researchers and in maintaining the level of research that they fund
— By making a long-term commitment to the CRSF, the Government would provide much-needed reassurance to both charities and universities, ensuring that they continue to work in partnership to provide world-class research for the benefit of patients
— Similar reassurances are also needed within the devolved nations to ensure that all charity-funded research in the UK is fully supported

September 2009

**Letter from the British Computer Society (BCS)**

**BCS Response to House of Lords’ Science & Technology Committee’s Call for Evidence: Setting Science and Technology Research Funding Priorities**

BCS, the Chartered Institute for IT, strongly endorses the submission of the UK Computing Research Committee (UKRC) to your call for evidence. UKCRC are an expert panel recognised by the Council for Professors and Heads of Computing (CPHC), the IET and BCS. They speak with authority on matters concerning computing research since their membership encompasses the major research areas in computing and all of their members are themselves internationally leading computing researchers.

Who we are:

— BCS promotes wider social and economic progress through the advancement of information technology science and practice.

— We bring together industry, academics, practitioners and government to share knowledge, promote new thinking, inform the design of new curricula, shape public policy and inform the public.

— As the professional membership and accreditation body for IT, we serve over 70,000 members including practitioners, businesses, academics and students, in the UK and internationally. We deliver a range of professional development tools for practitioners and employees.

— A leading IT qualification body, we offer a range of widely recognised professional and end-user qualifications.

September 2009

Memorandum by the British Council for Ageing (representing British Society of Gerontology, British Society for Research on Ageing, British Geriatrics Society)

“Older people, their families, those who care for them, those responsible for their health and ultimately all of us will suffer from the government’s failure to acknowledge the problems and opportunities presented by an ageing society”

—Quotation from The House of Lords Science and Technology Committee commentary on the government response to their 2005 report “Ageing Scientific Aspects”(1), endorsing the need to prioritise ageing research in a holistic fashion.

1. Executive Summary

The British Council for Ageing (BCA) represents the three learned societies with an interest in ageing issues, namely the British Society of Gerontology, the British Society for Research on Ageing and the British Geriatrics Society. The BCA was set up following the Committee’s previous Inquiry into Ageing: Scientific Aspects in 2005, when it was suggested that it would be helpful to have a single readily identifiable point of contact for policy makers.

The BCA is a strong advocate of the need for adequately funded and well coordinated research into ageing as better understanding of the biological, medical and psychosocial aspects of ageing is essential if, as a society, we are to achieve the following:

— Transform the ageing of the population from what is commonly perceived to be a threat or problem to being an opportunity

— Narrow the gap between life expectancy and healthy life expectancy and switch our emphasis from care to prevention

— Identify and develop novel interventions and therapies for the commonly occurring age related diseases

— Understand and appreciate the complexities and diversity of the experience of ageing in the 21st century and make better use of the experience and talents of older people

The BCA also believes that the current level of public funding for research at 0.5 per cent of government budget is insufficient to maintain a strong and competitive science base. In the current economic climate it is imperative that this modest budget is at least protected and that measures are put in place to ensure that funding decisions align with the challenges facing the UK in the 21st century. Moreover, ensuring that capacity in key areas such as ageing research is not only maintained but expanded must be placed firmly on the agenda of the public funding agencies.

2. What is the overall objective of publicly-funded science and technology research?

One of the over-arching objectives of publicly funded science and technology research is to develop the knowledge base to help society as a whole mature and respond to changing needs and new challenges. Population ageing is one of the biggest challenges facing us this century and brings with it opportunities as well as changing needs.
The gap between life expectancy and healthy life expectancy

Current demographic trends show that average life expectancy is increasing by two years per decade and by the year 2020 one in five of the UK population will be aged over 65. However, surveys of general health in older adults suggest that the extra years gained are often not spent in good health, presenting a significant challenge to health and social care services in coming years. If increased lifespan is to be enjoyed rather than endured, it is imperative that research places an emphasis upon improving understanding of human ageing to ensure that increases in lifespan are accompanied by extended health span and increased quality of life.

Our ageing population: a threat or an opportunity?

If we are to make better use of the experience and talents of the growing numbers of older people we need research into new ways of extending working life, developing social and educational activities in retirement, and research into the problems of social exclusion. In this digital age, it is timely that we investigate the role of Information Communications Technology (ICT) in promoting social inclusion and supporting health and social care.

The current call for evidence on “setting science and technology research funding priorities” comes at a time of economic crisis, when it is anticipated that difficult decisions will have to be made on the allocation of public funds for science and technology research. Indeed the full implications of the current financial crisis for the whole of public finances are still far from clear. Of note the recently published King’s Fund Report “How cold will it be? Prospects for NHS funding 2011–17” (2), devotes much of its enquiry into the impact of population ageing on funding need. The King’s Fund concludes that demographic pressures will contribute to a widening gap between funding and need in the NHS, a real increase in funding of up to 2 per cent per year being needed year on year so that NHS service provision can keep pace with increased demands arising from changes in the demographic structure of the population.

Changing emphasis from care to prevention

Currently there is an enormous mismatch between the amount we spend on services for older people versus the amount we invest in research into ageing; whether this is trying to identify the biological processes that underlie human ageing, understand the socioeconomic consequences of an ageing population, or address the prevention and treatment of age-related disease.

The UK spend on the NHS in 2009 amounts to £119 billion (17.7 per cent of total government budget) and it is estimated that over 40 per cent of all NHS spending on hospital and community health services is on people aged 65 years and over (3).

These figures are in stark contrast for example, with a current spend on ageing research by the Biotechnology and Biological Sciences Research Council (BBSRC) of £17 million (3.7 per cent of its budget). Thus the amount spent on researching the causes of human ageing, a pre-requisite to developing interventions to reduce the negative impact of ageing upon health and quality of life, is only 0.035 per cent of that spent on dealing with the health consequences of ageing. Despite being a research priority for each of the research councils, these figures suggest that the current procedures for allocating public research funding to those priorities bears no relation to the financial impact of the ageing population on the public purse.

There has been a growing emphasis on the importance of healthy ageing and a recognition by the Government that “prevention is better than cure”, with the Department of Health launching a Prevention Package for Older People this July. However, the 2005 UK Clinical Research Collaboration (UKCRC) analysis of medical research expenditure revealed that only 2.5 per cent was spent on prevention of disease.

The bigger issue is of course the very low public spend upon research (0.5 per cent of total government budget), from which Research Councils UK (RCUK) has to try and support all of its identified priorities across each of the different disciplines ranging from the arts and humanities through to biomedical research. A small loaf so infinitely divided can only ever distribute crumbs and such a diet will not nurture or sustain world class research activity.

The identification and development of novel interventions and therapies for the commonly occurring age related diseases

Research into ageing is probably the most direct way of identifying and developing interventions for commonly occurring age related diseases, many of which have common underlying mechanisms.
Until recently, there has been a widely held belief amongst clinicians and biomedical researchers, as well as the pharmaceutical industry, that ageing was a disease and that an old age spent in ill health was unavoidable. Recent developments in our understanding of the ageing process have revealed that ageing is malleable and that the morbidity associated with ageing can be delayed if not removed entirely.

Epidemiological studies, including the European Prospective Investigation into Cancer in Norfolk (EPIC) study (4) looking at how lifestyle can affect longevity, have shown that just adopting four lifestyle changes (stopping smoking, maintaining physical activity, eating five portions of fruit or vegetables a day and having a moderate alcohol intake) can add 14 years to a person’s life. Studies in a range of species have shown that a 25–30 per cent reduction in calorie intake, termed caloric restriction (CR) can extend lifespan by 30–40 per cent, but more importantly this approach also reduces age-related pathology (5).

3. How can industry be encouraged to participate in research efforts seeking to answer societal needs?

The relationship between industry and publicly-funded research

Much of the translational research underpinning the validation and safety testing of new treatments is undertaken by the pharmaceutical industry, but this industry still relies upon publicly funded basic science and research to deliver new drugs to the development pipeline. Further cuts to basic science research will impact rapidly upon the pharmaceutical industry and would be particularly harmful to the development of treatments to prevent age-related disease, which is currently not a priority for industry in the UK—though it is big business in the US.

The pharmaceutical giant GSK recently paid $237 million for Sirtris Pharmaceuticals, an American spin out company from Harvard University, which has already developed a CR mimetic, as CR itself is not a realistic lifestyle choice for the majority of the public.

Engagement with wider industry including design, housing and engineering related sectors is equally important particularly for the development of social science, policy and practice related research. The charities and independent sector also play a key role here. Increasingly partnerships and consortia of funders shape the research agenda, design and outcomes. The coordination of research agendas and priorities across a wide variety of stakeholders with an interest in ageing, including the research councils, charities, industry, older people and the scientific community is of vital importance.

Age discrimination in clinical trials

Another issue for science and technology that relates to the ageing population and involvement of industry is the development and testing of drugs for use in older adults. The ongoing under-representation of older people in clinical trials is a cause of major concern (6). Despite their high burden of chronic disease and subsequently high drug use clinically, older people have in many cases been systematically excluded from the Phase 3 randomised controlled trials that are the basis for evaluating safety and efficacy of newer treatments.

The underrepresentation of older people and women in cardiovascular clinical trials has long been recognised (7) and has given rise to considerable uncertainty in clinical practice (8). Like cardiovascular disease, cancer is predominantly a disease of older people, and is second only to cardiovascular disease as a cause of death amongst older populations. As with cardiovascular disease, older patients are very poorly represented in clinical oncology trials (9). Although over 60 per cent of oncology patients are older than 65 years, they make up only 25 per cent of patients enrolled in clinical trials (10). The needs of those with co-morbidities, the very old and the frail old have been particularly ignored by industry.

The burden of adverse drug reactions on the NHS is high, accounting for 6.5 per cent of hospital admissions per year, with a projected annual cost of such admissions to the NHS of £500 million (11). These admissions occur predominantly in older people, a group in which the pharmacology of a wide variety of drugs used in their routine medical care has not been tested. This phenomenon also extends to routine health prevention measures such as the annual influenza vaccinations. The efficiency of the immune system declines with age and it is now well established that older people make a poorer response to vaccinations. Almost one in three over 65 year olds will not make an adequate response to the annual influenza vaccination, yet the vaccines are not tested for efficacy on this population.

There needs to be much greater collaboration between industry, the scientific community, regulators, ethicists, clinicians and older people if we are to be more inclusive of older people in clinical trials and harness modern technological developments and discoveries for the benefit of older people.
4. Conclusion

Trying to understand human ageing and minimise its detrimental effects on individuals does require investment, but the relative cost pales into insignificance compared to the costs of age-related disease and the missed opportunities of failing to benefit from older people’s talents and potential.

September 2009

References


Letter from the British Heart Foundation

1.1 The British Heart Foundation (BHF) welcomes the opportunity to submit written evidence to this inquiry. The BHF is the largest funder of cardiovascular research in the UK and an active member of the Association of Medical Research Charities (AMRC). Between April 2008 and March 2009 we invested over £145 in heart research every minute—a total annual investment of over £78 million. We fund more than half of all university-based heart research in the UK, with BHF-funded researchers and projects at centres in over 30 cities across the UK.

1.2 Our research portfolio extends from fundamental laboratory-based molecular, biological and genetic studies to large scale clinical trials of novel and existing preventive and therapeutic interventions. We support research through infrastructure awards for buildings and equipment, project and programme grants for research staff and consumables and, most importantly, research training and career posts for basic and clinical scientists, from PhD students through to Research Professors.

General Comments

2.1 This inquiry is timely due to the overall cuts in public spending anticipated in the future resulting from the current economic climate. It is essential that where this occurs within Government, the effects on medical research within the UK are kept to a minimum. Medical research is fundamental to the UK economy, both in terms of the societal and economic benefits that result from the investment made, and as an employer of the UK workforce.
2.2 Research has a crucial role in improving standards in healthcare, with the potential to provide innovative approaches to prevention and treatment and achieve step changes in the quality of care.

2.3 We believe that there are three key areas in particular that demand prioritisation both now and in the future in order to maintain and strengthen medical research in the UK:

— supporting charity-funded research through the Higher Education Funding Councils (HEFCs)

— ensuring future sustainability of the research base; and

— ensuring that the UK research environment is facilitative for clinical studies.

2.4 There have been substantial developments in both diagnosis and medical treatment that have steadily increased survival for those with heart and circulatory disease. Some of the most ground-breaking and important achievements in heart health research over the past 45 years have been made thanks to work supported by the BHF. Prioritising these key areas will help to ensure that this progress continues in the future.

DETAILED COMMENTS ON SELECTED QUESTIONS

Are existing objectives and mechanisms for the allocation of public funds for research appropriate? If not, what changes are necessary?

Sustainability and the research base

3.1 The Government allocates public funds for research through the dual support system, providing two clear streams of funding to both the HEFCs and the research councils.

3.2 In England, as part of the quality-related (QR) grant provided to universities through the Higher Education Funding Council for England (HEFCE), a separate element has been provided since 2006 in the form of the Charity Research Support Fund (CRSF). Similar streams of funding are also in place in other nations of the UK. The CRSF aims to cover the gap in the full economic costs incurred from charity-funded research, and as a result helps charities such as the BHF to assist universities in attracting researchers of the highest calibre.

3.3 In 2004 the Government made a commitment to the financial sustainability of research, working together with all funders towards fully funding research in UK universities. Progress has been made, with a report earlier this year showing that almost all measures of sustainability amongst higher education institutions have improved in recent years.14

3.4 However, a pressing concern is the uncertainty surrounding the efficacy of the current level of funding, and the future of the CRSF beyond 2010–11, both of which impact on the confidence of researchers to seek funding and of universities’ enthusiasm in hosting the research. Many within the medical research sector are concerned that the CRSF will not reach its intended 2010–11 target of £270 million, and current evidence also suggests that some researchers are already being discouraged from applying to charities for funding.15 We believe that further reform is needed to place charity funded research on a level playing field with research funded from other sources, and to provide long-term reassurance to charities, universities, and researchers.

3.5 We believe that the Government should conduct a comprehensive review of the level of funding needed beyond 2011 to effectively support the substantial investment made by medical research charities. In particular, funding must be set at a level which allows universities to recover full economic costs for charity funded research at a comparable level to the costs they can recoup from research funded by Research Councils. The Government should also work with higher education institutions to ensure that universities, researchers and other funders are aware of the CRSF, and that charity research is not adversely affected.

3.6 A separate issue, connected to the overall sustainability of UK research, is the future willingness of clinicians to consider a research-based career. The BHF is concerned in particular about the attractiveness of cardiovascular research to academic scientists. Public funders have committed resources to research training, and there has been considerable reform of the system to make it easier to embark on such careers, but it is unclear whether these measures are sufficiently effective. Training and retaining a new generation of clinical researchers is paramount to future public health.

3.7 The BHF is currently surveying our own researchers on the research career pathway and the environment for cardiovascular research in the UK. We would be happy to share the results of this with the Committee in the coming months.


15 Breast Cancer Campaign (2009) Full economic costing: the effects on charity-funded research
How is publicly-funded science and technology research aligned and co-ordinated with non-publicly funded research (for example, industrial and charitable research collaborations)?

Collaborations and the research environment

4.1 Medical research charities currently fund research worth over £900 million. Many of these charities, including the BHF, have funded research in collaboration with the Medical Research Council (MRC) and the National Health Service (NHS). There are huge opportunities for charities like the BHF to collaborate with the publicly-funded sector to great mutual benefit.

4.2 Our history of collaboration has been much better with the MRC, who make clear cut financial commitments, than with NHS R&D which can change its level of commitment according to prevailing financial pressures. However, we are hopeful that the Office for the Strategic Coordination of Health Research (OSCHR) will help to create a better environment that facilitates interaction between the NHS and medical research charities. While there is more that can be done by the Government to involve charities in priority setting for biomedical research, there have been recent improvements through the MRC and National Institute for Health Research (NIHR), working in partnership via the UK Clinical Research Collaboration (UKCRC) and OSCHR with other funders including the major charities.

4.3 The establishment of the UK Clinical Research Network (CRN) and topic specific networks, such as those for stroke, kidney disease and diabetes, has provided helpful first steps in improving research in the NHS. It is essential in this regard for a dedicated cardiac and vascular disease research network to be established, alongside condition specific networks.16

4.4 Collaborations rely on a research environment facilitative for clinical studies in the UK. There are growing concerns among health professionals and patient organisations that NHS research has been stifled by an increased bureaucratic burden. In addition, we are concerned that clinical research within the UK could become progressively less competitive in the future, and are therefore keen that efforts be made to maintain and strengthen the UK as a world leader in clinical trials. The forthcoming consultation from the European Commission on the clinical trials directive provides an opportunity for the UK Government and medical research community to address these concerns.

To what extent should publicly-funded science and technology research be focused on areas of potential economic importance? How should these areas be identified?

Benefits of medical research

5.1 Research funds can be distributed either in response to demand from the research community, so called bottom up or response-mode funding, or it can be pre-specified by the funder for specific initiatives—top down funding. Most “breakthroughs” in medical research (eg monoclonal antibodies, stem cells, cell cycle genes) have evolved from investigator-led, curiosity-driven research (bottom up), in which the UK has played a leading role. A recent report from the House of Commons Innovation, Universities, Science and Skills Select Committee highlighted the importance of basic research in the debate on strategic science funding, citing cardiovascular research as a prime example where basic research has led to substantial translational benefits. Some of the key advances in cardiovascular medicine have resulted from a substantial amount of research carried out in non-medical departments, such as chemistry, physics and engineering.17

5.2 Whilst there are times when a top down approach can stimulate new research activity, it also runs the risk that funds can be allocated to projects (the best applications for the initiative) that would not have succeeded in open competition against other scientific proposals. Thus, funds are diverted away from high quality bottom up research towards poorer quality top down research. Therefore, it is crucially important that in any new funding arrangements there are sufficient funds for investigator-led, hypothesis driven research. Consequently, it is essential that the research budget should not be susceptible to short-term political considerations, and that Haldane principles must apply at all times. It is also important that the balance between basic and translational research must also be retained. Without basic research into mechanisms of disease, where the UK is highly competitive internationally, there will be no new findings to translate into better drugs or treatment.

5.3 Research funded by the BHF and other medical research charities makes a substantial contribution to the fight against major diseases, to interventions that can improve the lives of people living with ill-health and to the UK economy. There are therefore significant societal and economic benefits that arise as a result of investment into medical research, which underlines the importance of ensuring this is prioritised in the future. A 2008 report estimates that every £1 invested in cardiovascular medical research produces benefits that are worth 39p every year thereafter in perpetuity. The cost of research is therefore recouped through social gain within three years of making the investment, and it continues to pay such dividends every three years thereafter.

5.4 Cardiovascular disease is the UK’s biggest killer, with the costs of healthcare alone amounting to over £1.7 billion each year. There is therefore a great need to invest in research for improving cardiovascular health in the UK. The Cardio and Vascular Coalition (CVC), an alliance of 41 voluntary organisations chaired by the BHF, has identified research as a key area for a strategic approach to tackling cardiovascular disease in England in the next decade.

How does the UK’s science and technology research funding strategy and spend compare with that in other countries and what lessons can be learned? In this regard, how does England compare with the devolved administrations?

6.1 The CRSF is intended to provide universities within England with support for the full economic costs of charity-funded research, and is worth £194 million in 2009–10. Each of the devolved administrations provide a support element as part of their QR grant for this purpose in the UK.

6.2 As in England, the allocation of equivalent funding within Scotland is made primarily on financial drivers. In 2009–10 the Scottish Funding Council (SFC) used a two-year average of data of charitable income from 2005–06 to 2006–07 and calculated the charity support element of their QR grant at £17.4 million. In the Scottish funding model, the main volume indicator of research-active staff takes into account charity funded staff so this will also contribute to meeting the charity funded gap. The SFC currently estimates that their total contribution is around 18 per cent of fEC, which is comparable to the estimate in a recent report by Research Councils UK and Universities UK for the contribution in England.

6.3 Within Wales, the Higher Education Funding Council for Wales (HEFCW) also committed an additional £3m to charity funded research in 2007/08. This funding is allocated within QR in proportion to research income from UK charities in those Units of Assessment which are eligible. In addition, UK charity income is used as a minor volume measure within the QR funding formula. In 2008–09, a further £5 million of the total QR funding is driven by that minor volume measure. Similar support is provided within Northern Ireland.

6.4 It is vital that we have a supportive operating environment for charity-funded medical research to continue to thrive. Increasing the CRSF to its intended level of £270 million by 2011, and committing to maintain the support in the long-term, would provide welcome reassurance to medical research charities, to the researchers they fund, and to the universities that host them.

Conclusion

— The BHF makes a substantial contribution to research into cardiovascular disease across the UK. We are dependent on not only the generous donations provided by members of the public, but also on the support provided by Government to universities, and more broadly on an environment facilitative of research.

— Ensuring that sufficient, long-term support is given to universities for charity-funded research should be a priority, in addition to addressing the growing concern on barriers within the research environment, and sustainability of the research base in the future. The Government must review and commit to charity research support funding beyond April 2011.

— If you would like further information about this response, please contact Joseph Clift, Policy Officer, on 0207 554 0156 or cliftj@bhf.org.uk We would be pleased to discuss any of these issues further with the Committee.

September 2009

19 www.heartstats.org
Memorandum by the British Psychological Society

The British Psychological Society thanks the House of Lords Science and Technology Select Committee for the opportunity to respond to this consultation.

The British Psychological Society (“the Society”) is the learned and professional body, incorporated by Royal Charter, for psychologists in the United Kingdom. The Society is a registered charity with a total membership of almost 50,000.

Under its Royal Charter, the key objective of the Society is “to promote the advancement and diffusion of the knowledge of psychology pure and applied and especially to promote the efficiency and usefulness of members by setting up a high standard of professional education and knowledge”.

The Society is committed to providing and disseminating evidence-based expertise and advice, engaging with policy and decision makers, and promoting the highest standards in learning and teaching, professional practice and research. The Society is an examining body granting certificates and diplomas in specialist areas of professional applied psychology.

Comments on the House of Lords Science and Technology Committee Call for Evidence: Setting Science and Technology Research Funding Priorities

Are the existing objectives and mechanisms for the allocation of public funds for research appropriate? If not, what changes could be made?

The Society is concerned that the current structure of the Research Councils leaves much of psychology without a well-defined home. At present, no single Research Council is responsible for the funding of the discipline—as psychology spans a broad spectrum of cognitive, affective, sensory and social research—leaving individual researchers and teams to decide which specific Council remit their research best “fits” within. Despite the best attempts of the Councils to consider cross-Council funding where appropriate, funding tends to be conservative, stifling the creation of long-term interdisciplinary research areas. The direct consequence of this situation is a gap in funding for psychological research.

The Society believes a more appropriate approach could be forthcoming, within the creation of a framework of behavioural neuroscience: be it cognitive, affective, sensory or social. There are important applied problems in mental and physical health, education, criminology, etc. amongst others. In all of these areas psychology and latterly, behavioural neuroscience, has made a significant contribution.

Scientific psychological training is fundamental to behavioural neuroscience. This is an area of research which requires substantial funding as the techniques utilised are expensive. The Society firmly believes that greater recognition of the developments in these areas is needed. However, to date the UK Research Councils have failed to be responsive to these developments, with their current structure hindering considerations of applications for funding in this field. It is in this context that the Society would firmly support the recommendation to establish a Behavioural and Cognitive Sciences Research Council.

How are science and technology research priorities co-ordinated across government and the relevant funding organisations? Who is responsible for ensuring that research gaps to meet policy needs are filled?

The Society believes that an evidence-based approach to policy making is entirely appropriate and necessary—indeed, we believe it is crucial to ensure that science is governed by mechanisms flexible enough to allow sustained research in areas of societal concern, funded in a timely manner, and able to inform policy development and delivery.

Science has a fundamental role in informing both the development of policy as well as the way in which such evidence is used in policy making (ie the mechanisms through which it is obtained and evaluated). However, The Society believes that Government must be minded of the public’s perception (trust/distrust) of both science and scientists, and the importance of ensuring that the information provided is in a transparent and accessible form.

Policy work is often driven by high priority issues, with additional considerable time pressure. As a result, it is rarely possible to evaluate the potential positive and negative outcomes of policy strategies ahead of time. Nevertheless, an excellent example of the benefits of committing to such an approach comes from the Department for Communities and Local Government (DCLG), which decided to conduct such an evaluation ahead of launching its REACH role model campaign to raise the aspirations and achievements of black men. This research (conducted at the Centre for the Study of Group Processes at the University of Kent) directly informs the REACH campaign and involves close liaison with the policy and research advisors at the DCLG.
**Setting Research and Funding Priorities: Evidence**

*Is the balance between Government funding for targeted versus response-mode research appropriate? What mechanisms are required to ensure that an appropriate and flexible balance is achieved? Should the funding of science and technology research be protected within the Research Councils or Government Departments? How will the current economic climate change the way that funds are allocated in the future?*

The Society believes there is a need to ensure a careful balance between support for curiosity-driven, blue-sky research and targeted resources. The role of the Research Councils as the key mechanism through which funding allocations can best be made should not be underestimated. Whilst targeting funding by government departments does provide a means of supporting research to feed directly into immediate policy development, the contributions of the applied research that is being conducted across the UK are far reaching.

It is important to recognise the key roles that the Research Councils have played and will continue to play in supporting high calibre research in the UK. The best means of ensuring the development of breakthrough, next generation science research is to use a peer-reviewed, open-competition, responsive-mode funding model. Ensuring that the remit of the Councils remains broad enough to cover the ever-evolving research landscape in the UK will be essential. Opportunities for collaborative, multi-disciplinary research must also be fostered to ensure that key societal problems and concerns can be addressed in a timely manner to inform current and future policy development. Following the same ethos, advanced cross-Council liaison needs to be encouraged and strengthened in order to ensure that high calibre research is appropriately funded wherever it is being carried out.

See also response to the first question listed.

*How is publicly-funded science and technology research aligned and co-ordinated with non-publicly funded research? How can industry be encouraged to participate in research efforts seeking to answer societal needs?*

Many good research ideas are currently not being fully translated and developed into practice and production. Building up a stronger research culture and openness to inquiry within business is essential. Mechanisms for greater co-ordination and support for such translational research, perhaps involving co-funding from HEIs or industry are needed; securing funding for such high calibre collaborations, and their spin-off applications, is currently very limited, partly due to the complexities in coordinating logistics and timing required to gain co-funding from different sources. The Society would welcome improvements in facilitating this collaboration, and to encourage funding from business R&D into universities. We believe that business investment could be more successful if supported through local authority initiatives, as well as through ad hoc individual negotiation and direct collaboration with single HEIs and business.

*September 2009*

**Memorandum by the British Society for Development Biology**

**Introduction**

The British Society for Developmental Biology (BSDB) is a society open to all who have an interest in the science of Developmental Biology. Current membership (over 1,500) includes researchers of all levels, lecturers, and students. One of the BSDB’s aims is to represent developmental biology to external organisations in the UK and Europe and this document represents the collective concerns of our membership with regards to the recent restructuring of funding priorities with in the UK research councils. While the BSDB may not be large, it is the discoveries of its members that underpin the technological advances in stem cell research and may lead to the future development of regenerative medicine. However, we are concerned that in the current financial climate research councils appear to be increasing focusing on targeted translational research. If this trend continues the UK could lose its internationally renowned scientific base in these areas and still fail to make significant progress towards translation.

In particular we have just produced a formal response to the strategic plan for the Biotechnology and Biology Research Council (BBSRC). The BBSRC has historically been the UK’s principal funder of basic science in the biology. Breakthroughs in basic science funded by the BBSRC have also lead to significant advances in the translational arena, although it is difficult to pre-judge where translation will come from. While we applaud the efforts made recently to make investigators think more critically and carefully about the applications of their work, we are concerned that a push for translation may subvert the really significant translational advances that come from pure basic research.

This document was compiled in close consultation with the BSDB membership and represents the consensus that arose out of our own internal consultation. We will address three sets of questions in our evidence document.
Is the balance of Government funding for targeted versus response-mode research appropriate? What mechanisms are required to ensure that an appropriate and flexible balance is achieved? Should the funding of science and technology research be protected within the Research Councils or Government departments? How will the current economic climate change the way that funds are allocated in the future?

While we appreciate and support the need for UK government investment in basic research to have significant social impact, we are concerned that defined sets of strategic priorities risks damaging the fundamental science base that so crucially underpins the knowledge economy to which we all aspire. We wish to emphasise that the BSDB does not oppose themed research but we do think it is crucial that less directed responsive mode science does not suffer as a consequence. There are too many well-rehearsed examples demonstrating that it is from the more fundamental end of the research spectrum where many, if not most, of the most important breakthroughs emerge. There is a strong perception in our community that the current government plans for the research councils represent a downgrading of fundamental biosciences in favour of directed translational work.

In particular, while not opposing the principle of some light-touch strategic focus we do not agree with policies that attempt to focus the research councils heavily in specific areas. We believe in a strong responsive mode of funding with the major criteria being scientific excellence. The creation of council wide responsive mode priorities creates a situation in which the standard applied to council priority areas is different than that applied to the majority of applicants. There is a real risk, supported by much past experience, that targeted research initiates will result in the funding of mediocre science.

To what extent should publicly-funded science and technology research be focused on areas of potential economic importance? How should these areas be identified?

As a society we feel the most important issue in any strategic focus is not bring down the standard of the science proposed. The top criterion for support should be the excellence of the science as assessed by peer review. We do not object to existence of specific requests for funding applications in particular areas, but think this should be a minor component of a research council’s portfolio. There may also be times when applications in specific areas should be encouraged, but these applications should be subject to fair and equal competition with everything else.

History tells us that it is impossible to predict which areas of science will contribute to future economic growth. Today’s world-leading UK stem cell research is a direct outcome of the strong historical UK commitment to developmental biology, which, in the current climate, would not have been considered as having high societal or economic impact. Attempts to limit science funding to perceived areas of future economic importance are likely to miss the target.

How does the UK’s science and technology research funding strategy and spend compare with that in other countries and what lessons can be learned? In this regard, how does England compare with the devolved administrations?

As stated above, particularly in a climate of constrained resources, the central priority of the UK in biological sciences should be to protect its excellent science base. We are also extremely concerned that a further reduction in unrestrictive responsive mode funding may result in the migration of UK scientists overseas (brain drain). While the traditional destination of the United States is still attractive, a small but increasing number of prominent UK scientists have also been moving to Singapore. Singapore in particular has been a popular destination because of their strong commitment to funding basic research in the biological sciences. Other destinations in the far east may become more attractive in the next few years. Further decreases in responsive mode funding for basic research will stimulate this trend.

This document was prepared on the behalf of the BSDB committee by Josh Brickman (University of Edinburgh). The content of this document is based on input received from members of the UK developmental biology community over the last few months. The contents of this document were also discussed during at the 2009 BSDB AGM on 7 September 2009.

September 2009

Letter from the Cabinet Office

“SETTING SCIENCE & TECHNOLOGY RESEARCH FUNDING PRIORITIES” INQUIRY

The Science and Technology Select Committee, on 31 July 2009, issued a call for evidence to inform its inquiry into how priorities are established for scientific and technological research funding.

This response covers the Cabinet Office including: the Office of the Parliamentary Counsel; Office of the Third Sector; Committee on Standards in Public Life; and, the Independent Offices.
We have identified only one area of the work of Cabinet Office where research funding falls within the terms of the Select Committee’s call for evidence; Information Security and Assurance Research. The details are set out in Annex A attached.

Annex A

House of Lords Science and Technology Committee

SETTING SCIENCE AND TECHNOLOGY RESEARCH FUNDING PRIORITIES

INFORMATION SECURITY AND ASSURANCE RESEARCH EVIDENCE

The Information Security and Assurance team is a unit within the Cabinet Office which sits within the Office of the Government Chief Information Officer and Senior Information Risk Owner structure. The team provides a central focus for Information Assurance (IA) activity across the UK.

ISA works in partnership with a range of partners including CESG (The National Technical Authority for Information Assurance) and CPNI, Centre for the Protection of National Infrastructure which aims to provide assurance to government that the UK’s ICT systems and the information they handle are appropriately protected. ISA produces and maintains the National Information Assurance Strategy and, along with partner organisations, coordinates and sponsors work programmes to deliver on the strategy’s recommendations.

ISA has a lead role in helping government to realise the following future strategic outcomes:

- Government is better able to deliver public services through the appropriate use of ICT
- The UK’s national security is strengthened by protecting information and information systems at risk of compromise
- The UK’s social and economic well-being is enhanced as government, business and citizens realise the full benefits of ICT

There is a particular need for HM government to fund information assurance research as there are particular requirements for government, especially within the national security domain, which will not be delivered by the sector for its own market needs.

ISA RESEARCH FUNDING TO CESG

ISA provides £5 million annually to CESG in research funding. CESG needs to develop and maintain its intellectual capital base in subjects relevant to Information Assurance in order to fulfil its role as the National Technical Authority. This funding has enabled CESG to work with academia and industry to develop expertise and skills in a wide spectrum of technical subjects such as:

- Cryptography and key management,
- risk assessment and management,
- software engineering and security analysis,
- hardware engineering and security analysis,
- operational assurance techniques, as well as
- key technologies and products used by Government and its delivery partners

The expertise developed has put CESG at the forefront of Information Assurance in the Internet Age, and in a strong position to help HMG manage risks to its electronic information and services.

September 2009

Memorandum by Cancer Research UK

EXECUTIVE SUMMARY

In our response we have provided evidence on those questions that impact on the work of Cancer Research UK as a funder of medical research.
The key points that we would like to emphasise are as follows:

— Charitably funded research is key to the UK’s global reputation as a leader in scientific and medical research.

— The Charity Research Support Fund is essential in maintaining the unique research landscape in the UK.

— There needs to be a continued Government commitment to the UK Centre for Medical Research & Innovation (UKCMRI).

— A flourishing biomedical research sector can contribute to the well-being of the nation by providing both health and economic benefits.

— There is a risk that translational or clinical research will be over-prioritised to the detriment of basic and public health research if funding priorities are determined primarily by the potential impact of research.

— We can only build excellence in translational biomedical research if we have a robust base of basic science on which the translational science can build.

— Joint working across government departments has increased investment for biomedical science, and we think there is potential for greater coordination across government and between all four health departments in the UK.

— To attract industry to the UK, excellence in science as the source of innovation must be maintained through investment to Institutes and the University sector.

**INTRODUCTION**
Cancer Research UK is leading the world in finding new ways to prevent, diagnose and treat cancer. Over half of all cancer research in the UK is carried out by doctors and our scientists. In 2008–09 we spent £355 million on research, supporting the work of more than 4,500 scientists, doctors and nurses. We fund work in five of our own Institutes, as well as funding £165 million of research in UK universities in 2008–09.

Cancer Research UK funds research into all aspects of cancer from exploratory biology to clinical trials of novel and existing drugs as well as population-based studies and prevention research. Our scientists, doctors and nurses have contributed to the development of 19 of the top 20 drugs used to treat cancer patients worldwide today.

Cancer Research UK welcomes the opportunity to respond to this inquiry.

**What is the overall objective of publicly-funded science and technology research?**
The primary objective for publicly funded biomedical research should be to improve the health and well-being of the nation now and in the future. Whilst improving health and well-being should always be the priority for biomedical research we recognise that biomedical research in the UK also provides skilled employment, attracts inward investment and generates revenue.

With careful planning and management, and by working in partnership, we believe that a flourishing biomedical research sector can contribute to the well-being of the nation by providing both health and economic benefits.

**How are public funds for science and technology research allocated? Who is involved at each level and what principles apply? Where appropriate, is the Haldane Principle being upheld?**
The majority of government spending on biomedical science and technology is distributed through the research councils and National Institute of Health Research (NIHR). Budgets are allocated through the Comprehensive Spending Review.

In essence, the Haldane principle seeks to limit Government influence over how investment in research is spent, preventing short-term political aims from damaging the research effort.
The research councils and NIHR are becoming increasingly strategy-led, a development we welcome. We believe it is appropriate that Government contributes to the development of top-line Strategy for the research councils and NIHR, but at present the amount of influence the government has on the development of strategy is unclear so it is not possible to say if the Haldane principle is strictly being upheld.

Are existing objectives and mechanisms for the allocation of public funds for research appropriate? If not, what changes are necessary?

It appears that the Research Councils are increasingly being expected to demonstrate the impact of the research they fund, and that budget allocation will be linked to the ability to demonstrate impact. Cancer Research UK too is becoming more aware of the need to demonstrate and communicate the difference our research is making to patients and the public. However, we are keenly aware that for much of the vital research we fund, particularly for basic science and public health research, it may take decades before we can demonstrate impact on the population at large or in the clinic.

When public spending cuts are likely, there is a risk that Research Councils will over-prioritise research more likely to make an impact in the short to medium term in an effort to maximise budget allocation from central Government. Ultimately any sudden response could starve the biomedical research pipeline of innovation, and could damage the UK’s reputation as a destination for investment. Government must recognise the importance of basic and public health research when allocating budgets.

How are science and technology research priorities co-ordinated across Government, and between Government and the relevant funding organisations? Who is responsible for ensuring that research gaps to meet policy needs are filled?

The successful joint bid by the Department of Innovation, Universities and Skills and the Department of Health for MRC and NIHR in the last Comprehensive Spending Review demonstrates what can be achieved when true cross department coordination is implemented. By presenting central government with a coordinated strategy, additional funding was leveraged which has helped to foster translational research whilst at the same time maintaining investment in basic research. In light of this success, it may be fruitful to look for further opportunities for joint planning for biomedical research across different parts of government. We also think that there may be more opportunities for greater coordination between the devolved health departments.

Whilst we welcome joint planning by NIHR and MRC, we think that more effort needs to be made with communication to help researchers understand the changes in place following the establishment of the Office for Strategic Health Research (OSCHR), and to make it easier for them to know where they should apply for funding. We would particularly welcome greater clarity on the role and remit of the Health Technology Assessment and the Efficacy and Mechanism Evaluation (EME) programmes, as we have encountered researchers who are still uncertain of where best to apply.

Is the balance of Government funding for targeted versus response-mode research appropriate? What mechanisms are required to ensure that an appropriate and flexible balance is achieved? Should the funding of science and technology research be protected within the Research Councils of Government departments? How will the current economic climate change the way that funds are allocated in the future?

There is no magic formula to determine the balance between response mode versus targeted funding or basic versus translational versus clinical research that delivers most impact. Cancer Research UK has a long history of supporting excellent basic research, and in our five year Research Strategy we have committed to maintaining this investment (currently about 50 per cent of our total investment). We have also committed to providing targeted funding to realise new opportunities and promote areas of unmet clinical need. We would be very cautious before making any dramatic changes to the balance of how we invest our funds (response mode versus targeted or basic versus clinical versus translational) and would require robust evidence before making such a decision.

In the current economic climate we have been forced to think more carefully about what implications our funding decisions today will have on our fundraising and cash flow going forward. For government there may be an understandable temptation to prioritise short-term projects that will deliver impact quickly. However, if the government is serious about maintaining biomedical research in the UK as a key strength, this impulse must be balanced with the need to maintain investment in basic science. We can only build excellence in translational biomedical research if we have a robust base of basic science on which the translational science can build.
How is publicly-funded science and technology research aligned and co-ordinated with non-publicly funded research (for example, industrial and charitable research collaborations)? How can industry be encouraged to participate in research efforts seeking to answer societal needs?

**Importance of Charity Funded Research in the UK**

One of the influencing factors behind our success is the huge role that charitably funded medical research plays, with members of the Association of Medical Research Charities providing funding of £935 million for research in 2008–09 alone. This equates to a third of all publicly funded research in the UK. Further, the European Cancer Research Managers Forum, which compares funding for cancer research across Europe, indicated that in 2004 total charity spend in the UK on cancer research exceeded that of UK Governmental spend. Therefore, the charity voice in this debate is one that needs to be heard.

Over the next five years, we will be establishing up to 20 Cancer Research UK Centres across the UK. The Centres Initiative plays a major part in our five year research strategy. Our vision is to develop long-term, sustainable Centres of excellence in cancer, delivering world-class research, improved patient care and greater local engagement. The Centres will not be new buildings, but instead are virtual partnerships working at a local level with other charities, universities, cancer networks and NHS Trust(s), and at a national level with government and industry. Unlike many other research funders, charities are often able to offer innovative funding strategies. Charities also play a major role in facilitating and supporting the development of strategic partnerships involving a number of partners including universities, the NHS and industry. Cancer Research UK supports over 500 research group leaders throughout the UK, in research institutes, universities and clinical centres. We believe that through networks such as the Experimental Cancer Medicine Centres, and the Cancer Research UK Centres initiative, we can provide industry with state of the art facilities to conduct translational research and clinical trials, and from discussions with industry this is what they have indicated they need.

**Cancer Research UK funding in universities**

In 2008–09 Cancer Research UK funded over £11 million of research at the University of Cambridge, not including our work at the Cambridge Research Institute. One example is the research carried out by Professor Douglas Easton, the Director of the Cancer Research UK Genetic Epidemiology Group based there. Cancer Research UK is currently funding several of the group’s studies that look at genes that affect our risk of common cancers, including breast, ovarian, prostate and melanoma. This work will further develop our understanding of how genes influence the development of cancer, which will lead to new ways of preventing, diagnosing and treating the disease in the future.

In the 1990s, Professor Easton’s team helped track down two genes, BRCA1 and BRCA2, which strongly influence breast cancer risk. Following on from this work, the team is currently leading a large-scale study called EMBRACE that aims to monitor more than 4,000 women, half of whom have faults in BRCA1 or BRCA2. They hope to uncover other genes, as well as lifestyle and environmental factors, which affect their likelihood of developing breast cancer.

Professor Easton is also leading other large-scale DNA studies to hunt for genes that influence our susceptibility to other common cancers, including prostate and endometrial cancer. In collaboration with other researchers funded by Cancer Research UK he recently identified 16 new sites in the human genome that are linked to men’s risk of developing prostate cancer. Of special interest was a gene called MSMB which could possibly be used in screening for prostate cancer and disease monitoring. Another of the regions harbours a gene called LMTK2 which might be a target for new treatments.

The team’s findings will help identify people at increased risk of developing cancer, and could translate into patient benefit as genetic medicine will lead to new ways of preventing, diagnosing and treating cancer in the future.

**The Charity Research Support Fund**

Cancer Research UK awards grants to support the direct costs of research in UK universities. The full Economic Costs (fEC) of our research must also take account of the universities’ infrastructure costs, which are funded by the Government. The Charity Research Support Fund (CRSF) was introduced to ensure that universities in England receive the additional funding to top-up the proportion of fEC on the charity awards they receive. Research Council grants typically provide 80 per cent of the fEC, with the expectation that this will rise to 100 per cent and so the CRSF is in place to allow charity funding to remain competitive. However,
even with the additional amount the CRSF provides, we estimate that a Cancer Research UK award would only provide on average 65 per cent of the fEC. As a result the financial burden to universities of taking on charity awards is greater, and consequently universities are encouraging their researchers to apply to other funders.

This fund is due to reach a welcome £270 million by 2010–11 however there is no commitment beyond then. The continued existence of the Charity Research Support Fund and equivalents affects the entire medical research landscape in the UK. Universities and charities alike need to be able to plan their future funding with the secure knowledge that the Charity Research Support Fund and equivalents will continue to be in existence. In the development of our Centres, it will be essential that the funding councils provide clear guidelines on eligibility of universities in the initiative to receive CRSF.

Cancer Research UK alone funded £165 million of research in UK universities in 2008–09. We are particularly concerned about the long-term sustainability of cancer research in higher education institutions through the continued provision of long-term support funds that contribute to the charity research spend. We believe the Government should provide this as it is a national responsibility to maintain universities, and enable innovative charity research to be funded on a competitive standing, which is essential to the stability of the unique research landscape in the UK.

**Partnerships and coordinated priority setting**

The programme of research that Cancer Research UK has set out for the next five years is ambitious but is in line with the challenges we have set through our goals. We have reviewed the whole spectrum of our work, the impact we have had on cancer and other partner organisations’ roles in beating cancer.

Going forward, our strategy is to focus our work on the areas which will have the greatest impact on reducing cancer mortality. We believe that this is best achieved in partnership with the NHS, Departments of Health, universities, industry, other charities and the international research community, amongst others. One important element was therefore to articulate our strategy to those stakeholders to help us to build stronger partnerships.

In cancer we are also fortunate to have the National Cancer Research Institution (NCRI). This is a partnership of 20 of the largest funders of cancer research in the UK from the public and charity sector. Partners share information on the research we fund and work together to tackle areas of particular need.

The UK Clinical Research Collaboration (UKCRC) is also a useful forum for national dialogue on all biomedical research related issues. However the future role of the UKCRC is under review and we would therefore like to highlight the importance of a forum for dialogue continuing in the future.

**The UKCMRI—flagship for biomedical research in the UK**

Cancer Research UK is partnering with the Medical Research Council, the Wellcome Trust and University College London to build the UKCMRI. The vision for the UKCMRI is to create a world class research centre that will tackle some of the biggest medical challenges we face. This will be the largest biomedical research centre in Europe. The project aims to find new ways to treat diseases such as cancer, and will bring together the best scientists, doctors and researchers. Bringing together the leading research organisations will allow scientists to collaborate widely as well as share cutting-edge resources and knowledge. Continuing to support the creation of this ground-breaking Institute will be a clear demonstration of Government commitment to investment in science.

We are therefore calling for an unequivocal Government commitment to the UKCMRI, to be provided by continued funding via the Medical Research Council.

**Industry**

Cancer Research UK has always had a number of partnerships with industry, particularly around new therapeutic discoveries however, we have recently made further developments, notably with AstraZeneca. Industry will always be primarily driven by the need to make profit, but where their goals overlap with those of research funded from public sources, there is scope for partnership. We are hoping to forge more productive partnerships with industry through the Cancer Research UK and Department of Health funded Experimental Cancer Medicine Centres.

The industrial sector will choose to invest in the UK if we can provide:

- A favourable investment environment.
- A talented and motivated research workforce.
— A favourable environment for clinical trials.
— A source of innovation (e.g., our Institutions and Universities).

How does the UK’s science and technology research funding strategy and spend compare with that in other countries and what lessons can be learned?

The UK has an enviable global reputation for scientific and medical research. Both “blue skies” and applied research have an important role to play in maintaining the UK research base, and promoting the nation’s health and wealth. Despite only having 1 per cent of the world’s population we are responsible for 5 per cent of world science and 12 per cent of all papers with the highest impact.

As a country we still do not invest enough in science and technology, especially if it is our ambition for this sector to rival the financial services sector in economic importance to the UK. Since the merger that created Cancer Research UK we have more than doubled the amount we spend on research, and we still find that due to lack of funds we have to turn down promising applications, demonstrating that there is capacity for more investment in research.

Concluding remarks

We want the UK Governments to commit to supporting a world class science base in the UK with adequate support funding and long-term commitments for government spending in science.

As stated at the start of our response, we believe that a flourishing biomedical research sector can both improve the health of the nation at the same time as providing economic benefits. However achieving both objectives will require careful management of the research portfolio, and a long-term approach to investment.

September 2009

Memorandum by the Committee on Radioactive Waste Management

Introduction

1. This response to the call for evidence is submitted by the Chair of the Committee on Radioactive Waste Management (CoRWM) on behalf of its members. It is not a formal CoRWM response because there has been no opportunity to discuss and agree it at a plenary meeting of CoRWM.

2. CoRWM was established in 2003 to advise the Government on the method (or methods) to be adopted for the long-term management of the UK’s higher activity radioactive wastes (HAW). It reported in 2006 and recommended geological disposal, preceded by robust interim storage and accompanied by an intensified programme of research and development (R&D) (CoRWM, 2006). The UK Government accepted these recommendations and began to implement them (UK Government et al., 2006; Defra et al., 2007; Defra et al., 2008). The Scottish Government decided against geological disposal and is developing a policy of near-surface, near-site storage while supporting R&D.

3. CoRWM was reconstituted in 2007 with the role of carrying out scrutiny of the UK programme for the long-term management of HAW and providing independent advice to Government (Defra et al., 2007). It reports to the Secretary of State for Energy and Climate Change and to the Environment Ministers in Scotland, Wales and Northern Ireland. During 2009 CoRWM has issued two reports to Government: one on interim storage and one on geological disposal (CoRWM, 2009a, 2009b).

4. For about the past 18 months, CoRWM has been scrutinising the UK arrangements for R&D related to the long-term management of HAW. It issued a draft report for consultation in July 2009 (CoRWM, 2009c). It is currently finalising this report in the light of responses to that consultation. The report will be submitted to Government and published at the end of October 2009. This response to the call for evidence is based on the findings that will be detailed in the report.

Organisations that Fund or Carry Out Research on the Long-Term Management of HAW

5. Research relevant to the long-term management of HAW is funded and commissioned by:

— the Nuclear Decommissioning Authority (NDA), which has strategic responsibility for decommissioning most of the UK’s civil nuclear sites and specific responsibility for implementing geological disposal

HAW includes both high level waste (HLW) and intermediate level waste (ILW).
— nuclear site licensees, including the NDA’s Site Licence Companies, British Energy (which is owned by EDF and Centrica) and contractors to the Ministry of Defence (eg AWE plc, which runs Aldermaston)
— the regulators of the nuclear industry, namely the Health and Safety Executive, the Environment Agency and the Scottish Environment Protection Agency
— the Research Councils.

6. Almost all of this research is publicly funded, either directly or indirectly. The main exception is research funded by British Energy, which is ultimately funded by electricity consumers. This would also be the case for research by the operators of new nuclear power stations.

7. CoRWM estimates that the annual UK spend on R&D relevant to the long-term management of HAW is currently about £30 million. Over 80 per cent of the spend is by the NDA and its Site Licence Companies. Research Council spending is about £2.25 million per year, mainly by the Engineering and Physical Sciences Research Council (EPSRC).

8. The organisations that carry out the research are:
— universities (with funding from the Research Councils and via contracts with the NDA, nuclear site licensees and the regulators)
— the National Nuclear Laboratory (NNL), which is a Government owned, contractor operated organisation (GOCO)
— research institutes (eg the British Geological Survey)
— nuclear site licensees
— consultants and contractors (to the NDA, nuclear site licensees and the regulators).

HOW DECISIONS ARE MADE TO FUND RESEARCH ON THE LONG-TERM MANAGEMENT OF HAW

9. CoRWM has investigated how research funding decisions are made within the NDA and within the Research Councils. It has also investigated links between the various funding bodies, with a view to determining the nature and extent of co-ordination between them.

NDA and its Site Licence Companies

10. Within the NDA and its Site Licence Companies there are three different mechanisms for identifying research needs and deciding what research to fund. These mechanisms are for research on:
— treatment, conditioning, packaging and storage of HAW
— management of nuclear materials that may be declared to be waste (spent fuels, plutonium, uranium)
— geological disposal.

11. Most of the research on treatment, conditioning, packaging and storage of HAW is funded by the Site Licence Companies. They identify their needs in conjunction with the Life Time Plans for their sites. NDA funds some research directly, through its Direct Research Portfolio. All the research is discussed at an operational level by the Nuclear Waste Research Forum, which has members from NDA, all its Site Licence Companies, British Energy, the Ministry of Defence and the regulators. There can also be discussions at a more strategic level at the NDA’s HAW Strategy Group, which has members from the same organisations as the Forum.

12. Research on the management of nuclear materials is funded directly by the NDA and by a few of the Site Licence Companies (principally Sellafield Ltd). It can be discussed at a strategic level at the NDA’s UK Spent Fuels and Nuclear Materials Overview Group, which includes representatives from Government and the regulators, as well as NDA.

13. Research on geological disposal is funded by the NDA’s Radioactive Waste Management Directorate (RWMD), which will become a wholly owned subsidiary of the NDA and eventually the Site Licence Company for the geological disposal facility (or facilities if there is more than one). RWMD published its R&D strategy for consultation in 2008 and issued the final version in 2009 (NDA, 2009). It is currently developing its R&D programme to implement the strategy and has told CoRWM that it will publish the programme for comment late in 2009. RWMD is establishing a small advisory panel to assist it in establishing and running its R&D programme.
14. The NDA Research Board on Nuclear Decommissioning and Waste Clean Up is an advisory body that aims to “promote a common understanding and collaboration between relevant bodies across the UK about respective R&D needs, risks and opportunities required to enable the delivery of the NDA mission”. It has members from Government, regulators and the Research Councils, and two independent members. The Nuclear Waste Research Forum (para 11) reports to the Board.

Research Councils

15. The Research Councils work together on energy projects through the Research Councils’ Energy Programme, for which EPSRC is the co-ordinating lead. At present EPSRC is the main funder of research related to long-term management of HAW, on which it spends about £2 million per year (out of a budget for nuclear energy related research of about £26 million per year and an overall budget of about £740 million per year). EPSRC is advised by, inter alia, the Letter of Arrangement Group. This has members from NDA, other nuclear industry organisations and the Health and Safety Executive. It is a forum for research funders to share priorities and identify areas for collaboration.

16. The only other Research Council that is currently funding research specific to the long-term management of HAW is the Natural Environment Research Council (NERC). Its main contribution is through the British Geological Survey (BGS), which is a NERC Research Centre. BGS obtains about half its income from NERC and the rest from public and private sector contracts. It is devoting about 13 man years of effort per year to radioactive waste disposal. This effort is mainly funded from outside NERC. (BGS non-NERC income from HAW work is about £0.6 million; NERC spend on this topic is about £0.25 million.)

CoRWM’s Views

17. CoRWM thinks there is insufficient strategic co-ordination of research relevant to the long-term management of HAW within the NDA, between the Research Councils and between the NDA, the Research Councils and other funding bodies. The NDA has various groups at which research is discussed but none has a remit to provide co-ordination at a strategic level or to set research priorities for the whole of the NDA and its Site Licence Companies. It is unclear how EPSRC co-ordinates with NERC. Only EPSRC has a clear mechanism for obtaining input from the nuclear industry and its regulators for its programmes and this mechanism does not seem to include all the relevant organisations. There is no means at present to set national priorities for research on the long-term management of HAW (UK-wide or within England, Wales or Scotland).

18. A further CoRWM concern is that most of the processes by which decisions on research related to the long-term management of HAW are made are not transparent. The discussions are mainly held behind closed doors, they involve only a narrow range of stakeholders and little is published on decisions or the deliberations that led to them. NDA’s RWMD intends to be a notable exception but its annual spend is less than 15 per cent of the total UK spend (about £4 million out of about £30 million).

Balance of Funding for Targeted and Response-Mode Research

19. The long-term management of HAW is an area where the full spectrum of research is needed, from curiosity-driven research without any immediate application to targeted research directed towards a specific practical objective. Curiosity-driven research is particularly important for geological disposal because it is necessary to have confidence that a geological disposal facility will be safe over tens of thousands or millions of years. Research worldwide over the last few decades leads to the belief that geological disposal is viable but there is more to do to make a robust safety case for geological disposal of UK HAW at a specific site.

20. All nuclear industry research is targeted and almost all the Research Councils’ research funds for the long-term management of HAW are placed through managed calls. CoRWM is of the view that this situation is very unsatisfactory and that much more curiosity-driven research is needed, in addition to the targeted research.

21. It seems likely that the current situation is a direct consequence of the limited funds that have been available in the UK for radioactive waste management research since the late 1990s. (For example, the annual spend in 1989–90, in the prices at the time, was about £46.7 million, compared to about £30 million now.) There has been a tendency in the nuclear industry to keep research funding to the minimum to meet short-term needs and to regard curiosity-driven research as a luxury.

22. The closed nature of the decision making processes for research (para 18) has probably exacerbated the situation. In recent years there seems to have been little attempt in the UK to bring together the prospective researchers, who will provide the ideas, with the nuclear industry and its regulators, who will use the results. This is in contrast to several other countries, some of which invite researchers from the UK to contribute their ideas.
23. CoRWM recognises that it is difficult to rectify this situation in the current economic climate. Nevertheless, an attempt should be made. There should be open debate in the UK about research requirements for the long-term management of HAW and opportunities for public comment on proposed research programmes. This would help to make better use of limited funding now and to establish a more balanced approach as economic circumstances improve.

RESEARCH SKILLS
24. CoRWM has also examined the adequacy of UK skills for undertaking research into the long-term management of HAW. It did this against the background of the skills for nuclear R&D in general.

25. The number of people employed in nuclear R&D in the UK decreased from about 9,000 in 1980 to about 1,000 in 2004. Since then there has been a significant improvement, largely as a result of the efforts of the Cogent Sector Skills Council, the National Skills Academy Nuclear and the NDA. There is, however, some way to go for nuclear research skills in general and for skills for HAW management research in particular.

26. There are also concerns about the numbers of geoscience graduates who will be available to do research on geological disposal in the UK. Nationally and internationally, graduates in geophysics, hydrogeology and engineering geology are currently in short supply. There is strong competition from the mining, hydrocarbon, water and civil engineering industries for highly-qualified researchers.

27. CoRWM thinks that provision of research skills for the long-term management of HAW needs more national leadership and strategic direction. It believes that this situation could be best rectified by assigning to a single organisation the responsibility for providing this leadership and direction.

INFRASTRUCTURE FOR RESEARCH
28. CoRWM has considered the UK situation with regard to two types of facility for research on the long-term management of HAW:

   — active facilities, where experiments can be carried out with concentrations and quantities of radioactive materials relevant to HAW
   — underground facilities, either close to or remote from prospective sites for a geological disposal facility.

29. Compared to other countries, the UK has a very limited number of research facilities where significant quantities of radioactive materials can be used. The key civil facilities are those operated by the NNL. CoRWM thinks that further development of these facilities is required for UK research on the long-term management of HAW and that it is essential to improve access to these facilities, particularly for university researchers. Now that NNL is a commercially-driven GOCO, it is unclear to CoRWM how the funding for better facilities and access can be provided.

30. The NDA currently envisages that underground investigations at a potential geological disposal site will be carried out as part of the construction of the disposal facility. CoRWM thinks that this approach will not provide enough information for developing the design of the geological disposal facility and making a robust safety case. More underground research will be needed than can be carried out as part of facility construction.

31. CoRWM does not believe that underground research carried out in other countries, for their HAW and their geological conditions, will be sufficient to enable the UK to design and make the safety case for a geological disposal facility here. CoRWM is of the view that an underground research facility will be needed at the site of any proposed geological disposal facility in the UK. This research facility would operate before the disposal facility is constructed, while waste is emplaced and during any period when the disposal facility remains open after the end of waste emplacement.

September 2009

REFERENCES


Memorandum by the Council for the Mathematical Sciences

The Council for the Mathematical Sciences (comprising the Institute of Mathematics and its Applications, the London Mathematical Society, the Royal Statistical Society, the Edinburgh Mathematical Society and the Operational Research Society) is pleased to present its response to the House of Lords Science & Technology Committee’s call for evidence on the setting of research funding priorities.

The CMS welcomes the Committee’s attention on this issue, as this subject is a source of concern to us. Our response focuses on a subset of the Committee’s questions which are particularly relevant to mathematical sciences research.

Is the balance of Government funding for targeted versus response-mode research appropriate?

1. We believe that the balance between targeted and response-mode research has now shifted so far towards the former as to threaten the viability of basic science in this country.

2. The Engineering and Physical Sciences Research Council’s annual budget for mathematical sciences has been slashed in the last few years specifically to accommodate high level expenditure in targeted multidisciplinary themes such as Energy, The Digital Economy, Nanoscience through Engineering to Application, and Towards Next Generation Healthcare. In 2006–07 the Mathematical Sciences Programme budget stood at £21 million; in 2009–10 the figure is £14 million. Meanwhile, the total commitment in 2008–09 in the programmes referred to above was over £128 million.

3. Mathematical sciences underpin all other science subjects, and developments in maths often go hand-in-hand with advancements in biological, chemical and physical sciences. The reduction to the Mathematical Sciences Programme budget will require a 50 per cent increase to return to the 2006–07 level and will have a negative impact across science; we believe that the budget is now below the minimum needed to sustain mathematical sciences research. The effects of “turning the tap off” will be felt for a long time.

4. Mathematical Sciences has much to contribute to RCUK’s mission themes, and the opportunity to demonstrate the value of mathematics, statistics and operational research to societal challenges such as energy consumption and an ageing population is welcome. However, we have been told explicitly by EPSRC that investment in these areas has been at the expense of response-mode research, and it is our view that in the long term this is a mistake. The impact of advancements in mathematical sciences can take many years to have an economic pay-off, and a decision to decrease investment in fundamental research now is a decision to limit innovation further downstream, even in the targeted areas that the Research Councils are aiming to support. The Haldane Principle should offer protection from external pressures towards taking a short-term view, but the principle appears to have been eroded.

To what extent should publicly funded science and technology research be focused on areas of potential economic importance? How should these areas be identified?

5. Fundamental scientific research is itself of economic importance. As President Obama put it in his address to the National Academy of Sciences in April 2009:

"At such a difficult moment, there are those who say we cannot afford to invest in science, that support for research is somehow a luxury at moments defined by necessities. I fundamentally disagree. Science is more essential for our security, our prosperity, our health, our environment, and our quality of life than it has ever been before." — Barack Obama

23 For a complete list of RCUK priority themes see www.rcuk.ac.uk/innovation/ktportal/priority.htm. The list given above is those led by EPSRC.

24 Pioneering Research and Skills: EPSRC Annual Report and Accounts 2008–09 available from www.epsrc.ac.uk/Publications/Corporate/ARA08-09.htm

25 www.whitehouse.gov/blog/09/04/27/The-Necessity-of-Science/
6. We append for the Committee’s reference a short paper giving examples of fundamental mathematical sciences research that have had a considerable economic impact. These range from benefits to the pharmaceutical industry to face-recognition software.

How does the UK’s science and technology research funding strategy and spend compare with that in other countries and what lessons can be learned?

7. The UK cannot afford to lose out to other countries in science and technology research—it is essential for continuation of scientific research in the UK that talented individuals are not lured away to other countries by more attractive research prospects. This is particularly true in mathematical sciences, where investment is in people rather than large scale equipment. The USA has now committed to increasing expenditure on science to 3 per cent of its GDP, which will greatly overshadow UK expenditure:

Although the UK government has made similar commitments in the past, it needs to redouble its effort if we are to compete and collaborate with the US in the future.—Nick Dusic (Director, Campaign for Science & Engineering)

EXAMPLES OF THE INTERPLAY BETWEEN MATHEMATICS AND LEADING-EDGE TECHNOLOGIES

— Digital communications The mathematical development of error correction codes has had a huge impact on a range of communication systems where high volumes of data need to be communicated across noisy networks. Most striking examples of their application have included satellite communication, and, very recently, third generation mobile telephony. Most recently, the development of turbo codes has for the first time enabled transmission at almost the maximum theoretical volume of data—a feat achieved by, amongst other things, the mathematical understanding of derived likelihoods to resolve uncertainties in the received data.

— Cryptography The famous RSA algorithm underpins much of modern secure communication, especially involving financial services. The secure encryption and decoding in RSA rely heavily on Number Theory, one of the oldest branches of pure mathematics, and in particular on the prime factorisation of very large numbers. It was first publicly described by researchers at MIT, but was in fact independently developed by the British mathematician Clifford Cocks together with Ellis and Williamson at GCHQ. More recent fundamental research in these areas has led to the exciting possibility of using so-called quantum entanglement to develop unbreakable codes.

— Chemical & pharmaceutical industry Many industrial chemical processes require quantitative understanding of the dynamics of reacting multi-phase mixtures, often in turbulent fluid flow. These problems motivate an enormous international effort in mathematical modelling, ranging from study of the Navier Stokes equations describing the flow (often with unknown free boundaries), to developments in geometric measure theory describing the distribution of the components. Applications at very small scales, for instance in drug synthesis or chip manufacture, has stimulated the rise of micro and nano fluidics as new disciplines within fundamental applied mathematics.

— Google The success of the multi-billion dollar internet search engine relies on developments in numerical linear algebra. In particular, the so-called PageRank algorithm starts with an exceedingly large matrix describing the relative importance of linkages between different web pages, from which the importance vector listing the connection to a given search term can be computed rapidly with, crucially, the strongest link appearing at the head of the list.

— Intelligent paper Intelligent paper technology is concerned with the interface between traditional writing methods and computerised display and data storage techniques. A recent project between Oxford University and ArjoWiggins made use of the De Bruijn sequences, a pure mathematical concept concerning combinatorial arrangement of symbols dating from the end of the nineteenth century but with little previous practical application. The company estimated that this development alone was worth fifteen million Euros.

— Brain Imaging Modern medical scanning techniques, such as Single Particle Emission Computerised Tomography (SPECT) and Magnetoeencephalography (MEG), allow non-invasive imaging of real-time brain function. These techniques are underpinned by recent crucial mathematical developments. For instance, SPECT involves the inversion of the so-called attenuated Radon transformation, and the formula for computing this was found only in 2001. In MEG it is known that different neural activities patterns can lead to the same scan results, but mathematical advances have shown what information can still be uniquely determined from the scan.

http://news.bbc.co.uk/1/hi/sci/tech/8020930.stm
— Understanding the human genome The development of statistical computational methods of stochastic processes, from finite Markov chain Monte Carlo algorithms to point processes and Gaussian random fields, have proven pivotal in allowing the advancement of biomolecular sequence analysis. This science involves analysing DNA sequences, amino acid sequences and global profiles of RNA in normal and pathological processes. The results yield an insight into how diseases can be stopped at a molecular level, leading to the development of highly effective new pharmaceuticals and the possibility of gene therapy. However, these modern biological experiments create vast amounts of complex and highly variable data, which could only be analysed by employing these emerging statistical techniques.

— Uncovering environmental trends Determining the nature of global environmental change means measuring trends from the widely studied variable of global mean temperature to an array of less well studied parameters where variation is not clear cut. Understanding these trend components with their correlated errors presented a deep statistical challenge. Development of time series analysis such as the Yule-Walker equations allowed phenomenon like the El-Nino-Southern oscillations to be modelled and its impact on our global weather patterns to be understood for the first time.

— Driving the digital economy A digital economy is one which communicates goods and services electronically, over the internet: orders may be made electronically, goods such as audio and video recordings and written materials may be traded electronically, and banking and other services may be carried out. Such activity generates vast amounts of data, which can be analysed to improve the goods and services on offer. But analysing gigabytes of data presents theoretical and practical challenges. The new area of data mining has developed to meet those challenges. Data mining enables the summarisation of vast amounts of data, the identification of important structures within large data sets, and the detection of anomalous behaviour (such as fraud) within those data sets.

— What’s in a face? Developing systems that can recognise the human face is fraught with theoretical statistical problems, but the achievement has countless applications. Statisticians realised that the proposed kernel-based linear regression neural network solution, would need large amounts of training data to be stored and processed. This means the computational power required for facial recognition would be beyond our current systems. Theoretical statisticians overcame the problem of training these smart systems by developing relevance vector machines that sample much fewer data sets from images to undertake facial recognition. However, the level of dissimilarity of the human face is best suited to multivariate regression as many features have to be assigned to normal ranges to allow recognition. To achieve this Bayesian regression was applied to relevance vector machines to develop an application to automatically locate facial features using minimal data. This allowed the development of smart CCTV that could recognise the individual behind the human face.

September 2009

Memorandum by the Department for Children, Schools and Families

BACKGROUND

The DCSF’s rigorous research prioritisation and planning process is in place to ensure the best use of resources. It operates from the initial development of the annual social and economic research programme through to the management and delivery of individual projects. We rarely undertake any “science and technology” research, and the processes set out in this memorandum apply to our social and economic research programme.

The Department’s programme of external social and economic research, analysis and evaluation is developed in consultation with colleagues across the department and with key external stakeholders. Its purpose is to inform the development of strategy and policy to deliver the department’s objectives for children, schools and families, set out in our Departmental Strategic Objectives. The programme of work informs a wide range of policy areas and addresses gaps to support evidence based policy making and delivery, minimising overlaps and ensuring key evidence gaps are addressed. It takes account of relevant research being carried out by other organisations, for example, the Centre for Excellence and Outcomes in Children and Young People’s Services, our NDPBs and external academics. Where policy responsibilities are shared with other government departments, we engage with colleagues across government to agree joint governance or funding arrangements for particular projects, where appropriate.

DCSF commissions research to meet not only short term evidence needs, but continuing longer term and strategic priorities, so the amount we commission and the amount we spend may vary from year to year depending on the gaps that have been identified.
DCSF spends in the region of £30–40 million per year on external social and economic research and evaluation. This reflects the importance of a continued flow of evidence and analysis to support evidence based policy making to deliver better outcomes for children and families.

The strategic framework and forward programme of externally-commissioned research for the medium term are set out in our Analysis and Evidence Strategy, published in July 2009. This is organised around the Departmental Strategic Objectives (DSOs) and set in the context of the considerable volume of in-house analytical work carried out by analysts within the department.

**Overview of our processes and mechanisms for establishing social and economic research priorities**

DCSF is committed to evidence-based policy making and the effective use of scientific advice. Our Chief Scientific Adviser and Director of Research and Analysis, Carole Willis, chairs our Research Approvals Committee (RAC), which scrutinises all social and economic research and evaluation proposals to test their scientific rigour before funding is approved. The CSA also chairs the Policy Evaluation Group and oversees development and delivery of the Department’s Analysis and Evidence Strategy. Our CSA advises Ministers on the content of the forward looking research programme and the scientific integrity and validity of research and evaluation.

**Our processes and mechanisms in more detail**

The procedure for agreeing the annual social and economic research priorities in DCSF is as follows:

(a) Analytical planning activity begins in the autumn when Directorates develop their plans for new research, evaluation and analysis for the year ahead.

(b) These plans are further developed and refined throughout the winter in discussion with key stakeholders, under the direction of the Analytical Planning Board, chaired by the DCSF CSA. Last year we held a workshop with key external partners on 12 December to discuss future research priorities, and sought feedback on key research gaps from the 250 delegates (from the wider research and academic community as well as from other government departments) who attended our Research Conference last November.

(c) These kinds of consultation events with external experts about future research priorities are supplemented with on-going discussions between DCSF analysts and external researchers and academics, as well as experts in other departments, on specific policy areas.

(d) Priorities are drawn up and discussed by the Analytical Planning Board, taking into account the need to ensure that the programme is focused on the key evidence gaps.

(e) Ministers are consulted and asked to approve the final list of priorities in the Spring.

Once the list of priorities has been agreed with Ministers, new proposals for externally-commissioned social and economic research projects to meet the priorities, undergo scrutiny at the following stages:

(a) Before they are submitted to the Research Approvals Committee (RAC):

(i) Analysts work directly with policy-makers to determine if there really is an evidence gap that can only be filled by commissioning new research or whether, for example, it can be filled by internal analysis of existing data; they then frame the research questions to be addressed and methodology to be employed.

(ii) If the research is an evaluation of a major new policy initiative then the sponsor has the option of convening a meeting of the Policy Evaluation Group (PEG) to discuss how best to undertake it. The PEG consists of senior DCSF analysts and policy makers, who scrutinise the detail of the evaluation plans to ensure they are robust.

(iii) If the research involves children’s services, the proposal is sent to the Association of Directors of Children’s Services for comment.

(b) At the RAC meeting, each new proposal is scrutinised by the Department’s senior analysts to ensure that they will genuinely fill an evidence gap, offer value for money, are methodologically robust and will contribute to improving outcomes for children and families. The RAC presents its recommendations to Ministers for final approval to proceed with commissioning the work.

If the research involves schools or local authorities, the Star Chamber for Data Collection from Schools and Local Authorities scrutinises the research instruments and design to make sure that the burdens placed on the schools and local authorities being asked to participate are not excessive.

*September 2009*
Memorandum by the Department for Transport (DfT)

Introduction
1. This Memorandum responds to the Call for Evidence sent to the Department’s Parliamentary Liaison Officer on 31 July 2009. It considers how the Department identifies, prioritises and meets its research needs

Purpose of Research
2. Evidence fit for purpose is fundamental to the development and implementation of successful transport policy. Research is a major element of this evidence base and the Department invests in research to:

- inform present and future policy developments and interventions and make informed use of evidence and research;
- influence stakeholders by establishing a shared understanding of the evidence;
- “de risk” policies, programmes and schemes and thereby enhance the ability of the Department to deliver outputs and objectives predictably, and to change strategic direction if and when necessary.

Basic Arrangements
3. The model which the Department uses to manage research is based on delegation of responsibility and funding to Directorates and Agencies for the evidence they need to inform policy and operational decision-making. Best practice guidance, advice and challenge is provided through the Chief Scientific Adviser and his Unit (CSAU). A small part (currently just over 5 per cent) of the Department’s overall spend on research is spent by CSAU on cross-cutting or longer term research not otherwise addressed. These arrangements were last reviewed earlier this year and among other things are intended to promote:

- strategic business-related thinking about evidence and research requirements; and
- clear accountability for identifying and meeting research needs.

4. In brief, policy and operational units identify the evidence and research needed to achieve their business objectives. The units then directly commission, fund and manage the necessary research. An overarching Departmental Evidence and Research Strategy was developed centrally and published in 2006. Unit-level strategies were developed locally against a standard framework, scrutinised centrally and, after agreement by ministers, published on the Department’s website.

Engaging with Stakeholders
5. The range of people and organisations with whom we collaborate on the evidence base is extensive and diverse. Organisations involved in transport provision and research include universities, research councils, local authorities, passenger transport executives, industry, regulatory authorities, international research institutions, public and private sector research establishments and non-governmental organisations, both within the UK and abroad. We also collaborate with other governments. However, the degree and quality of our collaborations vary enormously. We have concordat agreements with Engineering and Physical Sciences Research Council (EPSRC) and Economic and Social Sciences Research Council (ESRC), both of whom have significant transport research interests. These concordats provide a framework in which the Department and research councils can interact, coordinate and collaborate on issues of common interest. We also maintain relationships with other research councils where we share common interests, particularly the Natural Environment Research Council (NERC).

6. When preparing their research strategies, units are directed to consult their key stakeholders. This encourages dialogue about the evidence needs, priorities and research practicalities. It complements existing policy-making and operational processes—including advisory mechanisms, consultations, workshops, conferences, publications and publicity.

7. Most results of the Department’s research are published (where appropriate after peer review). Typically, publication takes the form of the final report being posted on the Department’s website. But additionally it can take several other forms depending on the purpose for which the work was commissioned. Research is undertaken with a view to the results being used and thus they need to and can be communicated in a range of ways.
**DEPARTMENTAL OBJECTIVES**

8. The corporate vision and business objectives are set out annually in the Department’s Business Plan. A key driver of these is the work necessary to deliver—or contribute to the delivery of—the Public Service Agreements (PSAs). Good evidence contributes both to informing the PSAs and to fulfilling them. Implementing the PSAs and realising the business objectives may require evidence gaps to be filled and give rise to opportunities that the Department could exploit. It is here that research comes into play. To the extent that achieving business objectives needs research, the individual directorate or agency concerned will articulate those needs and invest locally to meet them.

9. The Department’s current work to achieve sustainable transport is bringing a new emphasis to modally neutral and crosscutting evidence needs. Some will be met through our existing research programmes—but new requirements are emerging as objectives and challenges are developed further. The Department is seeking to put in place arrangements to meet them using and adapting existing structures as far as possible. These include improved co-ordination and regular consideration of cross-cutting strategic evidence needs by the Strategy Committee.

**CURRENT FUNDING**

10. The Department currently spends around £60 million pa on research (circa 0.4 per cent of all its programme expenditure) though this varies from year to year according to the needs of the business. The figure below illustrates the scope of business needs informed by research.

<table>
<thead>
<tr>
<th>Research funding by Group 09/10 (£m)</th>
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</thead>
<tbody>
<tr>
<td>City and Regional Networks</td>
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<tr>
<td>Central Transport Analysis and Economics and Chief Scientific Adviser's Unit</td>
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<tr>
<td>International Networks and Environment</td>
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<tr>
<td>Motoring and Freight Services</td>
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<tr>
<td>National Networks (including contribution to Rail Safety and Standards Board)</td>
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<tr>
<td>2.90</td>
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<tr>
<td>4.88</td>
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<tr>
<td>12.00</td>
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<tr>
<td>28.32</td>
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<td>19.95</td>
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</tbody>
</table>

In this context, the cost of research is not necessarily an indicator of how valuable and crucial it is. And the level of research activity in any one year is inevitably tempered by what is affordable (or can be managed effectively) under the relevant Spending Review settlement given other calls on resources. Where possible, research is collaborative: the Department seeks to share the cost with other stakeholders or influences other stakeholders to carry out the research. The Department itself will normally only invest in research where

- a need will only be met (or only met on time) if it does so;
- there is a need to access the outputs—and/or shape the future—of external research investments by industry, academia, other government departments, research councils, the Technology Strategy Board (TSB) and the European Commission;
- there is a need to retain Intellectual Property Rights as a public good.

**GOVERNANCE**

11. The Department is currently managing research in support of a local business unit’s objectives, and delivering research through locally assigned budgets with some degree of central and independent scrutiny to ensure coherence of programmes. The key advantages are:

- it allows Director Generals to match research to business needs;
it gives them some flexibility on resources applied to research.

The main disadvantages are:

- the starting resource balance is historic and “bottom up”;
- there is limited provision for cross-cutting research.

12. In November 2008 the Department’s Executive Committee commissioned the Chief Scientific Adviser to examine these and other issues. Among other things, the findings, which he presented to the Committee in April this year and are now being followed up, should help to:

- provide greater central oversight and direction via involvement of the Department’s Strategy Committee in cross-cutting research;
- better focus research spend on priorities by linking research requirements and allocations more closely to strategic objectives in the business planning process;
- better influence external research investment decisions (research councils, academia and industry) that are strategically important to the Department.

**Summary/Conclusion**

13. In essence the following are the key aspects of the Department’s research management arrangements that lie at the heart of the subject the Committee is examining:

- The devolved authority and resources allocated to policy directors and agency chief executives to identify and meet the evidence and research needs of their business areas
- The fact that this responsibility is discharged through consultation and discussion with stakeholders—external as well as internal
- The funding of research commissioned from a wide range of research contractors (academia, private sector, PSREs) to provide evidence where this is necessary
- The scrutiny and challenge mechanisms that exist and are being developed in the light of the recent study to strengthen coherence and consistency between research programmes; and to ensure that the needs of research into cross-cutting issues are met effectively.

*September 2009*

Memorandum by the Department for Work and Pensions

1. **Epitome**

1.1 The Department for Work and Pensions was created in 2001 and inherited strong traditions of evidence-based policy making from its predecessor departments. Its performance in this area has been rated as “strong” in repeated capability reviews, and retains the full support of Ministers, the Departmental Board and the Executive Team.

1.2 The Department does not support traditional science, engineering and mathematics, and so technology, as they are not relevant to our work. We commission and support a variety of work by researchers to:

- Underpin new policy;
- Monitor trends and existing policies (including by long-term surveys); and
- Survey the literature and developments abroad.

1.3 We commission research through a single central framework agreement, but from a variety of functional sites where researchers are embedded into policy teams. We employ social researchers, economists, statisticians and operational researchers specifically to bring their professional perspective to the above processes, and to lead our research programme. We therefore support their professional development, covering the maintenance and development of their skills. Each group works to its appropriate professional standards; for example, social researchers are part of the Government Social Research Service and observe the GSR Code. Professional groups routinely work across administrative boundaries to ensure that there is a coherent overall DWP research programme which also reflects more local priorities.

1.4 The type and amount of our research reflects the policies Ministers set for the Department, traditionally after Spending Reviews have set the policy agenda.

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27 “Research” is used here to mean evidence collected by researchers for the purposes indicated. In some cases, this will be data collection and analysis, or literature reviews rather than “research” as defined by the Frascati Manual. Conversely, some such background work may be procured by administrative units outside the formal research programme.
2. Background

2.1 Since it was formed DWP has had a research budget reflecting the importance placed by the Department and Treasury officials on building and maintaining a sound evidence base. This stability has allowed us to balance short-term and one-off projects whilst investing appropriately in longer-term projects which provide better value for money over time, and unique additions to our evidence base.

2.2 Externally commissioned research projects are let through the DWP Social and Economic Research Framework. It is intended to ensure that we have high quality, consistent processes in place to let and manage research contracts, and to minimise the administrative burden on all involved. The Framework was re-let in July 2009 and consists of 89 organisations designed to meet the external research requirements of the Department. It is managed by a small team of Procurement Professionals who ensure all commissioning complies with DWP and European regulations. Roughly £20 million of work is commissioned over the framework annually.

2.3 Within DWP, we divide the bulk of our research into three programmes: the Pensions and Ageing Society Research Programme; the Jobcentre Plus Research Programme; and the Working Age Research Programme. There is a smaller cross-cutting Strategy Unit programme. Further details on these programmes are provided below. The division is for administrative convenience. In particular circumstances, work from one research programme will involve colleagues from other policy areas.

2.4 At a high level the externally funded DWP research process can be described as follows:

- As part of the annual budgeting round a sum of money is allocated to the research programmes, though usually set in advance as part of the process of responding to a Spending Review settlement;
- Priorities for the year ahead (informed by discussions with Ministers, senior officials) are determined and a research programme is established, with flexibility for changes during the year;
- The Working Age Research Programme described below is published and external researchers have the opportunity to comment on it; this will also apply to the Pensions and Ageing Society Research Programme;
- The research is then commissioned—using our contract framework;
- The programme is reviewed during the year and potentially some work is not started or delayed, and new research commenced if circumstances have changed;
- DWP publishes all the research commissioned (except in rare cases where it is not robust) whilst supporting researchers who wish to publish through learned journals or conferences.

3. Engaging with the Research “Community”

3.1 As well as commissioning and publishing the formal research discussed elsewhere, we also seek to engage with the wider research community. We:

- Organise welfare and policy analysis seminars at LSE;
- Sometimes organise seminars around particular items of research and, by doing this, help to ensure that our work is part of the wider agenda. For example the recent Pensions and the Macro-economy seminar (based on some research DWP had commissioned) involved external academic researchers. A series of seminars have brought stakeholders together to consider findings from evaluating “Pathways to Work”.

3.2 External researchers seeking funding from the Economic and Social Research Council sometimes approach the department to discuss their research before applying. This helps them identify how their research can have policy relevance. Robert Laslett (Chief Economist—Pensions) sits on the ESRC’s Research Grants Board.

3.3 The Social Research Head of Profession leads regular meetings with ESRC, and we use ESRC Case Studentships. DWP is a corporate member of the Centre for Economic Policy Research (CEPR) which provides another route by which DWP researchers can engage on a quasi-formal basis with researchers.

4. Balancing Long-Term and Short-Term Needs

4.1 We support a number of longer-term initiatives including:

- British Social Attitudes Survey: The survey provides strategic insight into the changes in public attitudes that are relevant to the Department.
— The Family Resources Survey (FRS): The Family Resources Survey collects information on the incomes and circumstances of private households in the United Kingdom. It has been running since October 1992. Whilst it was designed with our needs specifically in mind, it contains information of interest to researchers and analysts from a wide range of disciplines in both the public and private sectors.

— Millennium Cohort Study: This is a major investigation of the influence of early circumstances on health over the life course. The aim is to provide evidence for major policy initiatives.

— The General Household Survey (GHS): This is an inter-departmental multi-purpose continuous survey (by the ONS) collecting information on a range of topics from people living in private households in Great Britain.

— The Wealth and Assets Survey: A vital source of statistics about how households in Great Britain are managing economically. Key areas of the questionnaire focus on borrowing, savings, household assets, and saving plans for retirement. Data produced will be used to inform government policy on a range of issues, including pension provision.

— The English Longitudinal Study of Ageing: It provides data on the implications of labour market history for health and financial circumstances in later life.

These surveys play a vital role in filling the data and knowledge gap identified by a number of organisations. For example, the FRS and British Household Panel Survey are analysed to yield the Households Below Average Income Dataset. We make survey data widely available to inform research and analytical work carried out by Universities as well as organisations such as the Institute of Fiscal Studies.

4.2 We lead a funding consortium of other government departments, the ESRC and the MRC, to establish an Institute to examine Subjective Wellbeing and Public Policy, which will be advertised shortly. We are party to discussing replacing Families and Children Survey by the ESRC “Understanding Society” survey, and will be part funding it.

5. Pensions and Ageing Society Research Programme

5.1 The Pensions and Ageing Society Research Programme aims to:

— Inform a wide range of pension reform policy areas;
— Fill knowledge gaps; and
— Support evidence based policy on pensions and the ageing society.

5.2 In 2009–10, the agreed budget for the Pensions and Ageing Society research programme was £5.8 million and covered four broad workstreams:

— Workplace pension reforms (including automatic enrolment and personal accounts)
— Independence in later life
— Pension provision and savings behaviour
— Pension Reform Communications and Information

5.3 A sizeable part of this research budget funds a number of large-scale surveys sponsored or co-sponsored by DWP, with other government departments or the research councils, particularly the Wealth and Assets Survey and the English Longitudinal Study of Ageing. The remainder of the research budget is spent on research more directly related to current policy issues.

5.4 Process for Pensions and Ageing Society Research Programme

The current procedure for agreeing this annual external research programme is:

— Analysts and research managers consider pension policy areas, the policy context, the existing evidence and the evidence gaps;
— The results feed into discussions with policy colleagues within DWP, other government departments, external stakeholders on further research needed to inform policy development;
— Project bids are drawn up and prioritised in the discussions, taking into account resource issues and the need to ensure that the programme considers issues relating to gender, disability, race and ethnicity, where relevant (individual project specifications also include the need to cover such dimensions where relevant);
Setting Research and Funding Priorities: Evidence

— Ministers are consulted, with a review of the previous year’s programme, and their opinions incorporated into the research programme;

— A Research Steering Group, consisting of appropriate policy, analyst and finance representatives reviews and agrees any project proposals and the research budget bid which is submitted to Ministers for approval, after clearance by Directors;

— Ministers are consulted and asked to approve the final research programme.

5.5 The research programme is reviewed quarterly when project priorities are considered, along with a formal mid-year review of the overall programme and the budget position. Following the mid-year review Ministers are consulted over anything which needs their approval. In between these times, other emerging priorities are reviewed on an ongoing basis in light of the policy and budgetary priorities at the time.

5.6 Research projects are approved after scrutiny by project managers, Divisional Managers and the Finance, Planning and Performance Division. They are then carefully managed by expert analysts and further quality assurance is supported through appropriate and thorough consultation practices.

6. Working Age Research Programme

6.1 This programme supports:

— Policy development;

— Monitoring and analysis of progressing policies, and policy-relevant developments in the wider economy and society;

— Strategic and cross-cutting research which provides an underpinning evidence base for making strategic decisions. For example:

— Our Families and Children Longitudinal Study covers working age families with children but includes information about savings so that we can understand better the implications for income in later life;

— Policy and Programme Evaluations, for example how well do programmes like the New Deals and Employment Zones work and can they be improved?

— Expert advice can be commissioned from national or international experts;

— Evidence Reviews, important to synthesise evidence on particular topics; we increasingly use “Systematic” reviews (using robust review methods). This includes meeting the research needs of our one scientific advisory committee, the Industrial Injuries Advisory Council, for literature reviews on areas the Council intends to consider.

— Good practice guidance to ensure that researchers across DWP and government have access to good, practical information about best practice in their discipline.

As most projects are developed in close consultation with policy and/or operational colleagues, their results are always linked to advice on using them to formulate and evaluate policies. For example, we assess the impact of our policies and undertake process evaluations to understand how they are delivered and to inform future delivery (eg Employment Retention Allowance, Pathways to Work and New Deal for Lone Parents).

6.2 The spend in 2009–10 is about £10 million.

6.3 Process for working age research programme

— We set overarching priorities for the year ahead annually, based on discussions with Ministers and senior officials from across the Department.

— In the autumn of each year the lead analyst in each major policy area28 will work with individual research managers and policy experts to develop a proposal for a programme of research for their area for the coming year.

— In developing research proposals, social research professionals take account of the wider context to the policy questions to be answered as well as what is currently known, whether from Departmental or external sources.

28 These policy areas are in the main closely related to our Departmental Strategic Objectives and cross-Government Public Service Agreements.
— We encourage strong links between Government Departments: DWP researchers concerned with childcare and employment issues regularly meet their counterparts in DCSF to discuss projects of mutual interest, for example. This ensures we identify opportunities to work together and do not duplicate.

— Research proposals may include joint development or financing if appropriate (for example as has been the case for the Families and Children Study).

— Potential analysis of administrative databases will be examined before developing proposals to fill the gap through externally commissioned research.

— Once proposals have been received, a group of senior officials (the Working Age Research Group), led by the Chief Analyst for Working Age policy groups and including stakeholders from across the Department, reviews the proposals and decides which projects should be given financial authority to proceed.

— Each proposal is peer reviewed for quality, methodology and overlaps internally before being considered by the Working Age Research Group. The prioritisation takes account of a number of factors, including:

  — The expected strategic and policy priorities during the year ahead;
  — Significant gaps in the evidence base which will limit our capacity to take policy and operational decisions (over different planning horizons);
  — The kind of evidence needed in the identified policy priority areas;
  — Whether the evidence base could be strengthened through effective use of internal or existing resources (in house analysis of existing data, particularly administrative data; existing external research syntheses etc).

— Although this process provides a solid framework for the year ahead, we recognise that new priorities will emerge during each year. For example, no-one predicted the severity and strength of the economic downturn that was starting to take hold as we planned our research programme for this year last Autumn, and we have made adjustments to existing projects and commissioned new ones in response. We ensure that there is an allowance within the budget for priority projects to start in-year authorised by the Working Age Research Group, who can also can commission a complete review mid-year should it be needed.

7. National Jobcentre Plus Research Programme

7.1 The Jobcentre Plus research programme aims to investigate key operational and strategic issues for Jobcentre Plus and provide evidence to support decision-making and continuous improvement in our service delivery.

7.2 It is focused on the Jobcentre Plus Priorities including:

  — Delivering services more efficiently and effectively
  — Delivery of performance
  — Transforming our services.

7.3 To underpin the business priorities, the annual programme consists of a range of externally commissioned projects. These provide timely and robust evidence about key strategic and delivery issues and give the business an overview about how it is progressing against its priorities. The 2009–10 programme focuses on research into customer needs.

7.4 The total budget for the 2009–10 programme is £1.3 million.

7.5 Process for the Jobcentre Plus Research Programme

New areas for research are identified throughout the business year. But, each November, the Strategy Research Team of our Performance Measurement Analysis Division begins to develop a formal national research programme for Jobcentre Plus.

Senior Jobcentre Plus Leaders and social researchers are asked to submit expressions of interest detailing their thoughts on key areas where research should be conducted. New requests for research are then assessed against the overall business priorities for the year and a recommendation for the annual research programme is presented to the Jobcentre Plus Executive Board who has final approval of the programme. Once final approval has been granted a submission is sent to Ministers for information.
Standing research projects in the National Programme include the National Jobcentre Plus Customer Satisfaction Survey, which provides the national measure of customer satisfaction across all Jobcentre Plus regions. Around 90 per cent of the Jobcentre Plus Strategy Research Team resource is committed to delivering the annual National Research Programme. The remaining 10 per cent is committed to deliver ad hoc in year requests for research (subject to resource and funding constraints).

8. STRATEGY DIRECTORATE RESEARCH PROGRAMME

8.1 We aim to respond to Ministerial research needs flexibly (as issues arise or gaps are identified), as well as addressing longer term identified strategic concerns. These can arise directly from Ministers or senior management, but also from ongoing discussions between Strategy Unit and SoS, often initiated by submissions outlining research suggestions.

8.2 The decision to fund research follows the wider process outlined by the Department. This includes peer review of the research work specification and proposal, as well as final Ministerial authorisation. The quality of the outputs is also assured through peer review, often within the formal arrangement of steering groups.

8.3 Due to the reactive and short term nature of the research, it is not often possible to anticipate it, and so publish the research program in advance of the work being conducted. Research outputs are published in line with the Departmental publications framework. They have allowed us to develop and build upon the Department’s evidence base by:

— Providing insight into areas of central concern as well as ones which might otherwise not have been explored.
— Focusing on overarching or cross-cutting issues that were not the remit of any team, but were important to the Department.
— Publishing a number of informative reports and ad-hoc reviews, some of which address key criticisms levelled at Departmental policy.
— Providing the Department’s contribution to major national research projects.

8.4 Examples of relevant research include:

— People’s Priorities in the Benefit System: The research examined how the public perceive the DWP should spend its non-pension budget;
— Citizens’ Burdens: The aim of the research is to identify the types of burdens/problems encountered by citizens when making a claim to Jobseekers Allowance;
— Scoping Study for Longitudinal Destinations Survey: The aim of the scoping study is to identify any information and analysis needs not met by existing data in understanding benefit destinations;
— Impact of the Financial Incentives in Welfare Systems on Family Structure: The review examined both national and international evidence on the influence of financial incentives in the welfare system on family structure.

8.5 The annual research budget for 2009–10 is £1.3 million.

9. EVALUATING OUR RESEARCH PROGRAMMES

9.1 One of the aspects of the capability reviews of Government Departments is an evaluation of the capability of a department in making strategic choices based on evidence. DWP is one of only three of the 17 Departments assessed who were awarded this rating, and the quality and investment in our research played a major part in that.

9.2 In 2008, the Department commissioned a review of its external research programme in both Pensions and Working Age Groups. The resulting report—to be published in due course—focused on how well the Department uses, manages and prioritises its external research. The report will highlight a number of recommendations for consideration for the future.

10. THE DEPARTMENT CHIEF SCIENTIFIC ADVISER

10.1 Dr Bill Gunnyeon acts as the link between DWP and its analysts, the Executive Team and the Government’s Chief Scientific Adviser. Given that there is no programme of research into science, engineering and mathematics, he holds no research budget comparable to those described in this paper.

September 2009
Memorandum by the Department of Communities and Local Government

This Memorandum sets out the principles and processes which inform Communities and Local Government’s programme of research and how decisions on research priorities are taken. Research in this context is used to refer to development activities, technical research, analytical activity across all of the scientific and analytical professions. As such, it goes beyond the science and technology research that is the focus of this inquiry, but the processes operating within CLG cover the research programme as a whole. CLG’s agencies and Non-Departmental Public Bodies, such as the Homes and Communities Agency (HCA), also commission research, to inform their policy, strategy and operations, and these programmes are managed through the relationship established between the Agency and the Department and set out in Framework Documents.

Objectives for Setting Research Priorities

The Department’s research and analytical priorities and associated programme of research and analytical activity are directly informed by our Departmental Strategic Objectives and Public Service Agreements. These provide the overarching framework for the types of research, analysis and evidence needs identified, addressed and subsequently used by the Department to deliver on our policy objectives.

Communities and Local Government’s specific research priorities are also influenced by our commitment to deliver on value for money and to seek continuous improvement in our activities. Within the context of research and analysis, this commitment means that we try to deliver more and better evidence from the resources available to us.

Similarly, HCA aims to ensure that its investment in research provides the knowledge, information, expertise and good practice needed to inform policy and strategy development, delivery of its programmes whilst contributing to key partners and stakeholders work.

Processes for establishing Priorities

Our overarching research and analytical priorities are identified as part of the regular annual research planning and formulation cycle, which is linked to the Department’s business planning timetable. Within the research planning and formulation cycle, the following key activities are undertaken to identify our research priorities.

From November—February

— Identify through business planning rounds the key policy work-strands that need to be delivered.

— Policy and analyst teams specialising in particular policy areas take stock of existing evidence provision through a process called an “evidence health check”, considering both completed/on-going research, analysis activities and their adequacy to address current priorities. This stock-take usually includes contact with key partners and stakeholders outside of the Department who assist us in the delivery of our policies.

— Any relevant gaps in the evidence base for existing and new policy areas are identified and ranked in terms of priority need.

— Suggested new research and analysis needs are outlined (including timelines, costs, outputs). These research bids are ranked in order of priority by the policy-analyst teams. At this stage, suggestions for cross-cutting research both within the Department and with other Departments, are considered, with a view to achieving greater efficiency and better joined-up evidence.

During February—March

— Draft research programmes are considered by the Evidence and Strategy Group, (ESG) a sub-group of the CLG Board, who are responsible for deciding the strategic direction and priorities for the Department’s research programme. The ESG are supported in their decision by the Analyst Quartet, comprising the Heads of the Scientific and Analytical Professions. The Analyst Quartet scrutinises and challenges the research bids in terms of business need, methodological robustness, cost and potential contribution of the research and analytical outputs for the Department’s specific policy and delivery activities.

— The draft research programmes are revised in light of ESG feedback.
During March—April
— The revised research programmes are sent to the Board and Ministers for clearance.

Between April—October
— The approved research programmes are commissioned.
— Progress with the commissioned research is tracked through the Research Delivery Network, a support and advisory network comprising of procurement specialists and project managers.
— In September, the ESG reviews progress with the newly commissioned programmes of work, gathered through the Research Delivery Network. Any emerging priorities and new research needs are considered at this mid-point.

From November
— This research cycle commences again.

Our research programmes, by necessity are dynamic in nature, flexible enough to accommodate any new emerging needs but also resilient in continue to generate evidence on established policy areas. We also ensure that we reserve some headroom in our budgets to accommodate any emerging priorities. The Strategic Research Budget, which is signed off by the ESG, and is used to fund any critical strategic, cross-cutting research needs emerging during the financial year.

Throughout the year, analysts and scientists (including the Analyst Quartet, Heads of Analytical Units) in the Department and our have on-going discussions and external research partners (ESRC, other research councils), professional bodies (including, Government Economic Service/Government Social Research/ Government Statistical Service), stakeholders, and their counterparts in other Local and Central Departments (including Cabinet Office, GO-Science, Foresight), to keep up to speed with any emerging trends, issues and needs that will positively or adversely impact upon the programme of research underway. These discussions ensure that the research programmes we undertake are relevant throughout the course of the financial year and we make linkages.

HCA is a relatively new body with a range of inherited research commitments from its predecessor organisations and programmes against a background of tight resources. HCA has developed a draft research strategy (which is awaiting management approval) that will aim to meet these existing commitments whilst providing a forward programme focused on targeted areas/priorities to support core business and the development of that business whilst allowing a level of flexibility to respond to short term priorities.

Mechanisms for ensuring Priorities are met
In 2008–09, Communities and Local Government spent £23.9 million on research and analysis (across various disciplines and methodologies) covering our six DSOs and related cross-cutting research. We ensure that staff involved in planning, specifying, commissioning and managing research have the necessary skills and support so that we get the most from our research investment, through the following mechanisms:

— Programme and project management training for research managers.
— Providing on-going research procurement and management advice and support through the Research Delivery Network, who comprise research project managers; strategic Research and Analysis teams and procurement specialists, meeting every six to eight weeks.
— The Introduction of Category Management to improve relationships and with suppliers and contractors and ensure a clearer profile of spend against policy areas and contractors.
— All research projects of £100,000, or more, are cleared by a Gateway Review team consisting of the Analyst Quartet and Procurement Specialists.
— Our annual research programmes are promoted as widely as possibly among research suppliers, by advertising our annual research programmes in online newsletters.
— Virtually all of our research projects are procured through competitive tender actions to ensure we attract the best quality and cost proposals from research suppliers.
— Regular updates and progress reports on research programme activity for the ESG who meet four or five times a year.

To ensure that the evidence produced has real impact, we actively promote the outputs from our work through various ways—online and hard copy publications, public policy seminars, presentations and slide packs to diverse audiences, both in and outside of CLG.

Collectively, all of these activities are in place to ensure that the priorities identified by the Department are met efficiently and effectively. The outputs from these activities in turn, help to inform discussions about new and emerging research priorities over the current and forthcoming financial year.

September 2009

Memorandum by the Department of Energy and Climate Change

1. INTRODUCTION

The Department welcomes this inquiry. The Committee’s views will provide a valuable contribution to the current debate on future energy policy. This memorandum covers DECC’s objectives, processes and mechanisms for establishing priorities for departmental research and development for which we have responsibility. BIS are providing a separate memorandum covering the government’s overall strategic priorities and processes.

2. CONTEXT SETTING

We face unprecedented challenges to our environment, our economy, and the future security of our energy supplies—and the decisions we make now will affect the planet and our way of life for generations to come. DECC exists to tackle these challenges. The Department of Energy and Climate Change (DECC) was created in October 2008 to help address these challenges.

Our seven objectives are:

— To secure global commitments that prevent dangerous climate change.
— To reduce greenhouse gas emissions in the UK.
— To ensure secure energy supplies.
— To promote fairness through our climate and energy policies at home and abroad.
— To ensure the UK benefits from the business and employment opportunities of a low carbon future.
— To manage energy liabilities effectively and safely.
— To develop the Department’s capability, delivery systems and relationships so that we serve the public effectively.

The Department regards research and innovation as crucial to achieving these objectives and takes a close interest in research, development and demonstration activities. We understand the Committees’ inquiry is primarily focused on prioritisation processes for research but that the inquiry also touches on the later stages of the landscape. There are three aspects to its role in the energy and climate change research landscape:

— co-ordination of energy innovation landscape—including engaging with the Research Councils;
— funding for large scale Demonstration and deployment of energy technologies; and
— commissioning and management of R&D to generate evidence to underpin policy making.

These three roles are described further below in the context of the Committee’s questions.

3. CO-ORDINATION OF ENERGY INNOVATION LANDSCAPE

Since its formation DECC has taken a leading in coordinating the activities of the various supporters of energy innovation. In 2009, DECC completed a review of the energy generation innovation landscape that looked to enhance leadership, accessibility and support for developers of low carbon energy generation technologies. In particular, we looked to improve the accessibility and coordination of funding and support for developers and strengthen DECC’s role in providing the landscape and its bodies with strategic leadership.

As part of this work, DECC consulted a range of external stakeholders engaged in the development of energy generation technologies. There was a widely shared view amongst stakeholders that DECC should take on a stronger leadership role for the low carbon energy sector, in particular, promoting a clearer picture of the low carbon energy technologies identified as meeting the UK’s future energy needs and drawing on our technological strengths; that sign posting of public sector funding for developers of low carbon energy technologies is poor and should be improved; and that national and regional energy priorities differ, and that greater alignment and consistency would deliver better value for money for the UK.
The Review produced 11 outcomes aiming to offer practical solutions and support to innovators developing low carbon technologies. The key outcomes were published in the Renewable Energy Strategy and Low Carbon Transition Plan with the full report expected to be made available on the DECC website from mid-October.

Key outcomes focussed on improving coordination and technology choices include:

- Forming a more collaborative working arrangement between funders and better integrated programmes of support through a joint strategy. The group will include representation from Carbon Trust, Energy Technologies Institute, Technology Strategy Board, Research Councils and DECC, looking to accelerate technology development and avoid project funding shortfalls.

- Developing a shared vision, between Government and the private sector, to include potential technology and infrastructure requirements to support develop a future low carbon society. The output from this work should help identify technologies the UK is best placed to develop and the innovation dependencies and barriers we need to overcome.

- Support the launch of a Knowledge Transfer Network (KTN) for energy generation to promote collaboration and knowledge sharing between innovators. The KTN will also act as a one stop shop supporting innovators, particularly SMEs and start-ups who need support to progress their idea.

- Run an initial trial to develop action plans with industry for marine and hydrogen and fuels cells. The action plans will seek to establish funding gaps and barrier removal to identify the future role the technologies have to play in the UK.

4. Engagement with Research Council Programmes

DECC has frequent and detailed contact with the research councils and excellent sight of those programmes of relevance to DECC’s objectives. Research Council spending decision’s are independent of government policy—and DECC believes this continues to be the right approach. However the Councils are alert to societal challenges and, in the case of Energy and Climate Change, have been very responsive to those challenges. DECC endeavours to ensure that the RC’s have good insights into the direction of UK energy and climate change policy so that they can make informed decisions about the focus of their programmes. The cross-Council Energy Research Programme has, in our view, been very effective in supporting energy related research and has provided an important feed through into the later stages of the Innovation chain.

5. Management of Energy Demonstration and Deployment Programmes

DECC provides funding for low carbon technologies in the later stages of the innovation chain (Technology Readiness Levels (TRLs) 6 to 9). DECC’s funding is targeted primarily for large-scale demonstration programmes and pre-commercial deployment support—usually as grants or related funding.

This funding is targeted to help address market failures in key low-carbon technology sectors in order accelerate the commercialisation of those technologies thought necessary to the achievement of the UK’s energy and climate change objectives. This Demonstration and Deployment funding (D&D) complements market pull incentives such as the Renewable Obligation Certificate’s (ROCs) and the planned Feed-in-Tariffs (FITs) and Renewable Heat Incentives (RHI).

DECC’s primary source of funding in this area is the UK Environmental Transformation Fund (UK ETF). The UK ETF aims to encourage the development of low-carbon energy and energy efficiency technologies in the UK. Funds of up to £400 million have been allocated for the period 2008–09 to 2010–11 for the UK ETF. The ETF is not open to direct funding requests. Instead, schemes funded by the ETF, such as those run by DECC, and by others, such as the Carbon Trust, are publicised when funding is available. The ETF combines a number of Government low-carbon technology funding programmes that existed prior to the creation of the ETF itself, with new programmes. The range of these programmes is wide and includes:

- Carbon Trust’s innovation programme and funding for new low-carbon technology enterprises, together with loans both for the private and public sector (Salix Finance).
- Low Carbon Buildings Programmes.
- Bio-energy Capital Grants and Bio-energy Infrastructure Schemes.
- Offshore Wind Capital Grants Programme.
- Marine Renewables Deployment Fund.
- Carbon Abatement Technology Demonstration Programme.
- Hydrogen and Fuel Cell Demonstration Programme.
— In addition to the ETF, Budget 09 announced additional funding for low carbon technology—described as Low Carbon Investment Funding (LCIF). Responsibility for this funding is shared with BIS and the low Carbon Transition plan and the Low Carbon Industrial Strategy announced how some of that funding will be spent this included—for example—up to £120 million for Off-shore Wind and up to £60 million for Marine Energy. The LCI Funding complements the ETF in supporting low Carbon D&D to help achieve energy and climate change objectives whilst supporting the objectives of the Low Carbon Industrial Strategy which identifies and provides funding for key sectors where UK has competitive advantage or commercial opportunity and sets out Government action and new investment to maximise these and ensure our low

6. MANAGEMENT OF RESEARCH AND DEVELOPMENT PROGRAMMES

Considering the Committees’ questions in the context of DECC’s Climate, Energy, Science and Analysis Unit’s direct R&D spend:

What is the overall objective of publicly-funded science and technology research?

The purpose of DECC’s R&D spend is to provide the necessary evidence base to inform policy-making for the achievement of DECC’s seven aims—described in the introduction sections.

Our policies and decision-making on climate change and energy—both nationally and internationally—need to be underpinned by timely and sound scientific analysis and evidence. This analysis is provided through a team of in-house scientists working closely with policy teams. The Department directly funds a wide range of climate change and energy research to inform UK policy development.

The aims of this research programme are to:

— improve understanding of, and reduce uncertainty in, climate predictions;
— improve climate impact assessments and adaptation strategies;
— meet the UK’s national and international commitments for assessing trends in greenhouse gas emissions and future projections;
— improve assessment of mitigation options and costs;
— help to build internationally acceptable approaches to responding to climate change in the long term;
— continue long-term measurement of changes occurring in the ocean and the atmosphere;
— inform both short-term and long-term energy demand policy development; and
— monitor the effectiveness of energy demand policy once implemented.

As well as the research programme described above, DECC also funds development of low carbon technologies in the later stages of the innovation chain.

How are public funds for science and technology research allocated? Who is involved at each level and what principles apply? Where appropriate, is the Haldane principle being upheld?

DECC’s budgets, including those for R&D, were initially transferred from Defra and BERR (with some adjustments reflecting Machinery of Government changes and responsibilities). Since then the Department has reviewed all budgets as part of a zero-based business planning round, required because demand for spending is significantly greater than the resources available. The R&D financial bid was submitted by Dr Nafees Meah, Head of Science, based on input from scientists in consultation with policy colleagues. All bids were subject to review and challenge by the Management Board and final budget allocations were agreed by ministers, taking account of all priorities and financial pressures.

The Haldane principle is not applicable to DECC-funded research, as our research programme is specifically to support policy requirements.

Are existing objectives and mechanisms for the allocation of public funds for research appropriate? If not, what changes are necessary?

DECC’s R&D programme, which continues one established in predecessor Departments (originally in DoE) has been successful in commissioning world-leading science with a high profile. It has resulted in UK negotiating teams being well-respected in international fora and influenced the UK’s leading position on mitigation of climate change.
Nevertheless, two changes are necessary.

1. Machinery of Government changes mean that DECC is currently using two systems to commission research—one originating in Defra, and one originating in BIS. A single system is needed, and is under development.

2. An improved mechanism is needed for funding research projects and programmes which cross departmental boundaries (eg the European satellite altimeter project, “JASON-3”). Problems can arise when a number of departments stand to benefit from the outputs, but the project is not the highest priority for any one of them. Professor John Beddington, the Government’s Chief Scientific Adviser, is addressing this issue.

What governs the allocation of funding for Government policy-directed research through Government Departmental and agency initiatives? Are existing mechanisms appropriate? What is the role of Departmental CSAs?

Government Office for Science needs a view on strategic priorities for research, and the CSA Network has a key role to play in forming this view. Within Departments, policy-making should be evidence-based, and it is the CSA’s role to indicate the adequacy, or otherwise, of the evidence base and the allocation of funding for it. Thus CSAs are important in aligning the evidence base with government activity. DECC’s has recently appointed a CSA—Professor David MacKay—and he will take up his post on the 1 October 2009.

How are science and technology research priorities co-ordinated across Government, and between Government and the relevant funding organisations? Who is responsible for ensuring that research gaps to meet policy needs are filled?

The GECC (Global Environmental Change Committee), chaired by the Defra CSA, aims to co-ordinate research across Government, and ensure that gaps are filled. However, its remit is currently under review. There is a trend for Government Departments (or contractors) and Research Councils (who develop their research strategies in consultation with Government Departments) to work more closely together, eg the Met Office and NERC, which may result in better co-ordination and fewer gaps. This is being encouraged by the new LWEC (Living With Environmental Change) initiative, a partnership of Departments, Research Councils and other bodies who are committed to co-funding projects of interest to more than one of the partners.

Is the balance of government funding for targeted versus response-mode research appropriate? What mechanisms are required to ensure that an appropriate and flexible balance is achieved? Should the funding of science and technology research be protected within the Research Councils or Government Departments? How will the current economic climate change the way that funds are allocated in the future?

Within DECC balance is achieved by ensuring that all policy areas requiring evidence are addressed, either through our own research programme or by other bodies and programmes. It is essential that committees and steering groups which direct targeted research have adequate representation from government officials and government-funded researchers, to ensure the research does address real need in a useful way.

How is publicly-funded science and technology research aligned and co-ordinated with non-publicly funded research (eg industrial and charitable research collaborations?) How can industry be encouraged to participate in research efforts seeking to answer societal needs?

The area of climate science where industry is most likely to collaborate is impacts of climate change; at the UK level, this is Defra’s responsibility. DECC is in regular contact with NGOs and is aware of their views about evidence needs.

In energy innovation government currently collaborates directly with industry through a complementary range of forums and bodies which together provide a strong and varied interaction. Key organisations supporting low carbon research and innovation are the Carbon Trust, the Energy Research Partnership and the Energy Technologies Institute (ETI) and the Technology Strategy Board. The Carbon Trust is an independent company set up in 2001 by Government to accelerate the move to a low carbon economy by working with organizations to reduce carbon emissions and develop commercial low carbon technologies. Carbon Trust receives funding from DECC. Its activities are focused on: cutting carbon emissions now by providing business and the public sector with expert advice, finance and certification to help them reduce their carbon footprint and to stimulate demand for low carbon products and services; and cutting future carbon emissions by developing new low carbon technologies—through project funding and management, investment and collaboration and by identifying market barriers and practical ways to overcome them.
The Energy Research Partnership (ERP) was established to enable the UK to become a world leader in the development of innovative new technologies. Its high-level forum brings together key funders of energy research, development, demonstration and deployment (RDD&D) in Government, industry and academia, plus other interested bodies, to identify and work together towards shared goals. The Partnership has been designed to give strategic direction to UK energy research, development, demonstration and deployment (RDD&D), in the context of the Government’s Energy Policy and especially with regard to the aim of increasing national research and development expenditure.

The Energy Technologies Institute is an innovative and unique Limited Liability Partnership between international industrial companies with a strong focus on energy, and the UK government. The ETI aims to help bridge the gulf between laboratory proven technologies and full scale commercially tested systems. The ETI partners work together, sharing expertise and resources to speed up the development and demonstration of energy technologies and shorten the lead times to market.

The Technology Strategy Board is an executive non-departmental public body that works in partnership with government, academia and industry to promote, support and invest in technology research, development and commercialisation in the areas which offer the greatest scope for boosting UK growth and productivity.

DECC’s works to ensure that these bodies’ activities are complementary to each other and together maximise the UK’s support to innovation. It does this through regular dialogue and involvement in governing committees. DECC has also recently expanded the role of the Low Carbon innovation Group (LCIG)—which includes the RC’s, ETI, TSB, Carbon trust and DECC—to further strengthen that collaboration.

To what extent should publicly-funded science and technology research be focussed on areas of potential economic importance? How should these areas be identified?

These decisions should be considered in the context of dealing with problems such as climate change in the absence of an evidence base. There have been many studies of the costs of mitigation of, and adaptation to, climate change. The costs of providing an evidence base via research should be compared with these—much larger—sums.

How does the UK’s science and technology research funding strategy and spend compare with that in other countries and what lessons can be learned? In this regard, how does England compare with the devolved administrations?

CESA’s research budget is held on behalf of the devolved administrations and they are consulted about its content and direction.

September 2009

Memorandum by Dr Martin Dominik

1. My recommendations can be summarized in four main points: (a) foster curiosity, (b) take risks, (c) decide in a transparent process involving all relevant parties, (d) put public money where private money does not go.

2. Public funding for science and technology research is not about spending money, but about investing so that a huge return is achieved. A proper investment strategy is even more important in an economic downturn, and the total amount of investment should be larger rather than smaller in order to stimulate the economy and turn the crisis into a future benefit.

3. There is wide agreement within the society that research is beneficial, even if a potential economic impact is not foreseeable. In fact, humankind shows a far deeper desire to advance knowledge. This meets the generic role of a scientist, which is to increase the knowledge of the society rather than just his/her own.

4. Achievement of this goal not only relies on creativity, but also on the environment that might allow to turn a vision into reality, or force dreams to remain dreams forever.

5. A flourishing research landscape can only arise if one puts people first, and builds strategies and facilities around their ideas (rather than doing it the other way round). We simply cannot afford missing out on the best ideas, so that we need to make sure that the most innovative approaches become the winners in the evolutionary struggle of research proposals.

6. Capturing of the best ideas creates an explicit demand for a framework that does not disadvantage women, people with career breaks, or those who gained experience in a variety of fields, eg by having moved between academia and industry. We can be proud of the existing creative potential, but we cannot afford to waste it.

7. A large potential gain does not come without a substantial associated risk of failure. The more innovative research work gets, the less predictable it becomes. Therefore, willingness to take risks is a prerequisite for achieving excellence.
8. While the expertise of scientists is indispensable for decisions on science issues, the political responsibility cannot be laid on their shoulders. Otherwise, scientists would factually convert to politicians.

9. If one aims for decisions about science funding that work out to the benefit of the nation, these need to involve all relevant parties. In the advocacy of the establishment of “Advisory Committees”, the Haldane Reports points out: “But the preservation of the full responsibility of Ministers for executive action will not, in our opinion, ensure that the course of administration which they adopt will secure and retain public confidence, unless it is recognized as an obligation upon Departments to avail themselves of the advice and assistance of advisory bodies so constituted as to make available the knowledge and experience of all sections of the community affected by the activities of the Department.”

10. The Haldane report does not call for expert committees, but, to the contrary, if one realizes that the public is affected as the consumer of newly-gained knowledge, one finds a concept of public dialogue.

11. It is our society at large who “owns” science, and it would contradict the fundamental principles of democracy, if decisions about science were taken by scientists only. Similarly, I would guess that we do not want decisions on defence issues being delegated to army officers.

12. While specialists are required to check the technical feasibility of research proposals, they are the least suited to judge on the priority of their own area of expertise against others. The scientific and societal merit of research work can only objectively be assessed by a panel whose members are free from particular interests. Increasing distance also better allows to see the wider context.

13. Decision processes must be transparent and open to public scrutiny. Moreover, it needs to be ensured that all views are heard. In particular, fresh and radical thinking tends to provide suggestions and solutions that never would have emerged from consulting the same “great and good”. Intelligent life does not start at professorial level.

14. We currently waste most valuable human resources by forcing researchers to think within short-term projects, define short-term goals, and even worse, demand that specific results are delivered by a given date. It would make sense to shift money towards people-focused funding schemes or universities for supporting research excellence.

15. Public funding of research cannot replace private investment, and should not intervene with market forces. Public money is well-invested into research with large innovation potential (eg by addressing fundamental questions) but without foreseeable economic return or a risk too high for being attractive to private capital.

16. A “focus on economic importance” could mean quite different things. In fact, I would consider a long-term benefit of curiosity-driven fundamental research to be an investment of public money of highest economic importance, because it harbours the largest potential gain. In contrast, research with foreseeable economic benefit is more likely to be attractive to private investment and does not require the same amount of taxpayers’ support.

17. Research proposals are to compete on the basis of innovation potential and relevance to the society, without any preference for one area or the other. Maintaining a broad knowledge base both caters for arising new opportunities and challenges (of which we cannot predict where they will arise) as well as for widely spreading the risks.

September 2009

Memorandum by the Energy Research Partnership

Development of ERP

The Energy Research Partnership (ERP) was established in 2005 as a high level forum to underpin the increased investment in energy research and development, announced in the Budget. It brought together public and private stakeholders and sponsors of energy R&D to maximise the impact and coherence of all aspects of energy innovation, from fundamental research through to support for the deployment of emerging low carbon technologies in the market place. The Energy White Paper in 2007 noted its contribution, recognising the influential role it played at the time of the establishment of the Energy Technology Institute (ETI), as well the publication of significant reports on energy innovation.


Following an internal review in 2008, ERP enhanced its capability with the formation of an Analysis Team. This has enlarged its capacity to deliver projects and increased its Influence on policymakers and public and private funders.

**Broad Membership**

One of the key strengths of ERP is that it brings together senior public and private influencers of energy RDD&D from across the energy landscape, including nuclear, fossil and renewables and covering the full innovation chain. It is co-chaired by an industry and government representative, currently Nick Winser, Executive Director National Grid, and David MacKay, DECC Chief Scientific Adviser. Members are also senior level representative from government, including Chief Scientists, academia, industry, including Shell, BP, E.ON, Alstom, regional development agencies and research councils, plus other relevant bodies, at the end of this document (Submitted but not printed). This broad, high-level membership means it can provide a distinctive and valuable overview on issues relevant to energy innovation.

**Effective Coordination and Direction**

The ERP provides strategic direction to UK energy research, development, demonstration and deployment (RDD&D). Its wide perspective across the entire energy system and innovation chain puts it in a unique position to influence decisions regarding the development and deployment of new technology to enable timely, focussed investments to be made. It also has a key role in identifying blocks and risks.

Following the establishment of the Energy Technology Institute (ETI) in 2006, which included several members of the ERP, the Partnership recognised the need to ensure that its activities were coordinated with those of the Technology Strategy Board and the Carbon Trust. All three being major funders focussed on bringing new technologies to market and members of ERP. This was resolved through discussions at ERP meetings and the development of a joint strategy. Coordination of their activities is vital to maximise the effectiveness of their investments.

ERP’s activities are focussed on three areas: analyses of scenarios to identify technologies, identifying critical gaps in innovation for specific technology areas and exploring cross sectoral issues. Output is in the form of reports, briefing, and workshops, which draw on the expertise and knowledge of the members and their organisations, as well as engaging more widely with key stakeholders. Recent examples of work include:

2. Energy Technology Matrix, an extensive review of development status and needs of energy technologies, which is used by decision makers to help prioritise RD&D funding.
3. Carbon Capture and Storage, presentation to ERR and debate on recent developments; influential in emphasising the need to cluster demonstration projects.
4. Heat workshop, jointly organised by ERR, ETI and the Royal Academy of Engineering, which brought academics, policymakers and industry representatives together to inform thinking around the government’s consultation on heat and energy saving.
5. Skills report, investigating high level skills shortages in the energy sector. Published in 2007, the recommendations in this report have been taken on board and acted on by government.

ERR’s ability to take a long term view of the entire energy system was recognised in DECC’s Low Carbon Transition Strategy in 2009, where it was tasked to set out the technology and innovation milestones that will be needed to meet the 2050 energy policy objectives. This current piece of work was initiated by the then Energy Minister, Lord Hunt, and subsequently has the support of the Minister David Kidney. The report, which is due to be published in spring 2010, will provide an evidence base and clear guidance, from which energy RD&D, now and going out to 2050, can be prioritised. It draws on existing analysis and is being produced in consultation with ERP’s members and stakeholders from across the energy sector. ERP is also coordinating with other relevant activities in DECC, BIS; DfT and CLG, in order to maximise the report’s influence.

It is well recognised that the development of energy technologies to reduce global carbon emissions will require an international effort, with recent initiatives coming from the EU, IEA and G8/G20. ERP is currently preparing principles to encourage the public and private sectors to take a strategic approach to international
engagement, so that they work effectively to maximise opportunities for UK RD&D. This includes identifying potential priority areas for collaboration, and ensuring mechanisms are in place to allow researchers to participate in activities where appropriate.

11 January 2010

Memorandum by the Foreign and Commonwealth Office

The Committee asked for:

— separate memoranda from all Departments, on the objectives, processes and mechanisms used within the Department for establishing priorities for Departmental research and development for which they have responsibility.

The FCO does not have dedicated scientific and technological research funding or mechanisms. We used to have a stream of project funding to facilitate international opportunities for scientific collaboration in research and development as part of our Strategic Programme Fund (SPF). However, under the FCO/BIS agreement to jointly fund the Science and Innovation Network, science-themed project work previously funded from FCO’s SPF is now to be funded from the new BIS Global Partnership Fund. FCO met all project work costs for this in 2008–09. For 2009–10 FCO has transferred £500,000 to BIS’s new fund. No FCO contribution will be made in 2010–11.

23 September 2009

Memorandum by Forensic Science Service Ltd

Forensic Science Service Ltd (FSS) is a leading provider of analysis and interpretation of evidence from crime scenes. It provides a comprehensive service from crime scene to courtroom and analyses more than 120,000 criminal cases each year. It is the market leader in the supply of forensic science to the police and coroners in England and Wales. It is also a supplier to places such as the Isle of Man, the overseas territories and other Commonwealth countries. It has a global reputation for excellence in the development and deployment of new and advanced techniques and for world-class training services. FSS is a company wholly owned by the Home Office.

We hope that the House of Lords Select Committee find this response helpful and will be pleased to provide any further information that they might require.

1. CONTEXT

Forensic science is a cross-disciplinary applied science, one which is delivered via an emerging commercial market in England and Wales. It provides technical and scientific services for police and governmental service end-users such that society is ultimate beneficiary. Research within a science where the discipline and stakeholder structure is atypical does not fit comfortably within the remit of any one Research Council for academic R&D funding, and arguably spans a variety of governmental departments’ responsibilities considering its commercial, criminal justice, national security and policing foci.

2. REQUIREMENT FOR PUBLIC FUNDING IN FORENSIC RESEARCH

Publicly funded research should support objectives based on societal needs, particularly where the nature of the research is unlikely to attract private investment. Forensic science research leads to innovation in crime prevention, detection and investigation, which has an obvious bearing on the societal aspects of crime, but also on the economic impact, in terms of the potential for resource savings within the police and criminal justice systems, plus the wider financial costs of crime. Forensic research is also relevant to national security in its contribution to counter-terrorism and cross-border policing capability; technologies on the horizon could provide significant social and economic benefit in this respect.

— Forensic research is currently under significant pressure. In an economic environment where public spending cuts are likely to drive down police budgets for forensic services, the opportunity for forensic service providers to invest in R&D will be threatened. Coupled with the evidence that the forensic marketplace is immature and in need of stabilising influences, the outlook for independent investment in forensic R&D is bleak.
3. Current Forensic R&D Funding Mechanisms

The Forensic Science Service (FSS) currently supports the majority of its R&D through re-investment of revenue from its commercial activity. A small proportion of its collaborative R&D with academia is supported by funding from EPSRC (Electronics and Physical Sciences Research Council) via CASE studentships and a targeted research programme. Other research funding has been sought from the EU and the US government. Whilst the FSS was an agency of the Home Office, some R&D funding was obtained from the Home Office Hard Science R&D Fund, although this has ceased since becoming a Gov.Co.

Targeted research funding, such as the previous EPSRC Crime themed programme is beneficial as it encourages academics to relate their expertise to an applied science discipline with very real societal benefits. A similar themed programme with a cross disciplinary remit (perhaps supported by multiple Research Councils) would be most welcome.

An issue for the FSS with respect to accessing public funds for R&D is determining its eligibility for varying government initiatives. Despite the majority of R&D being self-funded, our interpretation is that the FSS would not be considered eligible as an industrial partner under the rules of Collaborative R&D Competitions funded via the Technology Strategy Board for example, as we are Government owned. Conversely, we are considered ineligible for funding opportunities aimed at non-profit organisations because of our commercial status. Thus initiatives to support academic/government research institutions and those aimed at supporting commerce can both become inaccessible for the FSS in its current Gov. Co. status.

4. Reputational and Economic Aspects

The UK has long been recognised as a world leader in forensic R&D; it is respected internationally not only for the generation of intellectual property in this area but its ability to implement that technology and provide demonstrable social and economic outcomes. The first National DNA Database is a classic example of this. Sustainable and secure investment in research is necessary to retain this status. Not only does forensic R&D provide the UK with this reputational benefit, as an emerging commercial market this status needs to be exploited commercially such that it can provide direct and indirect economic benefit. Resolving the publicly-funded research “gap” for forensic science would contribute greatly to this goal.

September 2009

Memorandum by GeneWatch UK

1. GeneWatch UK is a not-for-profit policy research group concerned with the science, ethics, policy and regulation of genetic technologies.

2. One of our aims is to improve public understanding, accountability and participation in decision making about science and technology, including decision-making about science policy and research priorities. In our view more accountable and democratic decision-making processes would lead to a more balanced, independent and open scientific research agenda.

3. We welcome the opportunity to input to the Committee’s inquiry.

What is the overall objective of publicly-funded science and technology research?

4. There are multiple reasons why it is appropriate for governments to make public funds available for research in science and technology. These include:

- Increasing understanding of physical, chemical and biological systems.
- Informing policy.
- Problem-solving using the scientific method to collect data and rule out invalid hypotheses.
- Making new discoveries which might be harnessed in future to develop new technologies or industrial or commercial applications.
- Exploring the possible future impact of technologies or policies on physical, biological or chemical systems.

5. New scientific discoveries can sometimes lead to new applications which have economic value and contribute to growth. However, treating science purely as an instrument to serve the interests of government and commerce neglects the important “non-instrumental” roles of science: including the creation of critical research.
scenarios and world pictures; the stimulation of rational attitudes; and the production of enlightened practitioners and independent experts. It is also notoriously difficult to predict future technological developments.

How are public funds allocated? Who is involved at each level of the decision making process? Where appropriate, is the Haldane Principle applied?

6. The idea of the knowledge-based economy (KBE) has become a key driver of research investment in Britain, Europe and worldwide and underpins how Government formulates science and engineering policy. The “knowledge” embedded in a product is seen as adding value to it and is protected by intellectual property rights, which gives value to this knowledge and allows it to be traded rather than freely used (by applying protectionism to “knowledge” rather than to goods).

7. Biosciences and biotechnology—particularly human and plant genomics—are seen as central to the knowledge-based economy, as are information and communication technologies.

8. GeneWatch UK has recently completed a major investigation of the influence of the idea of the KBE on research funding decisions in the biosciences, covering both health and agriculture. We found that the Haldane Principle—which implies that scientists rather than politicians should decide how research funds are spent—does not reflect reality because the entire system of research funding is now shaped by institutional commitments to the knowledge-based economy. We also found a near total failure in government science policy documents to recognise potential conflicts between the research needs of different stakeholders and institutions (eg to recognise that the research priorities of the NHS and the pharmaceutical industry, or of industrial and smallholder or organic farmers, may not be the same). This has led to a lack of diversity in funding, with large sums of money allocated to R&D intended to deliver the “visions” of particular commercial sectors, via largely undemocratic and unaccountable decisions. These “visions” are claimed to be win-win scenarios, in which investments in particular innovation strategies are presumed to deliver simultaneous benefits to health, wealth, security, the environment and the economy. However, they are driven by a narrow range of commercial interests and are often regarded with considerable skepticism by members of the public.

9. A small number of unelected individuals are highly influential in creating and maintaining “scientific bandwagons” which capture a large proportion of resources on the basis of future promises about what will be delivered. This has created “political entrapment” in particular innovation strategies, in which political commitments are “dug in”, in contrast to a system in which many diverse and creative alternatives are being pursued. In addition, non-instrumental roles of science (such as increasing understanding) are no longer valued by the decision-making system and there is a lack of independent advice for policy making. There is also a stark contrast between the political commitment to biotechnology as a driver for growth and the failure of the biotech industry to deliver economic benefit.

How are science and technology research priorities co-ordinated across Government?

10. Science and technology priorities are poorly co-ordinated across government.

11. In a study of health research in Canada, Lehoux et al. argue that departmental divisions within governments are one reason why innovation processes are not sufficiently informed by down-stream concerns. The innovation branch of government supports national innovation and commercialization activities in order to promote economic growth, whilst the adoption of medical innovations is largely constrained by the health policy branch, which seeks to increase evidence-based decision-making and set priorities given available resources. These branches of government tend to pull in opposite directions and, whilst the innovation branch tends to intervene early and mostly upstream, the health policy branch intervenes through regulation and evaluation just before innovations are ready to enter the market. Patients, clinicians and decision-makers often struggle with the local adoption of innovations because of ethical, clinical, economic or organizational problems and the innovation process is inefficient because of investment of time and resources in technologies that lack clinical relevance or are likely to be misused. Rather than limiting downstream evaluation, the authors argue that there is a need for clear and strong incentives for innovators to provide more desirable innovations; and appropriate feedback from health services and policy research about the level of fit (or misfit) between potential innovations and their likely real-world use.

12. This approach recognizes that a top-down approach does not necessarily produce innovations of great practical use and that resistance to innovation may sometimes be well-founded. This contrasts with the current emphasis on pouring more money into “translation” of discoveries into clinical practice, and using NHS procurement to drive adoption of new technologies, whilst weakening regulation to encourage innovation. For example, no genetic tests for susceptibility to common diseases currently meet medical screening criteria for
use in the general population—and there are good reasons to doubt that any ever will—yet ministers have constantly invented new schemes to encourage the “mainstreaming” of genetic testing in healthcare, because they previously identified this as central to developing a knowledge-based economy. It is not surprising that such schemes are unsuccessful.

Is the balance of Government funding between targeted and curiosity-driven, response-mode research appropriate? How will the current economic climate change the way funds are allocated in the future?

13. Due to the adoption of the knowledge-based economy as the key driver for investments in science and technology, scientists have been under increasing pressure to demonstrate the industrial applicability of their work. However, rather than delivering the claimed economic benefits, this has led to:

- Increasing strategic use of patents: directed more toward preventing others from innovating, rather than encouraging innovation, and difficulties in weeding “bad” applications (those that have little economic value but nevertheless create a backlog at the patent office and difficulties for competitors).^
- The creation of large numbers of university spin-out companies with high cash burn rates, which ultimately fail.
- Increasing hype and misleading claims by scientists that new cures or other breakthroughs will be delivered if only they secure the next round of funding.

14. Whilst much curiosity-driven research is still funded this is often misrepresented to policy-makers and the public as being closer to application and/or more reliable or useful than it actually is. Instead of safeguarding important blue skies research and the non-instrumental roles of science this has tended to devalue the benefits of science, which is rarely recognized than anything other than a means to lay the groundwork for new technologies and products.

15. At the same time, science and innovation has become increasingly disconnected from the users of research. This is most striking in food and farming research, where agricultural colleges and traditional plant breeding have largely disappeared and research priorities are driven by what can be patented by commercial seed companies or “add value” for food manufacturers. The re-structuring of the research councils to deliver supposed biotech solutions has also led to the loss of important knowledge and skills in other areas such as soil science and farmland management.

16. There are likely to be significant opportunity costs as a result of poor investments made via the current research funding system. Billions of pounds and euros are being spent on ineffective or spurious solutions to major social, environmental, health and economic problems: including hunger and obesity.

17. In addition, the public is becoming increasingly alienated and disillusioned and is sceptical that research priorities are being set in the public interest or that they will deliver economic benefits. For example, the Science Horizons project found that it is widely assumed that policy-makers in government and big business are not candid with citizens and that technology is being developed by industry and/or government in order to make profits, rather than in response to societal needs.

18. The current economic situation is likely to restrict the availability of future funds, but also provides an opportunity to revisit science policy and to recognise the enormous opportunity costs of the current system.

How is publicly-funded research aligned and co-ordinated with research that is not publicly funded? How can industry be encouraged to participate in research seeking to answer societal needs?

19. In the healthcare sector, public sector funding is strongly influenced by commercial research priorities and certain kinds of research attract little if any funding, either because results cannot be patented or they are of little scientific interest. As a consequence, public health research, for example, is poorly co-ordinated and funded, despite the potential to deliver significant cost savings for the NHS.

20. Currently, research institutions and decision-making processes are designed to encourage public-private partnerships which subsidise the research strategies of particular industrial sectors, but not which serve the needs of public bodies, such as the NHS, or the wider public good.

21. Major investment decisions in R&D and in research infrastructure are made without due scientific diligence or cost-benefit analysis. “Optimism bias”—leading to significant underestimates of social, environmental and economic risks—is rife. Yet the UK Treasury does not apply its rules for economic assessment or appraisal to major R&D investments, unlike other major infrastructure projects. In adopting this approach, policy makers undermine the knowledge and debate on which they and society at large rely to make informed decisions and to make realistic and informed appraisals of techno-scientific claims: they
become dependent on the latest promises that major breakthroughs will be delivered if only more public subsidy is forthcoming. This risks throwing good money after bad.

22. In practice, the key features of the knowledge-based economy distort the market in ways that make research investment decisions unaccountable to either market forces or democratic processes. Problems include that:

— protectionism in knowledge, via intellectual property rights, distorts research priorities and blocks competition and collective innovation;

— pre-competitive subsidy, via research funding decisions, lacks accountability and transparency and hides political and business commitments as if they were inevitable consequences of science and “progress”;

— public-private partnerships and public procurement policies shift investment risks and externalities onto the taxpayer, intermediaries such farmers, doctors and health services, and members of the public; and

— “light-touch” regulation fails to address market failures and protect health or the environment.

23. A better approach would involve:

— Openly recognising conflicts between different interests and investment priorities and the need for policy trade-offs, necessitating political decisions.

— Recognising governance and regulation as part of the system that influences who bears the costs and risks, or reaps the benefits, of innovation.

— Advocating approaches that examine and decide these trade-offs in a fair, democratic and transparent way.

— Viewing economic benefits as being rooted in society—for example, supporting rural economies and livelihoods—rather than in terms of gains for venture capitalists or city traders, or growth in particular industrial sectors such as food manufacture or pharmaceuticals.

To what extent should publicly-funded science and technology research be focused on areas of economic importance? How should these areas be identified?

24. Attempting to identify areas of economic importance is fraught with difficulty. For example, the 1995 Foresight Report on health and life sciences includes “genetics in risk evaluation and management” for common multi-factorial diseases, such as heart disease, as a key area for greater investment, concluding that “Consumer demand will certainly be strong, and the export potential is high”\(^\text{12}\) This idea has been variously endorsed by the Working Group on the Financing of High Technology Businesses (1998);\(^\text{13}\) the 1999 Genome Valley report;\(^\text{14}\) the 2000 NHS Plan;\(^\text{15}\) the Foresight Programme’s report Healthcare 2020;\(^\text{16}\) the DTI’s “Excellence and opportunity: A science and innovation policy for the 21st Century”\(^\text{17}\); and the Committee’s reports on Genetic Databases and Genomic Medicine (2001 and 2009). Billions of pounds were invested in centralizing electronic medical records in the NHS Spine in order to implement this vision,\(^\text{18}\) as well as hundreds of millions more in genetic research which has delivered little in terms of benefit to health.\(^\text{19,20}\) In practice, consumer demand for such tests is negligible—with one of the market leaders, DeCode Genetics, on the verge of bankruptcy—and none of the available tests provide information of any medical value.\(^\text{21,8}\)

25. An alternative approach to dealing with policy-making in the face of considerable uncertainty has been proposed by the Foresight obesity project\(^\text{22}\), which developed an initial strategy to tackle obesity based on a diversity of cross-disciplinary research over long timescales. The project advocated a “practice-based evidence” approach, involving monitoring the strategy over different timescales and modifying it as it becomes clearer which actions are the most effective.\(^\text{23}\) This would involve scientists being more fully involved in assessment and re-focusing of strategies and taking more responsibility for the wider implications of their research. The Foresight obesity project also adopted a “problem-led”, rather than a “technology-driven” approach, in which the biosciences may play a role but biotechnological innovations are not seen as the ultimate objective. Instead, the report identified five core principles for tackling obesity:

— A system-wide approach, redefining the nation’s health as a societal and economic issue.

— Higher priority for the prevention of health problems, with clearer leadership, accountability, strategy and management structures.

— Engagement of stakeholders within and outside Government.

— Long-term, sustained interventions.

— Ongoing evaluation and a focus on continuous improvement.
How does the UK science and technology research funding strategy compare with that of other countries? How does England compare with the devolved administrations?

26. Many of the structural problems with allocating R&D funding are similar in other countries because the OECD’s concept of the knowledge-based economy has been widely adopted in the EU and North America, where it is seen as a means of competing with the emerging economies of China and India, by adopting protectionism in knowledge (via Intellectual Property) rather than in manufactured goods.24 The OECD’s measures—including patents, citations, R&D expenditure and numbers of spin-out companies from universities—are now widely used to measure the development of the knowledge-based economy. For example, in its 2007 analysis, the EC’s Biopolis project used 14 indicators to measure the performance of the national biotechnology system of innovation in Europe: only one of these indicators (numbers of biomedicines) is likely to represent actual marketable products.25 Research suggests that the net value to the economy of this approach to driving science and innovation by “monetizing intellectual property” has been zero or negative.6

27. In contrast, the Scottish Government has set five strategic objectives: to be wealthier and fairer; healthier; safer and stronger; smarter; and greener.26 In this context, it has conducted a review of the areas where science in its broadest sense can make a contribution to policy development relevant to Scotland, in order to help shape the next Scottish Government Rural, Environment and Marine research strategy.27 The review will be used to develop a policy framework, which will then be consulted on.

28. Scotland’s review sought to identify policy relevant drivers, trends and challenges over the next 30 years; together with knowledge gaps and potential research needs, from the perspective of a range of stakeholders, including government, researchers and civic society. A number of important knowledge gaps were identified. In addition, key findings were:

— Many of the drivers of change and associated knowledge gaps are linked, and research programmes should take account of this interconnectedness. This approach requires a shift from analytical thinking to contextual thinking. Indeed Scotland could be considered as a national ecosystem—with the need to address the social, economic and environmental aspects of the system.

— There would be benefit from developing mechanisms for better integration of research into policy and better integration across policy areas.

— Scotland’s environment, agriculture and marine resources cannot be studied in isolation from changing patterns of societal demands and expectations or Scotland’s economic welfare.

— There are advantages in understanding the role of the natural environment in the economy as well as understanding links between environment, vibrant communities and entrepreneurship, particularly for rural areas.

— It is important to note the need for research programmes to be fuelled by and to increase innovation. This involves dialogue, networking and collaboration in shaping and developing the research. In addition, barriers to innovation such as planning and licensing issues should be considered at an early stage to ensure that desired outcomes can be achieved.

29. Scotland has thus adopted a more problem-led and more multi-disciplinary approach, involving more dialogue and consultation. In GeneWatch UK’s view this is more likely to deliver a more diverse system of science and innovation, which serves the interests of society as a whole and is more democratically accountable.

September 2009

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Memorandum by Professor Luke Georghiou, Professor of Science and Technology Policy and Management and Associate Dean for Research, University of Manchester

The response is in two parts—firstly some shorter responses to the Panel questions and secondly some contextual remarks on priority-setting for research.

1. What improvements could be made to the current system of priority setting for publicly funded research? In particular:

(a) What are the strengths and weaknesses of the UK’s system for setting priorities for publicly funded research?

The present system relies heavily upon research councils (and more recently the Technology Strategy Board) to act as intermediaries between socio-economic demand and scientific promise. In the early to mid-1990s the first cycle of the Foresight Programme provided an additional input and at the behest of the Office of Science and Technology there was evidence of some realignment of priorities. In part this was a necessary adjustment at that time towards the emerging importance of the life sciences. However, higher level across the board exercises of that type are only of value if they are infrequent otherwise they risk either offering little change between cycles or else they risk capture by lobby groups.

There could be an argument for such an exercise in resetting the research system in the new environment likely to follow the election. It would not necessarily follow the 1990s methodology. The current foresight programme has other (valuable) objectives.

(b) What principles or criteria should apply in the process of setting priorities for publicly funded research? What changes, if any, do you suggest?

As set out in part 1, a combination of scientific and technological opportunities, the UK’s strength (or attainable strength) in S&T in those areas, and where enough is known to answer the questions, economic and social needs and the capability of UK business (or public organisations) to capitalise on the findings. A substantial proportion of resources should be reserved for investigator driven work but this should not be for routine work—criteria of creativity and excellence should be applied even more strictly here.

In terms of changes the one aspect that the system has always failed to deal with is strategic withdrawal from an area—the reverse of prioritisation (sometimes called posteriorities!). In a climate of scarce resources this has conceptual appeal but researcher panels react very negatively to any requests to put forward proposals for negative priorities. If it were agreed that this was the right course of action, then an important question would be what minimum critical effort should be maintained in such areas so as to allow a revival if scientific progress or policy changes made future reversal necessary.

(c) To what extent are the organisations and individuals currently involved in setting priorities for publicly funded research fulfilling their roles? What changes, if any do you suggest to their roles and/or remits?

No comment.

2. How should the impact of research be assessed and at what stage in the process? How should this assessment affect the prioritisation of research?

A priori impact assessment is best carried out at the level of a programme or area of research. While it may be useful to encourage researchers to think about future impact at the proposal stage the current system appears too heavy-handed. The proposal to include impact in the REF is essential to maintain credibility with external stakeholders. The present methodology is broadly on the right lines but needs further development and a reduced weighting.

3. How might the UK further encourage innovation and the development of scientific discoveries into new products or services? What is an appropriate proportion of effort and funding to devote to research versus encouraging innovation?

Innovation policy goes well beyond the exploitation of research results even though the latter is important. Probably the most important dimension of innovation policy lies on the demand-side—providing the right framework conditions and using public procurement, regulation and standards to pull through innovation and also stimulate more business R&D. In terms of use of existing resources the R&D tax incentive for large firms would be more effectively used in focussed technology programmes.
4. **What lessons can we learn from research funding policies and priority setting in other countries?**

Germany has successfully developed a High Tech Strategy [http://www.hightech-strategie.de/en/350.php](http://www.hightech-strategie.de/en/350.php) which could be replicated here. This combines a series of sectoral strategies with a further set targeted on “cutting-edge technologies”. In the 17 areas covered actions are set out in three dimensions: developing lead markets for cutting-edge fields; launching new incentives and mechanisms for links between science and industry; and improving conditions for creative small businesses. This has been accompanied by a large and sustained funding commitment.

At European level a panel report chaired by the author (also summarised in Georghiou L, Europe’s research system must change, *Nature* Vol 452/24 April 2008) argued that the research system should engage with the “grand challenges” facing society (an approach also emerging in the USA) through large scale coordinated initiatives. Such challenges include sustainability and climate change, food and energy security, migration and the ageing population. One part of this argument is that to ensure public and political support from research it needs to be seen to contribute to economic, social and environmental priorities. The second dimension is that we may have entered a period when consumer-driven innovation will be replaced by societally-driven innovation as the central force.

5. **What impact has the economic climate had on R&D investment over the last year? How should the process of setting priorities for publicly funded research change in response to the economic climate?**

See answers above.

**Contextual Remarks on Priority Setting for Research**

There is a long tradition of setting priorities for national investments in science and technology, but it is worth considering exactly what this means. At its simplest it involves an increased share of resources being allocated to an area of science or technology which deemed to be of significance, normally because of its economic or social potential. As noted in a recent report by the Council for Science and Technology (Strategic decision making for technology policy, CST, November 2007), a principal driver is the notion that if investment is spread evenly across all candidate technologies, scarce resources will mean that the UK’s overall effort will be sub-critical by comparison with other countries. Other motivations for identifying priorities include the need for coordinated action to promote their development. Such coordination might be across the industry-science nexus or it might extend to the need for other policies relevant to innovation to take account of the priority. These could include policies affecting access to finance, the regulatory environment for research or for subsequent innovations and the possibility of using public procurement to stimulate the development of the area.

The contrast often made is with an investigator-driven allocation where resources simply follow the proposals made by researchers and allocation is by a quality-based peer review. In fact this distinction does not hold up well under scrutiny—investigator-driven resources are still pre-allocated between fields on some basis. One example is allocation by “proposal-pressure”—shared on the basis of the total amount requested in each field. This figure is driven by the number of researchers in a field and hence is dominated by historical inertia. On the other hand there is no reason why quality-driven peer review should not be a central allocation mechanism within a prioritised field or portfolio.

The OECD has previously identified three types of priorities in science and technology:

- Thematic priorities, referring to fields of science and technology.
- Mission-oriented priorities, referring to socio-economic or technological goals.
- Functional priorities, referring to characteristics of the science and innovation system.

In this exercise the clusters are principally thematic but are also linked to potential missions. Development of strategies to take them forward is likely also to involve functional priorities.

Setting priorities requires care to be exercised on several fronts. The first issue is the level of granularity at which the priorities are specified. If they are very broad (eg biotechnology) the term may cover very different activities with widely varying timescales and prospects. Furthermore, it is difficult to specify consequent actions and it is relatively easy for researchers or research organisations to re-label activities so that they comply with the priority. Re-labelling may not in itself be a bad thing—there is some evidence to show that the announcement of priorities does not necessarily lead to a dirigiste allocation of resources. Priorities serve more as an instrument of orchestration, whereby policymakers and researchers adapt to each others goals. Put more simply, researchers and funding intermediaries may be influenced by announced priorities but that influence has its limits—for example a new terminology may in part be used to re-label existing activities but use of the new label may then begin to change the self-perceptions and orientations of researchers.
The other important caveat that needs to be attached to any priorities is that of interdependency: an area which quite clearly meets criteria of relevance may be dependent upon progress in another area (for example, mathematics) where relevance is not immediately obvious. The interdependence of the clusters themselves has already been discussed. Similarly, realisation of a new technology can be dependent upon complementary policy initiatives, for example in education and training or in regulation and standards.

There is an international consensus that research funds should be somehow divided between:

- basic research (that for which no application is foreseen at the time it is carried out);
- applied research (research carried out for a pre-specified purpose); and
- strategic research (research which is expected to be applied but for which specific applications have not yet emerged).

The category of strategic research emerged in the UK in the 1980s in the context of collaborative programmes such as the Alvey Initiative for Advanced Information Technology. More recently, a popular taxonomy developed by the late Donald Stokes has been that of Pasteur’s Quadrant. The argument is that science can be technology-based as much as technology can be science-based and that there is an important neglected category of use-inspired basic research (named for the work of Louis Pasteur). This is distinct both from basic research with no application in mind and applied research with no attempt to develop theory.

Table 1

FRAMEWORKS FOR PRIORITISATION: PASTEUR’S QUADRANT

<table>
<thead>
<tr>
<th>Pure basic Research (Bohr)</th>
<th>Use-inspired basic research (Pasteur)</th>
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<tbody>
<tr>
<td>Pure applied Research (Edison)</td>
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To be worth supporting, an advanced technology must offer both a realistic chance of continuing technological progress or breakthrough and be in an area where the UK can capitalise upon it in economic or social terms. From the point of view of public expenditure (or other Government action) there is also the issue of the degree to which public intervention can make a difference. Prioritisation frameworks are normally constructed around these axes.
In the first cycle of the UK Foresight Programme, the Programme’s Steering Group, chaired by the Chief Scientific Adviser, classified the identified options according to framework widely used for prioritisation based on two axes, attractiveness and feasibility. Figure 1 shows how this was used:

**Figure 1**
APPLICATION OF ATTRACTIVENESS/FEASIBILITY FRAMEWORK

In fact, underpinning this graphic was a more elaborate framework which articulated the criteria in more detail. This is shown in Figure 2:

**Figure 2**
CRITERIA FOR IDENTIFYING GENERIC MARKETS AND TECHNOLOGIES
The Framework was supported by detailed accompanying questions designed to develop a clear view on each criterion. More recently a similar framework was applied by the Council for Science and Technology. This approach applied six criteria:

- UK Technological Competitiveness.
- Market Size.
- UK Capacity to Deliver.
- Potential Societal Implications.
- Government Interventions Needed?
- Risks.

Again the criteria were broken down into specific questions. The main challenge involved is in obtaining satisfactory answers to many of the questions in circumstances which almost by definition involve high degrees of uncertainty.

*February 2010*

**Letter from the Government Chemist (LGC)**

I have pleasure in providing the following evidence in my capacity as Director of LGC’s Research & Technology Division, which encompasses oversight of the designated UK national measurement institute (NMI) for chemical and bioanalytical science.

*What is the overall objective of publicly-funded science and technology research?*

1. At a high level it must be to provide a basis for UK prosperity and the well-being of our society. This necessitates a balance of funding that:
   - Builds fundamental knowledge.
   - Attracts overseas talent and investment.
   - Builds a skill base for sustained economic success.
   - Fosters innovation and catalyses industrial development.
   - Builds and sustains critical infrastructure and resources (including strategic assets for a knowledge-based society, such as the National Laboratories).
   - Protects the health, security and quality of life of citizens.

2. Science and technology research funding decisions great and small need to rest on a broad vision of the potential benefits, meeting real demand for improved, revenue-generating products and services as well as wider societal goals such as sustainability, healthcare, safe and secure food and threat reduction. The benefits of fundamental, curiosity-driven research may be less clearly articulated, so the rationale for public funding will rest on having a pathway to identify and develop them as they emerge. I am aware that independent economic studies are in progress for some major programmes.

*How is publicly-funded science and technology research aligned and co-ordinated with non-publicly funded research (for example, industrial and charitable research collaborations)? How can industry be encouraged to participate in research efforts seeking to answer societal needs?*

3. Departmental contacts can no doubt provide details of specific schemes to support public-private collaboration. Research Council delivery plans do reference collaboration with third sector funders such as Wellcome, but more could be done to ensure that the strategy for and approach to such alignments are transparent.

4. To some extent co-ordination of both these kinds is driven by the research community itself, and by scientific media, communications and networks transferring information and opinions. There is scope for improvement, and structured approaches—for example the Knowledge Transfer Networks (KTNs), Technology Strategy Board (TSB), and public-private partnerships such as the Innovative Medicines Initiative (IMI) and Stem Cells for Safer Medicines (SC4SM)—have played an important part in bringing together resource efficient collaborations. However, my daily contact with the current generation of scientists reassures me that they are often sufficiently informed and well-connected to identify and exploit synergies. (Meanwhile, successful KTNs such as Chemistry Innovation, whether individually or in concert, will evolve, and may have an increasing part to play in joining up the provision of underpinning tools such as analytical measurement science and IP strategies.)
5. Getting industry to back societal needs requires economic reasoning and incentives. Normally societal needs create markets and Government can help by making these markets more accessible, for example through:

- Sensible and proportionate regulation.
- Intelligent public procurement.
- Easy and affordable access to infrastructure.
- Espousing a pragmatic approach to IP issues, to oblige institutions to cut red tape whilst maintaining a fair deal for academics and industrialists. (Experts need some freedom to interact on a footing of personal trust.)

Government can also reduce barriers to participation by providing relevant tax incentives, or through long term grants direct to industry.

6. If the more direct economic instruments have to be scaled back, I believe that some loss of momentum is inevitable in public-private collaborative research. However, a cost-effective stopgap may be to help industry recognise win-wins. A simple challenge to seek mutually profitable partnership opportunities, laying bare the bones of a “new deal”, could achieve much. In addition, those parts of the public sector which are truly open for business need to be clearly signposted. Broadly, TSB is equipped to help here. LGC’s experience as host to the National Institute for Health Research Central Commissioning Facility (NIHR CCF) leads me to suggest that DH/NIHR would be well placed to advise on opportunities to pool resources with the NHS—the UK’s largest public body—for shared benefit.

7. A cautionary tale may be provided by the Substance Information Exchange Forum (SIEF) mechanism established to implement the EU REACH Regulation. SIEFs are intended to be industry-led and, through REACH, to work towards a safer, healthier and more sustainable society. Each SIEF focuses on a single chemical, but, because industrial manufacturing processes differ, short-term research may be needed to build up a shared understanding of a substance’s identity. Personal communications with independent consultants in this field suggest that most SIEFs have so far been unable to agree and fund their specific scientific requirements in a co-ordinated way. A weakness is that no-one is likely to have the incentive to act in the best interests of all participants as a SIEF facilitator.

8. In contrast, NMO-sponsored measurement programmes encourage scientists to put into practice their specific understanding of R&D goals by leading the development and clustering of industrial and academic collaborations. Partnership working implies a need to quantify inputs, progress and outputs with high confidence. NMO underpins all these steps, whether by tailoring existing measurement tools for the purpose, or providing objective evidence to demonstrate and characterise a fundamentally new research direction or disruptive technology.

To what extent should publicly-funded science and technology research be focused on areas of potential economic importance? How should these areas be identified?

9. It is essential to invest in areas that are intended to foster economic growth, because without this the UK will not have the means to sustain investment in public care and protection. However, maximum economic impact cannot be delivered solely by targeted research: it requires a depth of knowledge in the fundamental disciplines, together with well-maintained and accessible infrastructures in underpinning areas of science.

10. Certain core sciences tend to be overlooked by “grand challenge” style funding, although they are critical to economic success. In the words of the Royal Society, “The application of deep disciplinary knowledge (for example, environmental science, geology, medicine, chemistry, meteorology etc) remains important, especially to providers of specialist technical expertise and services, eg risk intermediaries providing services to insurers, or engineering design specialists”. I can certainly vouch for this statement as regards chemistry. For example, the chemical composition and surface structure of nanoparticles determine their properties, and must be known in order to optimise the benefit-risk balance. Green chemistry is supporting new ways of making safe, sustainable products from low-carbon, low-hazard feedstocks that will be needed throughout the consumer society. There is a risk of papering over the cracks if these “deep disciplines” are not kept firmly in sight.

33 http://www.lgc.co.uk/divisions/life_food_sciences/programme_management/services/nihr_ccf.aspx
11. Underpinning sciences such as computation, measurement and standardisation play a crucial role in making research outputs economically robust. They are needed to demonstrate regulatory compliance and to verify that innovations are ready for uptake by particular sectors of the market. Measurements are made to test claimed benefits and show that risks are effectively managed, and can be assisted by novel computational techniques. Standardisation helps to open markets by providing a shared technical platform for collaboration and further innovation.

12. Industry itself is most likely to identify areas for future economic development, and I believe should be encouraged to contribute to the debate at all levels.

13. It seems reasonable to ask entrepreneurs and SMEs to demonstrate that proposed research will repay society, whether directly or by generating revenue for the Exchequer, and over what timescale. In times of austerity, this needs to be ascertained with reasonable confidence—one of the reasons why past innovation support schemes incorporated a pilot phase (eg SMART as a prelude to SPUR), during which key characteristics of a proposal could be tested to provide an evidence-based evaluation of feasibility.

14. Public funding should aim to achieve maximum impact, taking full account of the potential economic benefits. This approach, which recognises that the best research can be economically important in addition to meeting criteria for public benefit, can be applied at each stage of the innovation pathway. Universities, in synergy with their teaching function, can aspire to deliver more focused benefits in keeping with national priorities through research, innovation and partnership. National Laboratories play a central part in translating academic innovation for robust application. For example, measurement R&D is undertaken both to clarify the commercial benefits and opportunities for innovative products and services, and to advance societal goals such as improved healthcare, a secure food chain and a safer world. Companies complete this innovation pathway by realising economic value in a manner that benefits both the direct consumer and the public purse.

15. Where research funders take into account a wide range of requirements and stakeholder views, each S&T offering is likely to rely on economic justification to a different extent and in its own way. It may therefore be difficult to sift for economic value at the level of a whole programme or portfolio. But in Government departments with more of a single sectoral mission, there may be a case for systemic culture change to place increased emphasis on economic evaluation. In such cases, better co-ordination and targeting could be achieved by ensuring that all bodies with relevant capabilities, whether public or privately owned, have a chance to demonstrate how they could deliver the required impacts cost-effectively. A freer and more open market for public funds can be expected to deliver improved benefit for every pound that is spent.

September 2009

Letter from Paul Wiles the Chief Government Social Scientist

The submission below relates to the call for evidence on setting science and technology research funding priorities. It provides information on the Government Social Research service (GSR) and relates to two issues: the overall objective of publicly-funded science and technology research; and information not covered in the call for evidence that might be relevant to the scope of the inquiry.

The purpose of GSR

1. The GSR Service exists to serve the public through providing the government of the day with objective and reliable social research evidence to support the development, implementation and evaluation of policy and delivery. By doing so, it strengthens policy debate, decision making and outcomes.

2. GSR is vital to the government policy process: without rigorous and robust research and evaluation, decisions may be based on an incomplete or uninformed understanding of the evidence base; policies and services are not based on a knowledge of what works and their effectiveness and value for money are not known. This can lead to policies failing or not delivering as expected leading to poorer outcomes for society and inefficient allocation of resources.

3. The evidence provided by GSR primarily concerns people: it ensures the design and delivery of government policy and operational delivery are built on an holistic understanding of, and engagement with, the people implementing and receiving that policy.

4. Funding for government social research rests with departments, although GSR are key players in the various groups coordinating analysis in government—the Heads of Analysis group; the Analytical Coordination Working Group and the Departmental Directors of Analysis Network. A separate submission from Nick Macpherson on behalf of the Heads of Analysis describes these groups in more detail.
What is GSR?

5. GSR is a body of around 1,000 social researchers spread across 20 departments/devolved administrations, drawn from a range of social science disciplines. GSR members collectively offer professional expertise and advice to policy makers in government.

6. GSR is one of the five analytical professions in government—the others being economics, statistics, operational research and science and engineering.

7. Professor Paul Wiles—the Chief Government Social Scientist—gives strategic direction to the GSR profession and is responsible for engagement with senior stakeholders in government and the external research community.

8. Leadership in GSR comes from Heads of Profession in each GSR department/devolved administration. They provide strategic leadership and the link back to individual members in their departments/devolved administrations.

9. The Government Social Research Unit (GSRU) based in HM Treasury is the professional support team for GSR. The unit supports Paul Wiles and provides support and guidance for members. GSRU also centrally recruits for the profession and provides opportunities for continuous professional development. GSRU is responsible for setting professional standards.

10. GSRU promotes and lobbies for a stronger voice for social science both externally and within government through work with the ESRC, learned societies and the other government analytical professions.

GSR Standards

11. All GSR members and products are expected to adhere to the GSR Code. The GSR Code is an addendum to the Civil Service Code, articulating the core principles underpinning all GSR behaviours and outputs. It has two key elements, divided into seven principles:

GSR Products

— Rigorous and impartial.
— Legal and ethical.
— Relevant.
— Accessible.

GSR people

— Outward facing.
— Perform role with integrity.
— Appropriately skilled and continuously developed.

12. Beneath the GSR Code lies more detailed guidance helping departments/devolved administrations implement the Code. Additional guidance is continually identified and developed in collaboration with departments.

13. The GSR Code is also used as the framework for departmental self-assessment of social research capability. Since 2008, GSR Heads of Profession annually assess their performance by way of RAG ratings on a number of indicators relating to each high-level principle in the Code. They are also asked to provide the evidence on which they based their ratings as well as highlight areas of good practice and any issues departments face in fully implementing the Code.

14. In 2009 GSR commenced a follow-up peer review element to the self-assessment exercise. Social Research Heads of Profession are paired and provide expert challenge to each other’s assessment ratings; challenging and sharing good practice. In addition, each Head of Profession is then required to develop an improvement plan for the year ahead, which will then be reviewed at the following year’s peer review.

15. GSRU is now in the process of compiling information from the peer review process to identify good practice and common challenging areas to inform future GSR policy.

September 2009
**Letter from Mr Chris Harries**

This response to the House of Lords Science and Technology Committee call for comments represents my own views and not those of the Institute of Biologists, who circulated the announcement to me.

The comments I have relate purely to the allocation of funding for medical research. They are listed below.

1. The research spend on each disease should be linked to the annual death toll attributable to each disease. Currently this is not the case and diseases such as vCJD receive millions but something like motor neurone disease receives relatively little yet the former has so far killed only a handful of people and the latter which was first described in about 1860 continues to kill about 1,400/year in the UK with a typical survival of about 18 months from diagnosis. Symptoms are similar for the two diseases.

2. The medical research expenditure on each disease should be linked to the care and medication cost typically attributable to that disease. This would involve NHS costs, Local Authority costs for home access modifications and living aids and very probably contributions from other government departments. I am not convinced that such calculations are ever done across all relevant branches of government.

3. Research spend should be downrated for lifestyle diseases such as certain types of cancer, obesity related conditions, alcohol related problems and fertility treatment.

*September 2009*

**Memorandum by the Health and Safety Executive**

The Health and Safety Executive issued its current strategy in June 2009—*The Health and Safety of Great Britain: be part of the solution.*

The strategy was agreed following an extensive consultation with employers, trades unions, local authorities, health and safety practitioners, and members of the public.

The goals are:

- **Investigations and securing justice:**
  To investigate work-related accidents and ill health and take enforcement actions to prevent harm and secure justice where appropriate.

- **The need for strong leadership:**
  To encourage strong leadership in championing the importance of, and a common sense approach to, health and safety in the workplace.
  To motivate focus on the core aims of health and safety and, by doing so, to help risk makers and managers distinguish between real health and safety issues and trivial or ill-informed criticism.

- **Building competence:**
  To encourage an increase in competence, which will enable greater ownership and profiling of risk, thereby promoting sensible and proportionate risk management.

- **Involving the workforce:**
  To reinforce the promotion of worker involvement and consultation ion health and safety matters throughout unionised and non-unionised work-places of all sizes.

- **Creating healthier, safer workplaces:**
  To specifically target key health issues and to identify and work with those bodies best placed to bring about a reduction in the incidence rate and number of cases of work-related ill health.
  To set priorities, and within those priorities, to identify which activities, their length and scale, deliver a significant reduction in the rate and number of deaths and accidents.

- **Customising support for small and medium enterprises:**
  To adapt and customise approaches to help the increasing numbers of SMEs in different sectors comply with their health and safety obligations.

- **Avoiding catastrophe:**
  To reduce the likelihood of low frequency, high impact catastrophic incidents while ensuring that Great Britain maintains its capabilities in those industries strategically important to the country’s economy and social infrastructure.

[36](http://www.hse.gov.uk/strategy/strategy09.pdf)
— Taking a wider perspective:
To take account of wider issues that impact on health and safety as part of the continuing drive to improve Great Britain’s health and safety performance.

The objectives for HSE’s research and development are to support delivery of HSE’s strategy. HSE’s mainstream science activities give priority to reactive scientific and technical support for inspections and investigations into accidents, incidents and ill-health at work. The remaining research activity focuses on applying scientific, technical and analytical knowledge and skills to improve regulatory activity and policy work. HSE does not conduct pure research (curiosity driven research).

**Objectives**

HSE will:

— Use scientific research and development to deliver its strategic business priorities, ensuring that money and resources are targeted at the delivery of the strategic priorities.

— Improve the linkages between science, policy and delivery and promote a better collaboration between scientists, policy makers and deliverers.

— Use science to meet its role as a modern regulator to understand the most effective and efficient ways of securing improved health and safety outcomes.

— Use its in-house resources, including the Health and Safety Laboratory, supported by external expertise where appropriate, to deliver its regulatory functions and contribute to the evidence base for the development of policy.

HSE uses scientific support to:

— Understand the causes of incidents and ill-health.

— Propose remedial measures.

— Contribute to the evidence base to develop and deliver its priorities and programmes.

— Make the knowledge gained widely available.

HSE will apply research:

— Where independent advice is required by HSE on the extent and nature of the hazards and risks involved.

— Where there is a need for informed HSE participation in national and international standards making.

— Where information is needed in the light of incident experience or to support specific enforcement activities or policy initiatives.

— Where other organisations are unlikely to conduct research projects themselves, even though there are clear health and safety benefits, eg when timescales are long and/or the technical risks are high; when the particular part of industry lacks the relevant scientific and technological expertise; or when the potential beneficiaries are too diffuse for any one company to undertake the research on its own or the availability of results will be restricted.

**Science Planning**

HSE has a rolling three year science planning programme. The Science Plan 2010–13 will describe the science that HSE will commission from the Health and Safety Laboratory and external contractors in support of the new HSE Strategy. It will be structured to follow the themes and goals of the Strategy and will provide information about on-going programmes of work, including HSE’s support requirements, and an outline of emerging new areas of work.

The purpose of a rolling plan is to help manage continuity of funding. It helps specify HSE’s scientific support commitments year on year and to build a more coherent research strategy over a three year time frame.

The Chief Scientist will next review the proposals for support and research in October 2009. An outline plan will be presented for discussion and agreement to HSE’s Senior Management Team in early 2010.

HSE includes its senior managers, analysts, specialist scientists and engineers to identify gaps in knowledge and what questions can be researched. External specialists from academia, professional organisations, trades unions and local authorities also participate in workshops to identify data and knowledge gaps, suggest priorities for research, and propose where responsibility for conducting research might lie.
HSE uses futures work, including horizon scanning, as part of its research work:

— To anticipate, identify and prepare for new or changing medium and long term risks in all workplaces and to the public from workplace activities.
— To help HSE keep abreast of the health and safety implications of cross-Government activities (eg Foresight programmes) that could impact on health and safety in the workplace.
— To inform strategic thinking, planning and target setting in HSE.
— To engage stakeholders (eg Local Authorities), and make the horizon scanning process, and its outputs, open and inclusive.

Horizon scanning helps identify developments that could significantly affect workplace health and safety in the UK, developments in:

— science and technology;
— the workplace;
— socio-economic factors that affect the labour force and market;
— public attitudes to risk and health and safety;
— the UK political agenda;
— the European Union; and
— international developments;

HSE produces an annual science report for the HSE Board, covering future plans and work delivered.37

SCIENCE PRIORITIES

HSE prioritises use of its research funding as follows:

— Reactive support for investigations into accidents and incidents. This includes major incidents like the Buncefield explosion and fire in December 2005, which required reprioritising research planned for the following 12–15 months.
— Research where the cost of research is only recoverable from industry in-year, as under the Control of Major Accident Hazards Regulations.
— Other research and planned support outlined in the Science Plan.

HSE uses models to make judgements about priorities, including research.

The HARM index is under development. It is a tool which assists high-level strategic decision making by providing accessible evidence about work activities and processes where further research might be merited. In addition to outlining levels of fatalities, major injuries and ill health in work activities and processes. It addresses issues such as severity, age at onset, or duration of effect could help identify where more or less health and safety activity might vary outcome or level of public concern.

The PAM (priority assessment model) index is used by specialists to identify those issues identified by our Futures Team, which merit further observation and research because of their potential for significant future impact on HSE or on health and safety in wider society or on the economy.

OTHER ARRANGEMENTS

There are two variations on this arrangement.

The HSE Nuclear Directorate manages research and support programmes which are funded entirely by nuclear power generation licensees and new build requesting parties. The research programme is agreed, reviewed and monitored by the licensees and HSE. HSE has a close working relationship with the licensees to ensure the research and support programmes deliver an agreed plan of work.

The HSE Chemicals Regulation Directorate manages a Pesticides Research Programme and pesticides monitoring work for Defra. Defra determines and provides the funding for this work. A steering group advises the programme on the research priorities and reviews the outputs and outcomes. The steering group includes representatives of Defra and independent advisers.

September 2009

Background

The HMRC external research programme aims to facilitate the delivery of high quality and timely research and analysis to inform the Department’s strategic and operational business needs and the delivery of HM Treasury (HMT) policy (the programme serves the needs of the HMT/HMRC policy partnership).

Objectives and Areas of Analytical Interest

Evidence is needed to inform: better decision-making and use of HMRC resources, including staff resources; better understanding of customer needs and behaviours leading to improved design of HMRC systems, products and processes; improved and more targeted compliance; and the development of a more robust, strategic HMRC and HMT knowledge base.

Below are current themes of analytical interest for the Department, which the central external research programme seeks to focus on:

- **Policy**: inform policy development, evaluate effectiveness, learn lessons and improve policy-making;
- **Compliance**: tax gap measurement: expanding and improving the measurement of the gap between theoretical liability and actual receipts; drivers of behaviour: understanding attitudes to compliance and how these impact on the tax gap; and how different types of non-compliance interact; evaluating compliance interventions: measuring direct and indirect effects of interventions; and tax planning schemes: understanding of the market for tax planning advice.
- **Compliance costs**: deregulation and compliance costs: understanding the relationship between compliance costs and other HMRC objectives; and measuring change in compliance costs over time/in response to HMRC actions.
- **Understanding customers**: developing knowledge of customers’ attitudes towards HMRC service; exploring and measuring customer perception and experience with HMRC services; and evaluating HMRC operational changes/guidance.
- **Operational Efficiency**: exploring the impact that long-term trends will have for HMRC service provision eg social demographics/technological changes.
- **Debt management**: exploring how people perceive the debts they owe HMRC and whether they change their management of these debts over time.

Planning and Prioritisation Process

To build in flexibility and cater for changing priorities within the Department, resources are allocated on a twice yearly cycle, with planned and current projects published on the HMRC Research webpage—www.hmrc.gov.uk/research. Published findings from research and analysis projects are also available on the website.

There is a transparent and thorough governance process which involves senior staff in decision-making at critical stages in the annual programme planning process. It starts with a letter from the Director of Knowledge, Analysis and Intelligence (KAI)—the main analytical group within HMRC—inviting bids from all parts of the department and relevant parts of HMT. The letter is accompanied by a detailed briefing document and papers setting out the short, medium and long-term strategic analytical priorities for key areas eg personal taxes, enforcement and compliance etc.

Senior KAI analysts, acting as Business Partners, then liaise with internal Lines of Business (LoB) customers for the research. LoBs will input into the prioritisation process at two stages in the process. At the initial stage where they are required to prioritise research bids from across their Line of Business only. The prioritised list of research bids is then considered by the Analysis and Research Committee (ARC), chaired by the HMRC Chief Economist. ARC reviews all bids from across HMRC and HMT and provides a recommended prioritisation across all LoBs. Directors General in LoBs are then asked to formally endorse their proposed programme allocation as recommended by ARC and the balance of the programme as a whole. KAI’s Director then approves the programme and it is sent to the Financial Secretary to HMT for information.

The prioritisation criteria used include:

- **Strategic Direction**—How will the research evidence inform the Department’s strategic priorities, such as Departmental Strategic Objectives, other Strategic Objectives and delivery of HMRC’s Business Plan?
- **Time Criticality**—What is the driver for the research being required now?
setting research and funding priorities: evidence

— Quality—Will the research methodology or analysis design deliver the information required to inform the evidence gap to a sufficiently high level of quality?
— Strategic Challenge—How will the research develop HMRC’s strategic evidence base and the analytical challenge function?
— KAI Capability Advantage—To what extent is KAI the only part of HMRC with capability to take on the work?
— Value for Money—To what extent does the research offer value for money?

Throughout the year thinking about research priorities and needs also benefits from input from the external research community through major conferences eg an international conference on Institutional Taxation Analysis on 21–22 September 2009, and joint working with leading academic institutes and the Economic and Social Research Council.

September 2009

Memorandum by HM Treasury

1. The committee requested information not covered in the call for evidence that might be relevant to the scope of the inquiry. Below is further information on analysis in government, provided for you by the Heads of Analysis group.

2. This submission sets out the structures in place to join-up and coordinate analysis across government and details the number of analysts in each discipline in each department. This activity complements the work of the Government Chief Scientific Adviser and the network of Departmental CSAs. and pulls together the GCSA’s work with that of all the other analytical professions.

3. There are three separate groups aiming to coordinate the work of the five analytical disciplines in government (economics, operational research, science and engineering, social research and statistics):
   — Heads of Analysis (HoA);
   — Analytical Coordination Working Group (ACWG); and
   — Departmental Directors of Analysis Network (DDAN).

4. Each has a distinct role, and complements and supports the work of the others. At their core, all aim to put evidence at the heart of government decision making through collaborative working and shared efficiencies and to speak with a collective voice on key issues.

5. The Heads of Analysis group gives leadership to all analysts in government and oversees cross-disciplinary, cross-government issues.

6. The Analytical Coordination Working Group coordinates the work of the five professional support teams in government. It supports the HoA group by bringing issues of joint concern across the five disciplines to the attention of the HoA group. It works to share learning and processes across the professions where appropriate.

7. The Departmental Directors of Analysis Network has a departmental, rather than discipline-specific, focus which it brings to bear on key challenges facing government. Its aim is to share learning across departments, identify key common challenges and solutions, and to bring these departmental issues to the Heads of Analysis. It aims to develop for the other analytical professions a forum of the sort that CSAC provides for CSAs.

8. Beyond this, each of the professions has a departmental Head of Profession to represent, oversee and lead the analysts within their department. The number of analysts from each profession varies considerably across departments, depending on the nature of their business and other factors.

9. A fuller description of the groups and their membership, followed by an illustration of the relationship of these groups to each other and to the other analysts in government is presented at the end of this submission. This is followed by a table of the number of analysts in each profession in each department.

Heads of Analysis (HoA)

10. Membership
    Nick Macpherson —Permanent Secretary, HM Treasury (chair)
    Tony O’Connor—Head of the Government Operational Research Service
    Paul Wiles—Head of the Government Social Research Service
    John Beddington—Head of Science and Engineering Profession/Government Chief Scientific Adviser
Jil Matheson—National Statistician
Dave Ramsden—Joint Head of the Government Economic Service
Vicky Price—Joint Head of the Government Economic Service
Siobhan Campbell—GSRU (secretary)

**Aim**

11. To champion first rate analysis across government to ensure policy and delivery of government services is as effective as possible.

**Objectives**

12. Delivering more consistency between disciplines to achieve the goal of working more effectively together.

13. Identifying emerging issues and new trends through the joining up of issues raised by each discipline.

14. Tackling issues of common interest to all, for example engagement with the Research Councils. Thus, the group will tackle the *how* to collaborate effectively and champion coordinated analysis as well as *what* should be collaborated on. This coordination is both within and across departments.

**Meetings/Communication**

15. The HoA meet quarterly.

16. Every month a Heads of Analysis Update is prepared by the Government Social Research Unit for the Heads of Analysis, providing information on the progress against actions; the work of the Analytical Coordination Working Group (ACWG) and highlighting any issues that might have cross-disciplinary relevance to the group. These are typically sent out the first week of each month.

17. The Heads of Analysis group (along with ACWG, below) have also run two Joint Heads of Profession conferences to date with a third scheduled for October 2009. These allow departmental Heads of Profession from across the disciplines the opportunity to come together, network and discuss areas of common concern. A series of smaller seminars/workshops is also being planned on specific cross-cutting topics for the same audience.

**Analytical Coordination Working Group**

18. **Membership**

Tony O’Connor—Government Operational Research Service (GORS) (joint chair)
Siobhan Campbell—Government Social Research Unit (GSRU) (joint chair)
Vivienne Raven—Government Operational Research Service (GORS)
Andrea Garman—Government Office for Science (GO-Science)/Government Science & Engineering (GSE)
Andy Roberts—Government Statistical Service (GSS)
Geoff Tily—Government Economic Service Team (GEST)

**Aim**

19. To support the Heads of Analysis in the delivery of their aims and objectives, and to ensure coordination and collaboration across the analytical disciplines to strengthen the government analytical community and thereby the quality of government policy and delivery.

**Objectives**

20. Delivering against the actions set by the Heads of Analysis.

21. Identifying and highlighting issues of shared interest or concern to all the analytical disciplines to the Heads of Analysis.

22. Working towards coordinated or complementary processes in areas such as recruitment, professional standards and training and development where appropriate and desirable.
MEETINGS/COMMUNICATION

23. ACWG meet approximately every 5/6 weeks. ACWG are responsible for organising the HoA events for Heads of Profession.

DEPARTMENTAL DIRECTORS OF ANALYSIS NETWORK (DDAN)

Membership

24. Established in Summer 2009, all known directors of analysis in non-science, engineering and technology-focused departments were invited to become part of the network, along with delegates from the Heads of Analysis in poorly represented professions. Membership represents the most senior social science analysts in departments.

Paul Wiles—HO (chair)
Tera Allas—DFT
Mark Beatson—BIS
Kate Chamberlain—WAG
Anita Charlesworth—DCMS
Rebecca Endean—MOJ
Grant Fitzner—CLG
David Frost—FCO
Douglas Greig—Scottish Govt
Robert Laslett—DWP
Jil Matheson—ONS
Tony O’Connor—DoH
Richard Price—Defra
James Richardson—HMT
Amanda Rowlatt—DWP
Partho Shome—HMRC
Ken Warwick—BIS
Carole Willis—DCSF
Siobhan Campbell (secretary)—HMT

Aim

25. To share learning across departments, identifying common challenges and solutions, providing a senior collective voice for departmental cross-government working and bringing key departmental issues to the Heads of Analysis.

Objectives

26. Peer support, challenge and learning on issues relating to running a multidisciplinary team/a flexible analytical resource.

27. Influencing the external research community: building capacity and influencing their priorities.

28. Working with the Research Councils, particularly with the ESRC through the Heads of Analysis to strengthen their representation of, and building of, social sciences in the UK.

29. Identifying the core priorities for the social sciences in government over the short, medium and longer term.

MEETINGS/COMMUNICATION

30. This has still to be agreed, but it is likely there would be 5/6 meetings a year. The next meeting will be in October.

October 2009
setting research and funding priorities: evidence
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* Other depts: ACAS, COCC, DSTL, LSRC, NPIA, ECGD.

Source:
GSR—Members data base: Mid Year Report 2009, HMT non-GSR members removed.
GSE—Government Science and Engineering database: up to March 2009, includes all members where S/E is essential or useful to their current post. Although the GSE includes “generalists” with a science or engineering background these have not been included in the figures provided.
GES—Members data base: April 2008—includes all member categories.
GSS—Members database March 2009.
GORS—Members database March 2009.

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**Supplementary memorandum by HM Treasury**

The Pre-Budget Report published in December 2009 announced a total of £600 million savings to be realised from the higher education and science and research budgets as part of the Government’s package of £5 billion of savings by 2012–13 from targeting and prioritising spending.

At PBR, the Government announced a global total of savings to be made from across the whole of the Higher Education and Science and Research envelope. Within this global total, savings will be made in a number of areas, including from within existing higher education student support arrangements; efficiency savings and prioritisation across universities, and science and research; some switching of modes of study in higher education, including an increase in part-time and co-funded degrees; and reductions in budgets that do not support student participation. The Government will achieve these savings by 2012–13.

In response to the Committee’s questions, the Government has not yet taken a final decision on the split of savings within this envelope. Once the independent review of higher education funding and student finance has reported later this year, the Government will need to assess the implications of its recommendations. It is the objective of the review to propose the right funding balance between the taxpayer, students and other private sources of income, to ensure a sustainable higher education funding system that maintains the Government’s commitment to greater and wider participation, and delivering a world-class skills base.

The Government remains committed to raising participation in higher education, making further progress towards achieving a world-class skills base, and world-class science and innovation in the UK. Its overall funding of higher education has risen in real terms by 25% between 1997 and 2009–10. This has supported the success of a world-class system of higher education. Investment in the research base has almost doubled over the same period.

26 February 2010

**Memorandum by the Home Office**

1. What is the overall objective of publicly-funded science and technology research?

1.1 From the Home Office perspective, as the lead government department responsible for crime, policing, immigration, passports, drugs and counter-terrorism, the purpose of our science and technology research is to help us inform, develop and implement our policies to deliver our over-riding objectives of protecting the public. The science we carry out, outlined in our Science and Innovation Strategy, is vital to delivering this aim by:

   — providing evidence for policy development,
   — understanding which interventions are likely to have the greatest impact, and
   — providing the technological innovation to support our operational requirements.

1.2 In order to achieve this, we rely not only on science and technology research but also social sciences, statistics, economic analysis and operational research.

1.3 Focusing on science and technology, examples of the science we fund include:

   — Research to protect the public against explosives and chemical, biological, radiological and nuclear (CBRN) threats,
   — Technology to support the policy and other agencies, including setting standards for protective body armour and less lethal weaponry,
   — Investigating new technologies to detect drugs, and
   — Biometrics to assure identity.

1.4 Two further important areas for the Home Office are regulating the use and practice of science and technology in the areas of:

   — Implementing the Animals (Scientific) Procedures Act 1986 (which regulates the use of animals in science), and
   — In 2007 we created the role of the Forensic Science regulator (whose job is to ensure the scientific quality of forensic evidence in the criminal justice system).

38 http://www.homeoffice.gov.uk/documents/science-strategy
2. How are public funds for science and technology research allocated? Who is involved at each level and what principles apply? Where appropriate, is the Haldane Principle being upheld?

2.1 Within the Home Office there is no central science budget. Science, engineering and technology research based at the Home Office Scientific Development Branch (and economic analysis) is led by units under the direct management of the Home Office Chief Scientific Advisor (CSA) and the budget is allocated within that provided to the Home Office Science and Research Group. Social research funded by the Office for Security and Counter-Terrorism is funded directly by the respective policy Directorates (social scientists are embedded within directorates working alongside policy counterparts) and is based on the science business requirements of the Directorates.

2.2 For the Home Office, public funds are allocated to research through a science business planning process. There are five science business plans covering: Security and Counter-Terror, Policing, Crime, Identity Management and Migration. The scope of science business planning includes all science disciplines: physical/natural sciences and engineering, social sciences, statistics, economic analysis and operational research. Each plan defines how the Home Office (including the UK Border Agency) intends to use science to deliver and inform the Department’s objectives.

2.3 The science business plans undergo a two-tier quality assurance process before approval by Ministers as described below:

- Science plans are prepared by civil servant scientists and researchers in conjunction with policy Directors, ensuring alignment with the Home Office science objectives outlined in the Science and Innovation Strategy and, where appropriate, other policy priorities as they arise.

- In the first stage of the quality assurance process, the plans are submitted for independent scrutiny to the Home Office Scientific Advisory Committee (HOSAC) — a group of external independent experts nominated by learned societies and representatives of key Home Office scientific advisory committees.

- In the second stage the plans go to the Home Office Science Challenge Board (an internal Home Office group formed of the CSA, the independent co-chair of HOSAC, senior Home Office scientists and chaired by the Director General of Home Office Strategy and Reform).

- The Challenge Board reviews the plans as a single entity and provides a view on the balance of investment in science across the Home Office. It makes its recommendations and submits the plans to the Home Office Board for approval.

- The process concludes with the plans being discussed with Ministers prior to approval.

2.4 The science plans contain a mix of highly specified research that is required to meet our objectives, and more outcome-focused research, whereby the outcomes of the research are outlined by the department, but there is greater flexibility on how such outcomes might be achieved. This aims to encourage the external science and engineering community to innovate to deliver solutions for the Home Office.

2.5 Overall, the Home Office maintains control over how its science and research spending is prioritised. However, the Haldane Principle, whilst not fully upheld, is, in spirit, encouraged both through our commitment in involving external scientists on our Science Advisory Committees and through defining some of our research programmes in terms of broad outcomes.

3. Are existing objectives and mechanisms for the allocation of public funds for research appropriate? If not what changes are necessary?

3.1 For the Home Office, the allocation of funds and its scrutiny, is appropriate to maintain a balance of encouraging innovation and delivering the science and engineering required to inform our policies and support operational delivery. We continue to prioritise funding, outlined in our Science and Innovation Strategy, by working closely with policy colleagues and ensuring that science funding is concentrated on the department’s most important, short- and long-term, priorities

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4. **What governs the allocation of funding for Government policy-directed research through Government departmental and agency initiatives? Are existing mechanisms appropriate? What is the role of Departmental Chief Scientific Advisers?**

4.1 The allocation of science and technology research funding in the Home Office is outlined in the answer to question 2, including the role of the Home Office Chief Scientific Advisor. In that respect the existing mechanisms are appropriate.

4.2 The mixed funding model practised by the Home Office means the Home Office CSA has a duel role of Advisor and Manager. Whilst he does not have a direct management role regarding the science and technology research across all policy areas, he has strong working relationships with embedded scientists across the department and advises the Home Office Board and Ministers on all the science funded by the department. The CSA has direct line management responsibility of the more cross-cutting areas of science and technology, including that undertaken at the Home Office Scientific Development Branch and has responsibility for the professional development of all scientists and researchers in the Home Office.

5. **How are science and technology research priorities co-ordinated across Government, and between Government and the relevant funding organisation? Who is responsible for ensuring that research gaps to meet policy needs are filled?**

5.1 The Home Office leads on coordinating the research of a number of cross-government issues. This includes Security and Counter Terrorism. Here research across a wide range of government department’s and agencies is co-ordinated with the principle objectives:

- To use horizon scanning to understand future scientific and technical threats and opportunities and inform Governments decision making on counter-terrorist.
- To ensure the development and delivery of effective counter-terrorism solutions by identifying and sharing priority science and technology requirements.
- To enhance international collaboration on counter-terrorism related science and technology.

5.2 The approach to this is outlined in the United Kingdom’s Science and Technology Strategy for Countering International Terrorism, along with the governance arrangements of how this research is co-ordinated across government. INSTINCT is a cross-Government programme led by OSCT that seeks innovative solutions to support our counter-terrorism strategy. Its aim is to enable Government to make the most of innovative projects and ideas in counter-terrorism by providing a greater understanding of the innovation community, smarter influence over external innovation and better coordination of investments in new ideas and solutions.

5.3 The Home Office also leads on illicit drugs research and is developing a research strategy as part of its Cross Government Research Programme on Drugs (CGRPD). This is being developed by representatives from the major government departments involved in drugs research (Home Office, Department of Health, Department for Children, Schools and Families, Ministry of Justice), the Medical Research Council, National Treatment Agency, policing organisations and the Advisory Council on the Misuse of Drugs. This will provide an important contribution to coordinating research in this field.

5.4 In addition to the specific policy areas above, the Home Office works bilaterally with the Ministry of Justice on areas of mutual interest. Across government the Home Office Chief Scientific Advisor is a member of the cross-government Chief Scientific Advisor’s Committee that supports cross-cutting research across government and a Home Office minister is a member of the Science and Innovation sub-committee of the Ministerial Committee on Economic Development.

6. **Is the balance of Government funding for targeted verses response-mode research appropriate? What mechanisms are required to ensure that an appropriate and flexible balance is achieved? Should the funding of science and technology research be protected within the Research Councils or Government departments? How will the current economic climate change the way that funds are allocated in the future?**

6.1 From a Home Office perspective, we do not regard the department’s spend on science and technology as the totality of science and technology research funding in our areas of interest. We maintain strong links with the external research community and in particular Research Councils through which we access the wider research community and work to investigate common areas of interest. For example:

- We worked with the Engineering and Physical Research Council (EPSRC) in leading a “Sandpit” on screening cargo containers for drugs and other illicit substances. We defined the scope and issue, supplied further Home Office technical and operational help to facilitate the process. We worked closely with around 20 academics from across the UK to ensure that they had a clear picture of the

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practical and operational issues to inform scoping research projects in this technically challenging area. This was very successful and resulted in around £2.7 million worth of collaborative and innovative research projects being funded to address this issue. We have established a network to continue interaction with and monitor the progress of projects.

6.2 We see this response-mode funding employed by the Research Councils as an important part of the research-chain to encourage and bring in innovation into more operational and policy focused applications.

6.3 It is vital that the balance between targeted research and response-mode funding streams are maintained (including during the current economic climate). Both are essential for ensuring there is good access to innovative academic research in the public sector and that there is a strong route for “pull-through” of academic research through to application.

7. How is publicly-funded science and technology research aligned and co-ordinated with non-publicly funded research (for example, industrial and charitable research collaboration)? How can industry be encouraged to participate in research efforts seeking to answer societal needs?

7.1 As described above in response to Q5, the Home Office engages with industry and charitable research through its cross-government research strategies. More generally we keep abreast of research in industry and the charitable sector through appropriate representatives on our science advisory committees (eg ACMD, APC, HOSAC, FSAC all have industry and/or charity representation).

7.2 The Home Office Scientific Development Branch, also works closely with industry through events such as the annual HOSDB exhibition (run in partnership with APPS), procurement of R&D via competitive tender and innovative research calls, as well as engagement via conferences and industry events. Through the Home Office Scientific Development Branch, the department has a very strong record of engaging with Small and Medium Sized Enterprises (SMEs) that undertake significant innovative research in the security field.

7.3 We work closely with the UK Security and Resilience Industry Suppliers’ Community (RISC) to encourage academic and industry research on counter-terrorism issues. We have recently published the first of a series of brochures specifically aimed to encourage industry to engage in counter-terrorism research—“Countering the terrorist threat—Ideas and innovation: How industry and academia can play their part”.

7.4 The Home Office welcomes the role of the Technology Strategy Board (TSB) in bringing closer together industry, and in particular SMEs, and government departments. We have worked with the TSB in a number of areas, including in technologies in identity management.

8. To what extent should publicly-funded science and technology research be focused on areas of potential economic importance? How should these areas be identified?

8.1 We encourage research that stimulates economic growth in specific fields and we encourage businesses to invest in security related research where there is likely to be an exploitable market. However, much of the research the Home Office undertakes is where there is little potential commercial exploitation—usually because the market is too small to be viable. Therefore, government funded-research needs to be focused on such areas to meet the demands of operational delivery.

9. How does UK’s science and technology research funding and spend compare with that in other countries and what lesson can be learned? In this regard, how does England compare with the devolved administrations?

9.1 The UK is a world leader in science and technology in many of the areas for which the Home Office has responsibility. However, the research funding we have is inevitably limited and we need to ensure we work closely with international partners to ensure we can share knowledge and maintain value for money. To facilitate this we have had a treaty with the US Government for Co-operation in Science and Technology for Critical Infrastructure Protection and other Homeland Security Matters since 2004.

9.2 Recently the Home Office has taken a leading role in establishing the European Migration Network to bring additional resources into knowledge co-ordination sharing. We are also participating in a new European Network of Police Technology Services. In the majority of the Home Office’s areas of responsibility where science and technology research plays a leading role, we lead on behalf of the UK. However, we maintain close relations with the Devolved Administrations.

September 2009

Memorandum by Imperial College London

What is the overall objective of publicly-funded science and technology research?

1. The purpose of publicly-funded science and technology research funding is to encourage and support high-quality, discovery-led research; produce skilled researchers; to advance and disseminate knowledge and technology; and to improve the quality of life and economic competitiveness in the UK. These tenets are embedded in the Imperial College London 1907 Royal Charter which states:

“Imperial College delivers world class scholarship, education and research in science engineering and medicine, with particular regard to their application in industry.”

How are public funds for science and technology research allocated? Who is involved at each level and what principles apply? Where appropriate, is the Haldane Principle being upheld?

2. The public funds for science and technology research are allocated via the Government Departments of Health and Business Innovation and Skills (BIS) and accountability for public funds lies with the elected Ministers of those Departments. Every two years the Government currently undertakes a Review of its spending—the most recent was the Comprehensive Spending Review 2007—and each government Department makes representations to the Treasury for the amount of money they should receive. Negotiations are made on previous allocations, value for money, cost/benefit analysis, innovation, economic impact and detailed requests from individual bodies accountable to these Departments, although CSR07 took a more root-and-branch approach, taking less account of previous allocations.

3. Under the dual support system, the Research Councils provide grants for specific projects and programmes. The UK’s Funding Councils provide block grant funding to support the research infrastructure and enable institutions to undertake research in their chosen areas of priority. This funding also enables universities to undertake research commissioned by the private sector, Government Departments, charities, the European Union and other international bodies.

4. There are four Funding Councils in the UK, supported by the Department for Business, Innovation and Skills and the devolved Departments of Education. Research Council funds are mostly awarded on the basis of applications made by individual researchers or groups of researchers, which are subject to independent, expert peer review by members of the research community. However, Research Council staff will sift-out proposals based on outline bids without external peer review. The primary criteria for making an award are research excellence and potential impact. Increasingly, Research Councils are distributing their funds in targeted programme areas, including the Government Global Challenges, and responsive mode is being focused on priority areas through “signposting”.

5. Funding Council support for research (Quality Related or QR funding) is distributed on the basis of the excellence of individual departments in higher education institutions, using the results of the Research Assessment Exercise (RAE). In future, this will be replaced by the more metrics-based Research Excellence Framework. Imperial College London is taking a proactive approach to working with the Higher Education Funding Council for England (HEFCE) to help develop and test this approach.

Are existing objectives and mechanisms for the allocation of public funds for research appropriate? If not, what changes are necessary?

6. Government Departments should make better use of senior academics in higher education institutions in helping them to make the case for the research budget.

7. We would welcome a focus on quality and not quantity—this relates to both the funding of universities and the funding of students. The recent RAE for example allowed a dissipation of funding across the UK. It is also clear that the RAE funding mechanism does not take enough value of HE/industry collaboration. A focus on science research and links with industry is essential if UK is to find a way out of this economic crisis.

8. Examples of successful funding are the ERC investigator awards with success being due to their long duration (five year renewable awards). Less helpful awards are those which are excessively political—for example—those which seek to disburse funds geographically rather than according to excellence. We want to avoid investigators wasting time on small grants that only last for a short duration. We suggest this is a more efficient use of investigator time which also gives more room for innovation and creativity. Grants which award a track record of research and award excellence is also supported. However, we would caution against shifting the burden of peer review onto HEIs.
Is the balance of Government funding for targeted versus response-mode research appropriate? What mechanisms are required to ensure that an appropriate and flexible balance is achieved? Should the funding of science and technology research be protected within the Research Councils or Government departments? How will the current economic climate change the way that funds are allocated in the future?

9. We support fully the need to fund the best research. However, some science funding is very poorly distributed (for example that which is the responsibility of DfID). In addition, funding sources which demonstrate value for money, provide adequate benefits to researchers and are allocated subject to peer-review are the ones which should be supported moving forward.

10. We recognise the importance of supporting a few, well-selected, managed programmes that address global challenges which are unlikely to change on a short time-frame, and which could not be achieved without co-ordinated funding. For example, long-term and concerted investment in e-Science has placed the UK in a strong position to attract inward investment because companies want to be close to the robust e-architecture and know-how that has been created.

11. However, in recent years the balance of Research Council funding has swung too far towards managed programmes at the expense of response-mode funding. This as a retrograde step for the following reasons:

- The choice of targeted research areas can never be perfect; the future of research has an inherent unpredictability, establishing managed programmes can take too long for them to be timely, and the decision-making process is often not perceived to be fair and transparent.

- The high administrative cost of selecting, devising, promoting and running managed programmes diverts funds away from research itself.

- University researchers in the UK are highly qualified, trained and motivated and have a vested interest in choosing profitable areas in which to invest their e-Vort. Reliance on these attributes led to the great advances of post-war British science—for example, breaking the genetic code, which has had incalculable economic and health benefits; discovering laser technology has also led to numerous technological advances, from laser eye surgery to CD players.

12. The Research Councils must continue to maintain an appropriate balance of targeted versus response-mode funding to enable discovery and blue-skies research to flourish. For example, Research Councils could be directed to allocate a minimum percentage of their research funds to response-mode applications. Such funding by BBSRC is currently around 47 per cent. A numerical target of “at least 50 per cent” is therefore achievable and would send a strong positive signal.

13. Research Councils should be directed not to dilute the responsiveness of the response mode. This is currently happening by “signposting” and “highlighting” preferred areas for responsive mode applications.

14. Administrative costs of Research Councils should be capped at a certain percentage of research funds to prevent over-management.

15. Freedom to explore new, un-prioritised, research areas is possible thanks to the diversity of funding sectors. It should be noted that under the current economic conditions the funding from many of these sources has diminished and a consequence of this might be a greater monopoly of research priorities by Research Councils.

16. The budget for research has, to date, remained ring-fenced within the host Department and we would not wish to see this position eroded. Devolving the budget to the current Research Council system would significantly reduce the opportunity for moving funds between areas of research that fall outside of a single Research Council and would reduce scope for supporting policy-driven priorities such as energy, climate and global health.

How is publicly-funded science and technology research aligned and co-ordinated with non-publicly funded research (for example, industrial and charitable research collaborations)? How can industry be encouraged to participate in research efforts seeking to answer societal needs?

17. The role of the Technology Strategy Board (TSB) and its integration with engineering is widely held up as an example of successfully aligning industry needs with research. However, accessing support from the TSB remains intractable for many higher education institutions as well as individual researchers. This problem is much worse in the area of Life Science research which is largely due to the initial set-up of the TSB, and its principles have not been adequately progressed to encompass a Life Science remit. Rather than continue to confuse the role of TSB, creating an industry-facing arm of the MRC could be the remedy.
To what extent should publicly-funded science and technology research be focused on areas of potential economic importance? How should these areas be identified?

18. Publicly-funded research should primarily be discovery-led. In almost all cases, especially in the STEM subjects, excellent quality, discovery-led research will have an economic impact in terms of technology transfer, training, inspiring, informing policy, generating new knowledge etc. This research will naturally feed into the global challenge areas which are of greatest economic importance, and there is a case for channelling this research into priority areas. Providing flexible systems are in place to enable researchers to move easily into multi-disciplinary groupings and out again when they are no longer needed, this is the most efficient way of tackling economically important areas. Research groupings which are artificially created to address new challenges have the disadvantages of being reactive rather than responsive, slow to get going, have a high management overhead, may not have track-record or reputation internationally and may be difficult to dismantle.

How does the UK’s science and technology research funding strategy and spend compare with that in other countries and what lessons can be learned? In this regard, how does England compare with the devolved administrations?

19. A notable peculiarity of the UK system is the 4-year cap imposed on PhD training by Research Councils. PhDs in many other countries are longer, and in several cases they are much longer. As a result, UK doctorates are not internationally competitive. EPSRC has recognised the problem but has attempted to address it by introducing Doctoral Training Centres. However, they focus research training in a few areas when a broad base is required, they tie up huge resources that could be better spent on, say, increasing success rates of response-mode applications, and the way in which they are allocated is not transparent. Removing the current penalties associated with PhDs lasting longer than four years would be a more balanced and cost-effective solution.

Translational Research Priority: Coordination across Government and relevant funding organisations post Cooksey (Response from Imperial College Faculty of Medicine)

20. In 2007, based upon a recommendation in the Cooksey report, a joint approach was made to Treasury for the entirety of health research funding. This resulted in the coordinated vision and the largest ever strategic award for health research funding in UK history. This funding is both important and very welcome. Both MRC and NIHR now report quarterly to the OSCHR Board and have a duty to deliver the OSCHR strategy. However there is a continued need to monitor this co-ordinated approach and the “ownership” of priority areas.

21. Given this coordinated budget for health research, there has still not been adequate or sufficiently rapid progress in furthering the translation of medicine in the UK. We risk falling behind our close competitors irretrievably if we do not redress this imbalance very soon. We would argue that whilst developments in this area have been positive in recent years (following the recommendations of the Cooksey report), the UK’s excellence in basic science research is still not being translated rapidly enough into benefits for the nation’s health and the economy. A fundamental change to the system is required address this deficit.

22. In an effort to translate our UK research prowess into improved clinical outcomes for patients, five UK Academic Health Science Centres (AHSCs) were designated earlier this year. The UK competes with the best internationally in research, education and service, and is second only to the US in terms of Life Sciences research outcomes (Times Higher Education 2008). The aim of the AHSC is to capitalise on that to create better health outcomes but also to bolster one of the last remaining pillars of the UK economy: the biotechnology, biopharmaceutical and Life Sciences sector. The UK is now in need of a coordinated science, health and wealth agenda which goes even further than that which Cooksey implemented to join-up health and education funds via OSCHR.

23. Whilst, as one of the UKs five AHSCs, we would like to see a greater focus on funding of translational research, we do not wish this to be at the loss of basic science. We believe there should be a nuanced portfolio comprising both basic and applied science along every step of the research continuum. Consequently, we would suggest that the remits of the BBSRC and MRC should be reviewed to achieve a seamless, balanced portfolio of UK biomedical research and protection of UK basic biomedical science base.

24. A further attempt to coordinate funding between science and health research has been the recent creation of the Office of Life Sciences (OLS) which is made up of officials from BIS and DoH under the leadership of Lord Drayson. What is more, this Department goes even further in attempting to reconcile health research with industrial policy. We see this as a very promising development as we feel the main problem is the need for a coordinated science, health and wealth agenda from Government in regard to science and technology research. By focussing on industrial policy, which is key given the current economic crisis, one is de facto
setting research and funding priorities: evidence

investing in science given its technological base. It could be that OSCHR may fit more comfortably within this, even more integrated and joined up OLS agenda?

September 2009

Memorandum by the Institute of Chemical Engineers

INTRODUCTION

IChemE is the hub for 30,000 chemical, biochemical and process engineering professionals worldwide. We are the heart of the process community, promoting competence and a commitment to sustainable development. Professional bodies such as IChemE occupy a unique place in society. Our Royal Charter and charitable status confers upon us an obligation to advance the discipline for the benefit of society as a whole and support the professional development of our membership, which spans a wide range of individuals from industry, regulators, academia and consultancies. We can call upon our member’s expertise in these fields without bias or favour, in order to reach objective advice based on sound science.

The Institution of Chemical Engineers (IChemE) welcomes the opportunity to submit evidence to this inquiry. The call for evidence document contains nine questions to which we have allocated numbers one through to nine, inclusive. The institution has responded to each question using this nomenclature.

CALL FOR EVIDENCE RESPONSE:

Question 1: What is the overall objective of publicly-funded science and technology research?

1.1 Science and engineering make a huge contribution to welfare—the health, wealth and happiness of citizens. For example, nearly 30 per cent of the UK’s GDP is produced by SET-intensive sectors, according to the 2009 IUSS Select Committee report Engineering: turning ideas into reality (para 7). Likewise, research programmes in science and engineering are contributing significantly to advances in healthcare.

1.2 The objective of public funding is thus to support science and technology research that is in the public interest, and for which other sources of funding are not available. Sometimes the provision of public funds enables partnerships to be initiated, where industry or charities, for example, also contribute: encouraging such partnerships is another desirable objective.

1.3 Research in SET topics also contributes to culture—it captures popular attention and generates interest in young people, stimulating the formation of the Science-literate Society commended in the Bodmer Report of 1985 (Royal Society).

1.4 A vital additional purpose of publicly-funded research is the training of highly skilled manpower for the UK workforce.

1.5 For the purposes of this response we distinguish three types of research:

Curiosity-driven: Discoveries in science, including engineering science, which have been made thanks to public funding of research, underpin many of the benefits of modern life. Very often these discoveries were not made with any specific application in view, but were the result of Curiosity-driven research. This is thus an essential element of any publicly-funded research programme.

Application-conscious: The second type of research, Application-conscious, is that in promising areas of long-term interest, aimed to develop know-how that could be applied. Much engineering research is of this nature. We make a distinction between this and Mission-driven research, since Application-conscious research is speculative in nature, in an area of science/engineering chosen by the researcher. The research is not Curiosity-driven though, because it is carried out in a field with potential application in mind.

Mission-driven: The third type of research is that which is designed to yield science-based solutions to particular challenges, generally within a set time-frame. Industrial R&D is mainly of this type.

Question 2: How are public funds for science and technology research allocated? Who is involved at each level and what principles apply? Where appropriate, is the Haldane Principle being upheld?

2.1 The IUSS Select Committee report Putting Science and Engineering at the Heart of Government Policy (pp50–53) gives a useful set of flow diagrams summarising public funding streams for research and new technology. Whilst some diversity is inevitable and can be an advantage in enabling targeting of cash to specific needs, the complexity of the overall picture is striking. The downside is evidently the difficulty of ensuring balance, in overlapping programmes, in transparency, and the potential for certain areas to experience shortage of funding. And, perhaps most importantly, in presenting a complex and fragmented support
mechanism to the research community. Government has constructed a complex set of channels for feedback into government around science and engineering issues.

2.2 The Haldane Principle, by which we understand “decisions about research funding should be made by scientists and not politicians”, is broadly being upheld at the level of individual project submissions to Research Councils. Decisions about these, following peer review, could be fairly said to be based on scientific grounds.

2.3 However, an equally important question is that of allocating funds to the different types of research we distinguished above, and between different technical areas. We do not feel that questions of allocation are best decided solely by scientists, and agree with current practice that an appreciation of societal issues should also inform decision making. But the overall effect of funding allocations on the research community needs to be considered—for example, the effect on the development of trained manpower.

Question 3: Are existing objectives and mechanisms for the allocation of public funds for research appropriate? If not, what changes are necessary?

3.1 IChemE is concerned that pressure on Research Councils to generate science and technology of immediate practical use may jeopardise the Curiosity-driven and Application-conscious programmes that are a vital part of a healthy research community, and which the Councils have a unique role in funding. We note that the Research Councils have recently introduced a requirement that applicants write an “Impact statement” to explain who will benefit from their research.

3.2 It is essential that research that is moving successfully into commercial application is supported, but this is not a task for Research Councils with their ethos of scientific peer review. It is a space in which, since its creation in 2007, the Technology Strategy Board has been active. There is a case for widening the remit of the TSB (or some similar organisation) and increasing its funding. At the same time there should be more clarity about the roles of the Research Councils and their managed programmes, and the interface with TSB and ETI (Energy Technologies Institute). We believe that Curiosity-driven and Application-conscious research should be the province of Research Councils, but that Mission-oriented research should be promoted by other bodies which are tasked also with delivery.

3.3 The UK has a rather poor record at translating scientific discoveries into commercial application, but we do not feel that putting the Research Councils under pressure to fund translation activities is the correct approach. Making relatively small sums of money (all they can afford) available for technology development, which is an expensive business, has been characterised as a policy “guaranteed to fail, but cheaply”. Successful innovation programmes require a different approach to those funding science and technology research.

Question 4: What governs the allocation of funding for Government policy-directed research through Government departmental and agency initiatives? Are existing mechanisms appropriate? What is the role of Departmental Chief Scientific Advisers?

4.1 Our impression is that the allocation of funding for policy-related research from Government Departments and Agencies tends to be inconsistent, as it depends upon the degree to which individual senior managers are informed about, and enthusiastic about, the potential benefits of research. A greater awareness of the importance of sound scientific and engineering evidence across Government, and an appreciation of its value in identifying and developing opportunities as well as governing downside risks, should be inculcated and the Departmental CSAs have a key role in achieving this aim. Sometimes it appears that Government departments would rather fund a consultant, than a scientist.

4.2 We applaud progress made under Professor Sir David King and Professor John Beddington in promoting and enhancing the work of the CSAs but believe that these individuals still have more to do to establish their position at the heart of informing and shaping policy. Furthermore, it is essential either that Departments engage Chief Engineering Advisors in addition to CSAs, or that the CSA explicitly assumes a role which embraces both science and engineering, as indeed Professor Beddington himself has done.

4.3 In support of these aims, we advocate that scientists and engineers in Government should be encouraged to network with professional colleagues through a range of mechanisms including those provided by the professional institutions. They should aim to secure professional registration as both the benchmark of their professional standing and a symbol of the importance attached by Government Departments and Agencies to the contribution of the science and engineering community.
Question 5: How are science and technology research priorities co-ordinated across Government, and between Government and the relevant funding organisations? Who is responsible for ensuring that research gaps to meet policy needs are filled?

5.1 As already commented, we are not confident that the current fragmented research support mechanism can identify gaps, nor fill them.

5.2 As an example of funding gaps, we cite the uncertain funding of biotechnology applications, which involve chemical engineers and biochemical engineers, and which have tended to fall between EPSRC (with its emphasis on physical science) and BBSRC (with its emphasis on bioscience). The Technology Strategy Board has recently announced funding of £2.5 million for Industrial Biotechnology, which is very welcome. But assurance of consistent funding of technology development and application in this exciting area, related to topics like pharmaceuticals and healthcare, food and drink, biofuels and the low-carbon economy, is still awaited.

5.3 Another “gap” area of which we are aware is that between social science and engineering where matters of sustainable development are coming forward. The impact of new technology on society, for example in the low-carbon economy, is under study, but this inter-disciplinary research risks failing to attract sufficient support from either community.

Question 6: Is the balance of Government funding for targeted versus response-mode research appropriate? What mechanisms are required to ensure that an appropriate and flexible balance is achieved? Should the funding of science and technology research be protected within the Research Councils or Government departments? How will the current economic climate change the way that funds are allocated in the future?

6.1 In recent years there has been an increasing diversion of Research Council funds from Responsive mode research to “Managed programmes” in specific areas, and to Mission-driven research also funded by a variety of other bodies such as the ETI and TSB. Naturally, research funded by Government departments is mostly Mission-driven.

6.2 Thus we have seen success rates in Responsive mode fall. By number, the success rates of grant application to EPSRC Responsive mode was 32 per cent in 2004–05, 30 per cent in 2006–07 and only 23 per cent in 2008–09. These are average figures, and in some areas (eg Physical Sciences), Responsive mode success rates are now less than 20 per cent. Researchers thus perceive that support for Curiosity-driven and Application-conscious research is falling. Low success rates are a challenge for both funders and researchers: they put the peer-review system under strain, and cause the whole process to be regarded by researchers as something of a lottery. A single non-supportive review (sometimes from an inexpert referee) can cause an application to fail, so that applications inevitably tend to avoid potential criticism by being less speculative and imaginative, and thus less risky. This is not to the benefit of the overall programme.

6.3 IChemE strongly welcomes the growing emphasis on research of commercial and social relevance, but nevertheless remains concerned about the overall picture. With a variety of organisations being responsible for different aspects of public funding, we are not confident that the overall balance of different types of research is being considered or guided.

6.4 The current deterioration in the public finances, as a result of the economic slowdown, will clearly affect the sums of money available for public funding of research. A particular threat is that many leading researchers in engineering in the UK are from overseas and a funding drought could lead to a significant emigration of this talent causing a major long-term setback for UK SET research. Continuity of funding, essential to keep skill-groups in place, is at risk.

6.5 The arrangements for allocating funds should be robust against a wide variety of economic situations, and we feel that the opportunity should be grasped to make the necessary changes, irrespective of the economic climate.

Question 7: How is publicly-funded science and technology research aligned and co-ordinated with non-publicly funded research (for example, industrial and charitable research collaborations)? How can industry be encouraged to participate in research efforts seeking to answer societal needs?

7.1 Ultimately publicly-funded science and technology research must be more strongly aligned with that funded by other sources. Tax and financial measures must play a key part in encouraging a significant enhancement both in the volume of industrial collaborative research and in the willingness of industry to
engage in science and engineering R&D. Measures need to be taken to ensure that industry views the UK as a location of choice for collaborative R&D, for example through:

- Arrangements for the utilisation and ownership of intellectual property.
- The appropriate funding models, ensuring that “full economic cost” does not simply act as a deterrent to collaboration with the UK.
- The supply of well trained graduates and postgraduates, which is the key factor in determining where companies place their globally mobile R&D investments.

**Question 8:** To what extent should publicly-funded science and technology research be focused on areas of potential economic importance? How should these areas be identified?

8.1 IChemE thinks that an appreciation of the technology needs of particular industrial sectors is one legitimate consideration in allocating public funds to science and engineering research. The well-established principle that research programmes should be “pre-competitive” is still appropriate. Other leading considerations will be societal needs, and technical potential.

8.2 In 2007 IChemE undertook a consultation with its members worldwide about priorities for the profession in the 21st Century. It identified the following:

- Sustainability and Sustainable Chemical Technology.
- Energy—Securing Reliable and Affordable Supplies in the Near Term.
- Food and Drink.
- Water.
- Bioprocess and Biosystems Engineering.

(www.icheme.org/technicalroadmap)

8.3 These topics, many of which feature as priorities in current government policy, give rise to a whole range of issues, some of which need more research.

8.4 Our consultation did not attempt to spot particular winning technologies, and in general we believe that publicly-funded science and technology research also should stop short of trying to spot winners. Consultation with a range of stakeholders is well able to identify needs and opportunities sufficient to inform public funding of research. Bodies such as TSB have a vital role in promoting innovation, but funding ideas through to the market is a task for those companies (and individuals, partnerships etc) who will take on commercial risk, and rewards.

**Question 9:** How does the UK’s science and technology research funding strategy and spend compare with that in other countries and what lessons can be learned? In this regard, how does England compare with the devolved administrations?

9.1 Citation statistics and other evidence show that UK science research punches above its weight in terms of international ranking, which is a splendid result for our scientists, and a testament to the good work of our funding agencies. The IUSS Select Committee report *Putting Science and Engineering at the Heart of Government Policy* (p10) shows though that the UK’s Gross domestic expenditure on R&D, at 1.8 per cent of GDP, is somewhat less than that of our main competitors (Japan 3.4 per cent; USA 2.6 per cent; Germany 2.5 per cent). We also have the impression that competitors are more successful at funding the translation of science through into useful technology.

9.2 In its recent response to the BBSRC consultation on its strategy, IChemE commented that the Research Council needed also to fund engineering research, if its bioscience research was to have the hoped-for impact. Applied science and engineering research are essential steps on the path to realising a successful application (see response, above, to question 3), but are too often neglected.

9.3 However we are encouraged by a growing entrepreneurial culture in the UK, and the Government’s efforts to stimulate this. We applaud the recently announced creation of the £1 billion UK Innovation Investment Fund, intended to invest in technology-based young businesses. Such support will surely stimulate the science and engineering community and help us to build on the UK’s strengths in SET-based research.

*September 2009*
Letter from Institute of Physics

The Institute of Physics is a scientific charity devoted to increasing the practice, understanding and application of physics. It has a worldwide membership of over 36,000 and is a leading communicator of physics-related science to all audiences, from specialists through to government and the general public. Its publishing company, IOP Publishing, is a world leader in scientific publishing and the electronic dissemination of physics.

The Institute is pleased to submit its views to inform the House of Lords Science and Technology Committee’s inquiry, “Setting science and technology research funding priorities”. The response was prepared with input from the Institute’s Science Board, and Business and Innovation Board; both of which formally report to Council.

The attached annex details our response to the questions listed in the call for evidence.

If you need any further information on the points raised, please do not hesitate to contact me.

Summary of Key Points

— The objectives of publicly-funded research include the pursuit of new knowledge; the challenge of solving major societal problems; transforming new ideas and concepts into products and services; and attracting the brightest students into higher education.

— It is not easy to track how and where the money government departments allocate to other bodies to undertake R&D is spent. This lack of transparency is something that should be addressed; looking ahead, if departmental budgets are cut, it will not be clear how the overall R&D spend has been affected.

— The Haldane Principle needs to be updated for the modern era to take into account, amongst other things, the interaction between science policy with regional development policy due to the money and authority now held by the devolved governments and the Regional Development Agencies.

— The RCUK Review of UK Physics recommended that the Director General for Science and Research would benefit from the advice of an independent advisory group during future CSR allocation processes to ensure there are no unintended consequences of allocations and there is appropriate accountability to the scientific community. Learned societies, universities and individual academics should be appropriately represented on any such advisory group.

— There is a need to focus more on increasing the effectiveness of the translational research that brings scientific innovations to the market, building on the strength of the UK’s curiosity-driven research. There needs to be more strategic coordination between the research councils and an increased recognition of the importance of funding for translational R&D. There seems to be a real danger of a widening gap between the research councils and the TSB in this respect.

— There has been greater emphasis towards targeted funding in recent years, and there appears to be a central lack of understanding that targeted research is dependent on curiosity-driven research having taken place.

— It is understood that the government influences the selection of cross-council priority areas, which is fine as it should play a key role in the over-arching strategy of the UK’s research base. However, the research councils deny this involvement and claim that the areas have been chosen through consultation with their research and user communities. There needs to be a greater level of transparency as to how the areas are shortlisted and selected.

— To address societal needs, and particularly the major challenges that face the UK, there needs to be, and to some extent is, a realisation within government that the ring-fenced “Science Budget” is not of the correct order of magnitude to fund the necessary R&D.

— The Institute proposes that in order to preserve funding for curiosity-driven research, targeted programmes of research (and their funding) should be removed from the remit of the research councils and placed within the “lead” government departments. The departmental budgets would then have the critical mass to tackle the major societal challenges and the scientific funding that remains devoted to the research councils could be driven on a peer review basis towards the goal of international excellence.

— To facilitate this, the number of STEM qualified people in government departments needs to increase markedly along with the schemes required to achieve this, and government departments and university STEM departments will also need to develop closer links.
The UK spent 1.8 per cent of its GDP on R&D in 2005. This is still somewhat more than both China and India, at present, but behind what the UK’s leading competitor nations spend, such as the USA, France and Germany. While this overall figure is strongly dependent on the chosen metrics, the critical point to note is that the proportion of this R&D financed by industry, as opposed to the government, is almost double in the USA, Germany and China than in the UK.

Innovative public procurement strategies, tied in with programmes of targeted research could enable the government to achieve its stated policy objectives, address the major societal challenges and also allow UK science and technology to become world-leading in these areas.

What is the overall objective of publicly-funded science and technology research?

1. Publicly-funded science and technology research is the means by which the UK maintains its position as an internationally leading knowledge-based economy enabling significant contributions to be made to its GDP, improving the quality of life of its people, and allowing it to respond to global challenges and opportunities. The objectives of such research are manifold, including:

- the pursuit of new knowledge, which is the foundation of new discoveries and applications. For instance, MRI scanners, GPS systems and LCD displays, owe their development to principles discovered via curiosity-driven physics research coupled with science-based innovation to produce market-ready technologies that have had significant economic and societal benefits;
- the challenge of solving major societal problems, such as health, national security, energy, climate change and an ageing population. For example, in healthcare, condensed matter physicists are manipulating exterior magnetic fields to heat magnetic nanoparticles to target and kill cancer cells. A simple system for detecting whether breast cancer has spread into lymph nodes is in the process of being commercialised. In addition, physicists are working on tiny semiconductor structures called quantum dots, which may lead to applications to beat financial fraud.
- to transform new ideas and concepts into products and services, creating jobs, and contributing to GDP. The knowledge generated in the science base is not easy to track, but has substantial and broad benefit to the economy. Industries ranging from banking and retail to aerospace and pharmaceuticals are dependent on physics research and expertise, and physics-based industries contribute more than £70 billion to the UK’s economy; and
- attracting the brightest students into higher education which will lead to highly skilled graduates that make significant contributions to many sectors within the UK’s economy. For example, a graduate in physics or chemistry earns around £190,000 more during their career than someone with A-levels but no degree, whereas history and English graduates earn only £89,000–92,000 more. In addition, physics and chemistry graduates pay approximately £135,000 more in tax than those with A-levels and £40,000 more than the average graduate during their working lives.

How are public funds for science and technology research allocated? Who is involved at each level and what principles apply? Is the Haldane Principle being upheld?

2. Public funds for science and technology research are allocated to government departments by the Treasury during spending reviews. The government department responsible for science and innovation (currently the Department for Business, Innovation and Skills, BIS) will make a case to the Treasury for an amount of funding for a specified range of projects and initiatives taking into consideration important public policy issues (which comprise the nominal “Science Budget”), and will then allocate the funding it receives to the research councils, higher education funding councils, the national academies, and via special (often openly competitive) initiatives such as HEIF, PSRE, and formerly SRIF. In addition, along with other government departments, BIS will commission research by allocating R&D contracts to universities, industry, national laboratories, research-based institutes, etc., funds for which will also be factored into the overall case each department makes to the Treasury. The funds allocated by departments for SET R&D are not insignificant; the NHS R&D budget alone is equivalent to that allocated to the MRC and the Ministry of Defence commands a SET R&D budget larger than that of any single research council. Due to the nature of the allocation mechanisms, and also the relatively small proportions of overall departmental budgets involved, it is not easy to track how and where this money is spent. This lack of transparency is something that should be addressed; looking ahead, if departmental budgets are cut, it will not be clear how the overall R&D spend has been affected.

42 Physics and the UK economy; http://www.iop.org/activity/business/Business_and_Innovation_Policy/Publishations/economy/page_29809.html
43 The economic benefits of higher education qualifications; http://www.iop.org/activity/policy/Publishations/file_4149.pdf
44 SET Statistics— Science, engineering and technology indicators; http://www.dius.gov.uk/science/science_funding/set_stats
3. The higher education funding councils allocate money for research (ie infrastructure, staff costs, and if needs be, to facilitate curiosity-driven research) via their research funding formula, the algorithm which is informed by the results of the Research Assessment Exercise (RAE); the last of which reported in 2008 and will now be replaced by the Research Excellence Framework (REF). Crucially, a number of government and funding council interventions have ensured that strategic and important subjects, such as physics, are afforded additional funding for both teaching and research to meet the high-costs associated with these subjects. For instance, on the teaching side, HEFCE has implemented a recurrent fund to allocate an additional £1,000 + per FTE undergraduate student, and following RAE2008, STEM subjects are guaranteed not to receive less funding than they did following RAE2001.45

4. The remainder of the response to this question will deal with further aspects of the allocation of public funding for university-based research (we deal with departmentally-funded research in response to later questions).

5. It is our understanding that the Director General for Science and Research (DGSR) in consultation with senior representatives from the government department responsible for science and innovation and, of course, the heads of the research councils, decides how the research-funding elements of the Science Budget will be “carved-up” between the various research councils. Each research council has to submit a draft delivery plan on its planned objectives over the spending review period (based on flat cash, and increased/decreased allocations) that drives funding allocations. In addition, an evaluation of how a research council performed against its delivery plan for the previous spending review is also taken into account.

6. The research councils will use the allocations they receive to fund their broad range of activities, which includes support for research grants, cross-council priority areas, studentships and fellowships, funds for international subscriptions, etc.

7. The RCUK Review of UK Physics46 which was, in essence, commissioned after CSR07 due to the financial situation that engulfed the STFC, investigated the issue of the allocation process, as did the House of Commons Innovation, Universities, Science and Skills (IUSS) Committee,47 and reported that the Haldane Principle was being upheld in terms of the allocation process. However, according to the IUSS Committee, the government had an influence on how the Science Budget was to be spent in CSR07, in terms of the research councils funding the full economic costs of research, the creation of new (knowledge transfer-led) bodies such as the TSB and the ETI, and the cross-council priority areas, which all led to a change in research council priorities, ie more emphasis on economic impact.

8. The Haldane Principle has recently come to the fore as a result of the STFC financial situation, where there were doubts as to whether decisions, such as those pertaining to the future of the Daresbury Laboratory, were made by research council officials based on independent scientific advice or were influenced by ministerial intervention.

9. The RCUK Review of UK Physics did raise the issue of confusion over whether the government has a regional development policy in terms of where large scientific facilities should be located which impinges on the Haldane Principle46. Thus, it recommended a restatement of the Haldane Principle for the modern era to take this into account; the recommendation was rejected by DIUS/RCUK.48 The Institute is of the view that the Haldane Principle should be restated along the lines recommended by the RCUK Review of UK Physics as there is a strong case for expanding it in light of the money and authority now held by the devolved governments and the Regional Development Agencies (RDAs). We believe that there is currently a question mark over the effectiveness of the Haldane Principle in insulating this funding from government directions coupled with concerns over the role of the RDAs in this issue. The IUSS Committee investigated the Haldane Principle in depth in a recent inquiry and has also recommended that a new framework to replace the Principle should be commissioned from the Council for Science and Technology (CST), whilst also reflecting the relationship between the government and both its funding agencies and the research community (the latter no doubt reflecting tensions between funding curiosity-driven research and the cross-council priority areas).49

10. In addition, in light of the difficulties faced by the STFC during the CSR07 allocation process, the RCUK Review of UK Physics recommended that the DGSR would benefit from the advice of an independent advisory group during future CSR allocation processes to ensure there are no unintended consequences of allocations and there is appropriate accountability to the scientific community.50 This recommendation arose as it was considered that the burden and pressure of making such difficult discussions regarding the allocations could be eased with input from the wider scientific community. This in the Institute’s view is unlikely to lead

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45 Funding for universities and college in 2009-10; http://www.hefce.ac.uk/news/hefce/2009/funding.htm
46 The RCUK Review of UK Physics; http://www.rcuk.ac.uk/review/physics/default.htm
47 Science Budget Allocations; http://www.publications.parliament.uk/pa/cm200708/cmselect/cmdius/215/21502.htm
48 RCUK response to the Review of UK Physics; http://www.rcuk.ac.uk/review/physics/default.htm
49 Putting Science and Engineering at the Heart of Government Policy; http://www.publications.parliament.uk/pa/cm200809/cmselect/cmdius/168/16802.htm
to major changes in the allocation of funds but will help improve the transparency of the arrangements, but we support the recommendation nonetheless which has been accepted and a number of national bodies, such as the Royal Society, have been selected for this purpose. However, the IUSS Committee stated\textsuperscript{50} that the learned societies, universities and individual academics are the guardians of the independence of science, hence room should be made available for appropriate representation from these bodies as well.

\textit{Are existing objectives and mechanisms for the allocation of public funds for research appropriate? If not, what changes are necessary?}

11. The existing objectives of the research councils, particularly EPSRC and STFC which are the two main funders of physics research, include funding world-class UK research through grants for basic and applied research undertaken either in university laboratories or via exploiting large national or international facilities. The Institute, overall, is of the view that the mechanisms used by both EPSRC and STFC are fine, even though we are concerned by the increasing shift towards targeted programmes (which is discussed later), but there are a number of issues as follows, some of which are long standing that need to be addressed.

12. A perennial issue for the UK’s research councils is that of low responsive mode success rates, which are currently too low and need to be raised somehow. The problem, especially for physics in terms of EPSRC, is perfectly stated by the 2005 International Review of Physics and Astronomy Research panel:\textsuperscript{51} “…there is some unease about the current system of ‘responsive mode’ funding within EPSRC, although the basic idea behind this funding scheme is widely supported. The problem is that when the perceived success rate, for proposals submitted through this channel is very low, the whole system can become unstable: referees are unwilling to make critical comments, proposers are unwilling to propose high-risk research, and as more proposals get rejected, even more are submitted. This situation poses a strain on the organisation of the research councils and it wastes the time of the proposers, referees and grant panel members. It is essential to consider new strategies that would enhance the success rate of excellent high-risk proposals…the research councils should aim to ensure that high-risk research in new topics or entirely new fields should have resources for appropriate funding.”

13. As a response to the pressures that low success rates place on the peer review system, EPSRC announced a policy to limit repeatedly unsuccessful grant applicants,\textsuperscript{52} which caused uproar amongst the physics and chemistry communities. The Institute recognises that EPSRC has a difficult situation to manage, as the continuing increase in the number of grant applications, combined with a real-term reduction in the volume of funding, is threatening to overwhelm the peer review system. Even though the Institute supports EPSRC’s underlying aim of safeguarding peer review, which has proved its value over many years as the most effective mechanism for evaluating research proposals, there is a need to monitor the impact of this policy, which will be implemented in April 2010, to ensure that academics who submit high-quality curiosity-driven research proposals are not disadvantaged in favour of those that submit risk-averse proposals.

14. In addition, there is a need to focus more on increasing the effectiveness of the translational research that brings scientific innovations to the market, building on the strength of the UK’s curiosity-driven research. There needs to be more strategic coordination between the targeted programmes currently operated by the research councils and an increased recognition of the importance of funding for translational R&D. There seems to be a real danger of a widening gap between the research councils and the TSB in this respect, which conflicts with the Sainsbury Review of Science and Innovation\textsuperscript{53} recommendation of closer collaboration: “…to help identify complex, high-value-added production technologies that current and emerging industries require and which are likely to flourish in high-cost economies.” This should also apply to the relevant streams of departmentally funded R&D where there is the additional complication of bringing R&D funding closer to the procurement requirements of the commissioning department. To aid this, more use should be made of the users of research in deciding on targeted programmes and additionally, programmes such as the Small Business Research Initiative (SBRI) should be expanded and rolled out across all government departments.

\textit{What governs the allocation of funding for Government policy-directed research through Government departmental and agency initiatives? Are existing mechanisms appropriate? What is the role of Departmental Chief Scientific Advisers?}

15. This is a difficult question to respond to as the processes on which evidence is being sought in this question are not transparent. Departmental R&D expenditure is not broken down sufficiently in published accounts, and indeed, the most recent data on headline public spend on R&D (2006–07 onwards) have been withheld for several months limiting opportunities for scrutiny.

\textsuperscript{50} Putting Science and Engineering at the Heart of Government Policy; http://www.publications.parliament.uk/pa/cm200809/cmselect/cmdius/168/16802.htm


\textsuperscript{52} Amendments to Policy for Repeatedly Unsuccessful Applicants; http://www.epsrc.ac.uk/Content/News/PolicyAmendRUA.htm

\textsuperscript{53} The Race to the Top: A Review of Governments Science and Innovation Policies; http://www.hm-treasury.gov.uk/sainsbury_index.htm
16. We understand that the government influences the selection of the cross-council priority areas such as those focusing on climate change, an ageing population, etc. It has been noted by the IUSS Committee\textsuperscript{54} that these targeted themes are very similar to a list of policy challenges prepared by the Treasury, and that there is an increasing shift towards research which has short-term economic or societal impact, at the expense of curiosity-driven research. This is evinced by the request for two-page impact plans for grant applications and, in EPSRC’s case, it was reported that it would reduce its responsive mode funding budget in order to support its targeted programmes.\textsuperscript{55}

17. The introduction of departmental Chief Scientific Advisers (CSAs) a few years ago was very welcome and has proved effective in some areas at bringing science to the forefront of policy development. The CSAs reflect the reach of science and keep it in the minds of all ministers and departments, rather than just one. It is evident that in some departments the CSA has direct involvement and influence in policy formulation and oversight of execution at board level; this is not yet the case for all departments. But whether the CSAs have any influence on government policy-directed research is something we cannot easily offer comment on. To this end, appointing all CSAs to their departmental boards would be a positive step, together with a commitment to wherever possible, publish formal advice provided by CSAs to enable their influence to be gauged, and to understand the impact that scientific advice has on policy formation.

18. It should be noted that in some departments the individual holding the title of CSA is a senior civil servant, rather than someone with a strong track record in scientific R&D that detracts from the notion that the CSA can offer expert and independent advice. Also, at this time, the Ministry of Justice does not have a CSA. In addition, and perhaps more crucially, the Treasury has yet to formally agree, even in principle, to appoint a CSA.

\textbf{How are science and technology research priorities co-ordinated across Government, and between Government and the relevant funding organisations? Who is responsible for ensuring that research gaps to meet policy needs are filled?}

19. Co-ordination across government departments is the remit of the Government Chief Scientific Advisor (GCSA), who chairs the Chief Scientific Advisers Committee, amongst others, and the team of departmental CSAs and their associated advisory boards, that have been put in place.

20. In terms of filling gaps, the GCSA heads a number of initiatives such as Foresight and the Horizon Scanning Centre, that aim to produce visions of the future, based on a robust scientific evidence base, for the purpose of influencing cross-departmental strategic policy decisions. Most of the topics covered by Foresight over the years have been focused on societal challenges such as flood and coastal defence, crime prevention, etc.

21. The CST could be regarded as an under-exploited resource. The membership and remit of the CST should mean that it is able to drive the agenda of science in government from the centre, providing independent advice and a “wide-angle lens” on policies that relate to science and technology. However, to date, its public profile is low and its impact appears to be limited.

22. In addition, the RCUK also has an important role to play in highlighting research gaps where the UK has an opportunity to be internationally competitive. From the Institute’s perspective, through its individual research councils, scientific and user communities can be consulted, who are often best placed to spot opportunities. However, curiosity-driven research is unlikely to influence government policy in the short term.

\textbf{Is the balance of Government funding for targeted versus response-mode research appropriate? What mechanisms are required to ensure that an appropriate and flexible balance is achieved? Should the funding of science and technology research be protected within the Research Councils or Government departments? How will the current economic climate change the way that funds are allocated in the future?}

23. While there is a role for both types of research in the UK, there has been greater emphasis towards targeted funding in recent years (and will continue to do so due to the current economic climate), and there appears to be a central lack of understanding that targeted research is dependent on curiosity-driven research having taken place. Indeed, as Lord Krebs stated to the IUSS Committee:\textsuperscript{56} “\textit{Applied research relies on the foundations that have been developed by basic research}”. The success rates in EPSRC responsive mode panels in both physics and chemistry have been quite low over the past year or so. This is a real threat to the platform of internationally excellent research that a decade of improved science funding has generated, and that the RAE2008 measured.

\textsuperscript{54} Science Budget Allocations; http://www.publications.parliament.uk/pa/cm200708/cmselect/cmdius/215/21502.htm

\textsuperscript{55} EPSRC cuts to blue-skies funding raise concern; http://www.timeshighereducation.co.uk/story.asp?storyCode=401172&sectioncode=26

\textsuperscript{56} Putting Science and Engineering at the Heart of Government Policy; http://www.publications.parliament.uk/pa/cm200809/cmselect/cmdius/168/16802.htm
24. In principle, the Institute is not opposed to targeted research initiatives that are closely linked to application, but it should not be at the expense of curiosity-driven research, as they are not the same things. On this note we wholeheartedly agree with the view of the IUSS Committee which stated that: “Curiosity-driven research is a key component of a successful knowledge-economy. We strongly endorse the view that increased focus in applied and industrial follow-through should not be at the expense of blue-skies research, which is one of the UK’s greatest strengths.”

25. The RCUK Review of UK Physics reported that: “…it is absolutely vital that fundamental, curiosity driven research continues to be conducted within all the sciences, engineering, mathematics and medicine. An important observation made within a variety of different evidence sessions was that there is a clear need to adequately fund core research within the [physics] discipline in order to maintain the capacity to innovate and propel future interdisciplinary activities. There is a substantial body of evidence that demonstrates that many technical aspects of the modern world have their origin in fundamental research conducted without any such applications in mind. Demanding and fundamental challenges can drive developments that then find application in a much wider (and sometimes radically different) context. The recent report by Lord Sainsbury illustrates this vividly and also points out the long timescale often associated with such developments.”

26. Therefore, the Institute proposes that in order to preserve funding for curiosity-driven research, targeted programmes of research (and their funding) should be removed from the remit of the research councils and placed within the “lead” government departments. For example, the Department for Transport could fund research into low-carbon cars, and the Department of Energy and Climate Change could take over the responsibility of the UK’s fusion programme. The departmental budgets would then have the critical mass to tackle the major societal challenges, together with the required focus and intent required to accomplish them, and the scientific funding that remains devolved to the research councils could be driven on a peer review basis towards the goal of international excellence.

27. In such an arrangement, research funding will still be accessible to academic research groups, but possibly from a departmental base rather than through the research councils. The new model may have further benefits for industrial collaborations as targeted programmes have tended to be at the more applied end of research and provide strong market opportunities. This approach is not inconsistent with the Haldane Principle, and would allow the government to make a clear commitment to curiosity-driven research that will form the basis of future discoveries and technologies, while at the same time tackling today’s major societal challenges through targeted research.

28. To facilitate this, the number of STEM qualified people in government departments needs to increase markedly along with the schemes required to achieve this, and government departments and university STEM departments will also need to develop closer links, for example, through fixed-term secondments of academics, who will not only help run the targeted programmes but also maintain strong links to the curiosity-driven research landscape.

29. Of course, with any new proposal there are bound to be several pros and cons that will need to be aired and analysed thoroughly to avoid any unintended consequences (such as too much money being transferred from the research councils to government departments), but we are of the view that this proposal is worth considering as an option to alleviate the current tension within the research base.

How is publicly-funded science and technology research aligned and co-ordinated with non-publicly funded research (for example, industrial and charitable research collaborations)? How can industry be encouraged to participate in research efforts seeking to answer societal needs?

30. Progress in research collaborations between the private and public sectors, and universities in particular, since the Lambert Review, has been extremely encouraging. However, despite this, it is evident that the greater part of publicly and non-publicly funded research is not aligned. The key question here is promoting and facilitating engagement between private sector and public sector/societal priorities. The work of the TSB in bringing industrial research funding into areas that have closer connection with the research base, through matched-funding agreements with the research councils, is still in its early stages. Stand-alone centres such as the ETI are also nascent, but have significant industrial buy-in even at these early stages. There remain major barriers to collaborative work between companies and universities, not least the cultural divide—the conflicting pressures on academic careers and business interests. There must also be mechanisms for users to access the research that has been completed—academic rewards and systems are necessarily directed towards

57 Putting Science and Engineering at the Heart of Government Policy; http://www.publications.parliament.uk/pa/cm200809/cmselect/cmduis/168/16802.htm
58 The RCUK Review of UK Physics; http://www.rcuk.ac.uk/review/physics/default.htm
59 Lambert Review of Business-University Collaboration; http://www.hm-treasury.gov.uk/lambert_review_business_university_collab.htm
pursuing novel research. To address societal needs, and particularly the major challenges that face the UK, there needs to be, and to some extent is, a realisation within government that the ring-fenced “Science Budget” is not of the correct order of magnitude to fund the necessary R&D.

31. There have been some recent steps to try to connect public spending on research and procurement strategies with the major societal challenges as a means to engage with industry. We are supportive of this and look forward to greater integration of procurement with both the extra-mural departmental R&D and the catalytic activities of the TSB. One of the hindrances to this is the management of risk, both the risk-averse culture within government departments and the broader civil service, and also the risks that must be undertaken by companies if they are to engage in the R&D needed to support these programmes.

32. One means of mitigating such risk is through the confidence gained from a coherent programme of R&D and procurement. In this way the government can act both as a funder of R&D and also as a “lead” consumer to benefit science-based companies of all sizes. We believe that this “demanding innovation” doctrine has a key role to play in stimulating and supporting R&D-intensive businesses as the UK comes out of recession. Innovative public procurement strategies, tied in with programmes of targeted research, could enable the government to achieve its stated policy objectives, address the major societal challenges and also allow UK science and technology to become world-leading in these areas.

33. However, alongside a commitment from industry, effective partnerships will require true cross-government support. It is essential that there is commitment from procurement leaders in all government departments, particularly the key purchasing departments such as the Ministry of Defence and the Department of Health. The Institute is of the view that to truly promote innovation and R&D in science-based small businesses, a change in culture is required within government, coupled with an understanding that while such strategies will involve increased risk-taking, the final products will often turn out to be superior and more cost-efficient in the long term than the results of “over-specified” directed procurement.

To what extent should publicly-funded science and technology research be focused on areas of potential economic importance? How should these areas be identified?

34. The prediction of the best prospects for future discovery and invention is notoriously difficult, hence it is essential for the UK to support a broad research base and not attempt to pick winners. It is not clear whether focusing on select, narrow areas will result in short-term economic gains, but it is obvious that in the medium-to long-term, it will undermine the UK’s ability to retain the highly trained, inventive and innovative scientists and engineers who will maintain and strengthen the UK’s international competitiveness.

35. However, to a certain extent, the cross-council priority areas are already focusing on areas of potential importance. It is our hope that government strategy effectively balances the need to plan for major societal challenges such as global warming, advancing healthcare, etc., with support for curiosity-driven research, technological discoveries from which will help facilitate the development and implementation of policies that will help plan for and combat the issues that will either threaten our existence or advance our lives.

36. As stated earlier, we understand that the government influences the selection of these priority areas, which is fine as it should play a key role in the over-arching strategy of the UK’s public investment in research. However, the research councils deny this involvement and claim that the areas have been chosen through consultation with their research and user communities. There needs to be a greater level of transparency as to how the areas are shortlisted and selected.

How does the UK’s science and technology research funding strategy and spend compare with that in other countries and what lessons can be learned? In this regard, how does England compare with the devolved administrations?

37. Without the detail of how the UK’s research funding strategy actually compares with each individual international competitor nation, it is rather difficult to respond to this question. However, the UK strategy is punching above its weight as evidenced by the PSA target metrics for the UK research base that show that in many scientific sub-disciplines, the UK is either internationally leading or internationally competitive. Indeed, the international reviews of physics and astronomy research undertaken in both 2000 and 2005 stated that overall, at its best, research in physics and astronomy in the UK is at the very highest level worldwide, but maintenance and growth on this level is predicated on increased levels of research funding.

61 Demanding Innovation: Lead markets, public procurement and innovation; http://www.nesta.org.uk/demanding-innovation
38. In terms of the amount of gross domestic expenditure on R&D (GERD), according to the OECD, the UK spent 1.8 per cent of its GDP on R&D in 2005. While this is still somewhat more than both China and India it is still less than what the UK’s leading competitor nations spend, such as the USA, France and Germany. While this overall figure is strongly dependent on the chosen metrics, the critical point to note is that the proportion of this R&D financed by industry, as opposed to the government, is almost double in the USA, Germany and China than in the UK.

39. To address this point, the broader environment should be considered. For example, it is currently the case that Germany is viewed by some companies as a better place for R&D than the UK. It is imperative that work is ongoing to understand why this is and how it can be countered. Businesses in different sectors and at different stages of development will have differing requirements of their local environments, ranging from a strong supply of skilled workers to levels of corporation tax. It is important for the UK to remain aware of the systems in other countries.

40. One aspect of the UK system which has shown some early success is the R&D tax credits scheme, which was introduced in 2002 with the aims of stimulating domestic R&D and promoting inward R&D investment from overseas-based companies. While it could be argued that neither of these headline indicators has improved substantially since the introduction of the scheme, it should be remembered that the process may take several more years to properly “bed down” and that there are some signs of positive effects. A recent CBI survey has suggested that R&D tax credits have influenced an increasing number of companies to either continue with or undertake additional R&D. Internationally, the scheme has had the effect of balancing similar schemes operated by other European countries such as France, and has pre-empted the possible introduction of a German scheme and is also a key part of the “package” when promoting the UK as a place of inward investment in R&D. The international comparisons should continue to be monitored and the R&D tax credits scheme kept under review to ensure it remains internationally attractive to companies.

September 2009

Memorandum by the James Lind Alliance

This evidence addresses the following questions:

— How are public funds for science and technology research allocated? Who is involved at each level and what principles apply?
— Are existing objectives and mechanisms for the allocation of public funds for research appropriate? If not what changes are necessary?

ABOUT THE JAMES LIND ALLIANCE

Research on the effects of medical treatments often overlooks the shared interests of patients and clinicians. Questions important to both these groups may not be identified by others who influence the research agenda, such as industry or academia, and vital research areas may therefore be neglected.

The James Lind Alliance (JLA) was established in 2004 to bring patients and clinicians together to identify and prioritise the unanswered questions about treatments they agree are most important. The JLA (www.lindalliance.org) aims to raise awareness among those who fund health research about what matters to both patients and clinicians so that clinical research is relevant and beneficial to end users.

The Alliance has several hundred affiliates—organisations and individuals that identify strongly with the objectives of the JLA, and wish to be involved in it and to support it. The JLA is funded by the National Institute of Health Research (NIHR) and the Medical Research Council and has input from most of the key health research groups in the UK, for example the, NIHR Evaluation Trials Coordinating Centre, and the Cochrane Collaboration.

As well as practical experience of developing priorities in treatment uncertainties in different clinical areas, the Alliance has also commissioned research that has revealed the lack of systematic priority setting in public and voluntary health research funding and commissioning, and the disconnect between priorities identified and funding awarded.

64 Business Innovation Investment in the UK; http://www.dius.gov.uk/reports_and_publications/?2OHIDDEN/~/media/publications/BusinessInnovationUK
65 R&D tax credits; http://www.hmrc.gov.uk/randd
The first study provided the JLA with a “snap shot” of priority setting activity, and the key findings are outlined below.

The JLA commissioned this scoping study to find out whether and how clinical research organisations currently set research priorities and whether and how patients and the public are involved in this work. The exercise involved a review of the websites of 104 UK clinical research organisations, and further analysis of 55 of those, of which 52 fund research. Of these, 49 were voluntary sector organisations or medical charities and three were government funding bodies. 22 of the UK clinical research funding organisations that identify research priorities or commission research were interviewed.

**Key Findings**

**Identifying priorities for research**

— The majority of research funding bodies operate in responsive mode, relying on researchers to submit ideas for research rather than identifying priorities.

— Fewer than half the organisations surveyed state priorities for research. They are reluctant to place restrictions on researchers by asking them to address priority topics.

— The organisations which do identify research priorities do so for a range of reasons, in a number of different ways, including surveying patient members or researchers or simply relying on informal communication with them.

**Involving patients and the public**

— Few organisations identify the research priorities of clinicians and patients. Only a small proportion is aiming to address the priorities of both groups.

— There is a tendency to consult the research community as part of developing a research strategy, rather than consulting clinicians and patients.

— The type of patient and public involvement in decision-making processes varies between the organisations surveyed. Where they are involved, they are more likely to be asked to review research proposals than to identify priorities for research which is important to them.

— There is a growing trend towards patient and public involvement among patient organisations that fund research, but the impact of this on funding decisions is not currently measured.

**Challenges to identifying research priorities**

— There is no agreed best practice or consistent approach for identifying priorities.

— Some organisations have faced resistance from researchers both to developing a research strategy, and to identifying research priorities, due to concerns about the usefulness of the research and potential funding cuts.

— Where organisations have involved patients in the prioritisation process, they have found it difficult to interpret and summarise views accurately and to manage expectations of how quickly priorities can be addressed, if at all.

**The current influence of research priorities**

— Only a small number of organisations that identify priorities actually commission research to address them.

— A minority of organisations interviewed allocate funding solely to applications that address one of their identified research priorities.

— Most organisations do not take a systematic approach to addressing identified priorities and very few ring-fence budgets to fund prioritised research.

— Funding decisions are largely based on judgements about scientific merit, rather than on the relevance and importance of outcomes to end-users.
THE FULL REPORT OF THIS WORK IS AVAILABLE AT:
http://www.lindalliance.org/Scoping_research_priority_setting_PPI.asp

Related research done by the Social Science Research Unit at the Institute of Education looked at priority setting from a different perspective. After a thorough search of the literature a preliminary list of 640 potentially relevant studies two researchers independently reduced the list to 258 studies with abstracts suggesting that clinicians and patients might contribute to research priorities, namely:

- Directly, through patients’ and clinicians’ consideration of research, through active collaboration in setting research priorities and consultations seeking their views about research priorities;

- Indirectly, through patients’ and clinicians’ consideration of health and services, through active collaboration and consultations, following which researchers interpreted the implications for research priorities.

Clinicians are more involved than patients in the whole process of priority setting, with patients less likely to be consulted about their research priorities than clinicians (18.2 per cent of studies elicited patients’ views, 88.5 per cent among which included clinicians’ views as well) and patients were less likely to be involved in writing reports of these activities than clinicians. Clinicians and patients are also more likely to work separately on identifying research topics, than collaboratively. 77.0 per cent of studies included people of a single type (nurses, doctors, patients etc) and 18.9 per cent included people working together in mixed groups. This makes the JLA process of Priority Setting Partnerships highly distinctive.

**KEY FINDINGS**

Despite policy support for patient and public involvement within health research, such involvement rarely extends to influencing clinical research agendas. Furthermore, clinicians and patients seldom work together to identify and prioritise research. There is a need for careful consideration of these findings by those involved in funding, commissioning and undertaking research. Further investigation of the nature and outcomes of patient/public and clinician involvement in setting research agendas would inform these discussions.

The full report of this work is available on:
http://www.lindalliance.org/Map_studies_patients_clinicians_research_priorities.asp

Finally the JLA has practical and pragmatic evidence in its own programme of Priority Setting Partnerships. Each Priority Setting Partnership (PSP) will have contributed to the NHS Evidence UK DUETs (Database of Uncertainties about the Effects of Treatments) collection of treatment uncertainties www.library.nhs.uk/duets. To achieve this, partner organisations have to have canvassed their membership for uncertainties, or unanswered questions, about the effects of treatments. Methods to gather questions may have included questionnaires, focus groups and internet message boards.

They will also have appraised documents/policies/guidelines that identify unanswered questions about treatments, such as BMJ Clinical Evidence, Clinical Practice Guidance, Cochrane Reviews, NICE Guidance Research Recommendations and registers of ongoing research, such as those identified through the UK Clinical Trials Gateway. Partner organisations may also have existing research strategies/priorities that should be considered. Some partners may have extended this consultation exercise to patients/health professionals who are not necessarily members of the partnership organisations, but have valuable perspectives to offer.

In the JLA’s experience, this process can yield between 200 and 1,100 potential treatment uncertainties. Further refinement and checking ensures that uncertainties that are entered into UK DUETs are genuine and accurate. The refinement process will record the provenance of each uncertainty, where they are duplicated, where themes of uncertainties exist, and where there are shared uncertainties (i.e. the same uncertainty has been submitted by different groups). The JLA has trialed and reported on methods for interim and final priority setting that are robust, inclusive and transparent. The JLA believes that these should be the core principles and values that underpin the allocation of public funds for science and technology.

The partnership between the British Thoracic Society and Asthma UK was the first formal Priority Setting Partnership (PSP) to complete the JLA process in 2007. The Urinary Incontinence PSP followed in 2008, and Vitiligo and Prostate Cancer PSPs will complete in 2010. Eczema will follow in 2011, and it is likely that there will be PSPs in type 1 diabetes, schizophrenia, wound management and stroke.
**Summary of Key Messages from the James Lind Alliance**

*How are public funds for science and technology research allocated? Who is involved at each level and what principles apply?*

The JLA research suggests that systematic processes for transparent, equitable and robust priority setting are not in place. Indeed peer review is the only consistent process for judging the merit of funding applications—and whilst this has its merits, assessing scientific quality does not necessarily address or assess the health and economic benefit of research for patients, or place it in contexts from which its importance can be measured from a variety of perspectives.

*Are existing objectives and mechanisms for the allocation of public funds for research appropriate? If not what changes are necessary?*

The process needs to take account of multiple perspectives, especially from those that either live with or treat health conditions. There are pockets of existing good practice for priority setting, and more can be learned from these. There is also a growing community of interest from researchers, patient groups and clinicians who see that models for priority setting could democratise the research agenda in a systematic and thoughtful way.

The JLA has worked hard to pilot and provide working models for priority setting in health research, and sees its role in the next three years to mainstream this activity and explore areas beyond treatment uncertainties, such as research on diagnosis and prognosis, and early stage trials.

Thank you for the opportunity to present our views and experience.

*September 2009*

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**Memorandum by the John Innes Centre**

The John Innes Centre is currently celebrating its centenary and has a proud tradition not only of research but also of training science’s next generation, starting with William Bateson FRS, the founding Director of the John Innes Horticultural Institution, who pioneered the science of genetics in Britain and coined the word “genetics”. The John Innes Centre is an institute of the Biotechnology & Biological Sciences Research Council. Website [www.jic.ac.uk](http://www.jic.ac.uk)

Response submitted by Catherine Reynolds, Head of JIC Communications [jic.communications@bbsrc.ac.uk](mailto:jic.communications@bbsrc.ac.uk) on behalf of the senior scientific staff at the Centre.

*What is the overall objective of publicly-funded science and technology research?*

The overall objective of publicly-funded science and technology research has to be to generate knowledge for the benefit not only of society but also of the individual.

Scientists are driven by a mixture of curiosity and the desire to do something of value for society, and a thriving curiosity element is essential for an independent, motivated and healthy science base that will attract new researchers.

Fundamental research is the bedrock from which innovation will arise and future problems will be solved. The payback time on fundamental research is often long, but patience can ultimately be very profitable. There are many examples of curiosity-driven science that have led to unexpected outcomes with real application through innovation and enterprise.

The “trick” is to recognise the potential for application and foster that and to provide cultural frameworks that foster and reward such endeavour amongst scientists. Examples at the JIC would include the discovery of novel antimicrobial therapies (eg control of gene action and synthesis of novel antibiotics—both now in spin out companies—through fundamental study of *Streptomyces*) and recognition that the genetic control of dwarfing in *Arabidopsis* is part of a fundamental mechanism to control plant growth overall, with direct parallels into crop species. Other fundamental discoveries have led to the development of new applications that we take for granted in everyday life from electronics to optics, new materials and DNA fingerprinting. Or they may increase our understanding of the world around us, and enable ways to protect the environment for the benefit of all.

Publicly-funded research must now, in the light of economic uncertainty, also be considered as a tool for maintaining the standard of life we have come to take for granted in the developed world while still seeking to enhance the standard of life for the developing world. Whilst economics has a role to play, it is important that it does not drive the research agenda.
The answer is not to push all of the public research budget into short-term, applied programmes designed by policy-makers, but rather to encourage and empower scientists to recognise and take on these problems themselves, working together with the policy-makers. One of the UK’s strengths has been in bright, inventive and often “quirky”, individuals who are less likely to conform, or desire, to be part of syndicates; it would be a pity if this pool of talent was lost.

_How are public funds allocated? Who is involved at each level of the decision making process? Where appropriate, is the Haldane Principle applied?_

The Haldane Principle is an essential underpinning element in the history of the John Innes Centre. Funding decisions are largely made on the basis of peer-review by expert national and international researchers who are members of the relevant committees. Other criteria can be included in the assessment process, eg strategic relevance, implications for quality of life, etc, but whether it is basic or applied, research must aim for scientific excellence and the lead people who should judge applications against that criterion are other scientists.

Research Council funding is vital for JIC, both in its Strategic Programme Grants and Responsive Mode funding. Funding from Government Departments and Agencies, especially DEFRA and FSA, is also important.

_How are science and technology research priorities co-ordinated across Government?_

JIC feels that further gains for science are possible through Government Departments with R & D portfolios, agencies and Research Councils working more closely together. A recent example is BBSRC and DFID with the Sustainable Agriculture Research for International Development [SARID] initiative. DFID have also put together a DFID/NERC joint initiative based on common priorities. But these are only small initiatives and there is a need for more extensive discussions between the different Departments.

It is difficult to predict what will be “useful” in the future and the UK needs to avoid being too “top down” and sucked into “fashionable” new areas at the cost of existing, excellent fundamental science.

There are also risks in top-down initiatives through which relatively large sums of money are made available in a short space of time to address particular problems. These initiatives do not necessarily attract the best research, and tie up large amounts of funding and the pool of young researchers. Their benefits are not always apparent after the event. Arguably such programmes are motivated by a desire to demonstrate compliance with policy objectives rather than being the best way to tackle the problem in hand.

_Is the balance of Government funding between targeted and curiosity-driven, response-mode research appropriate? How will the current economic climate change the way funds are allocated in the future?_

Even in the present economic climate, fundamental research must NOT be seen as a luxury. From the viewpoint of seeking public benefits from science, applied research is most dynamic—and therefore more effective in fulfilling strategic objectives—when it is closely linked to strong programmes of fundamental research. The John Innes Centre is an excellent example of this balanced approach.

Research Council grant-making committees must continue to place strong weight on scientific excellence; strategic relevance, timeliness and promise and training potential are also key issues. In judging either basic or more applied science we need to ask whether it will have wider impact beyond the immediate research community involved.

Whitehall Departments have supported a considerable amount of research with clearly foreseeable applications, usually through funding ear-marked for specific projects, or at least for specific research topics. This is generally less attractive to researchers than response-mode funding from Research Councils because the direction of research is driven top-down rather than bottom up, and there is considerably less opportunity for creativity and initiative.

Since science is essentially a creative activity, it works most effectively when the initiative is taken by the scientists themselves. The best way to achieve the balance is to encourage and empower individual researchers to create balance within their own research funding portfolio. This requires:

- Transparent policies in the Research Councils about funding a mixture of fundamental and strategic research within their “responsive” portfolios.
- Clear lines of communication between stakeholders, policy-makers and researcher about problems and policies to which the science base needs to contribute, so all publicly-funded researchers are fully aware of these requirements.
Setting Research and Funding Priorities: Evidence

- Clear mechanisms by which the outputs of more basic research can be taken forward to the point at which it can be exploited for wealth-creation and/or public-good purposes. These mechanisms need to be readily accessible to individual researchers, and to be joined up—there is a plethora of current schemes for exploiting the outcomes of more basic research but these can be confusing, are not obviously joined up, and are often too far towards application to attract more fundamental researchers.

- Appropriate recognition and reward for the application of science to applied problems.

How is publicly-funded research aligned and co-ordinated with research that is not publicly funded? How can industry be encouraged to participate in research seeking to answer societal needs?

Post-graduate CASE awards can provide training for PhD students at the interface between fundamental research and industry-targeted research. Getting the balance right between the two is critical for success.

BBSRC’s Industrial Partnership Awards provide a route for bottom-up proposals for strategic research. The requirement that industry provides 10 per cent of the Full Economic Cost of the project in cash, not in the form of work in kind, can be a barrier to small companies taking part in this scheme.

Several new R&D clubs are being established. Where these originate from a genuine desire to address particular areas of relevance they achieve success. Identifying areas of pre-competitive research where new intellectual property could be made available and benefit all club members is a key requirement, and requires in-depth knowledge of the subject area. If clubs are managed at a distance from the concerns in question, they will not succeed. Industry wants to make sure it gets value for money from the investment of being a club member.

LINK programmes are effective in linking academic researchers with industry. They address problems which are important to UK industry but are not sufficiently near-market to be funded by industry alone. They therefore meet most of the Government’s objectives for strategic research and should continue much as at present. To ensure quality of science, they should continue to be managed by scientists, using peer-review as a large component of the process of awarding grants, while taking account of anticipated practical benefits.

A disincentive to industrial participation in LINK is the criterion that at least 50 per cent of support for the project must come from industry. Relaxing this criterion could encourage greater participation by industry in research which is still a considerable way from application. By reducing the proportion of industrial funding required in the LINK system one might also enhance the “draw-through” of more basic research into the process. Perhaps this could be done by adjusting the balance between scientific merit and strategic relevance in the assessment process in line with the proportion of support from industry?

More consideration needs to be given to the kind of industry and the role of R&D in the generation of new products. For example, it is unreasonable to use the same mechanisms for pharmaceutical and the plant breeding industries, where the size of the relevant industrial sector is relatively small (for example in cereal plant breeding) and it is too easy to reach a situation where the sector is LINK-saturated and cannot participate in additional projects until at least one of their current commitments has finished.

Funding of research focussed on public benefits should be modelled on the successful funding of fundamental research in the UK. This means it should favour bottom-up proposals from researchers, industry and other agencies (such as agencies concerned with the general environment), rather than top-down prescription by Government. The process of allocating research funding should encourage innovation, creativity, flexibility and excellence and should not require researchers to conform to preconceived ideas of what research ought to be done.

Strategic research should not always have to involve industry, because in many cases research does not immediately benefit them. For example, research on plant resistance to insect pests may compete with the interest of the pesticide industry in selling pesticides and hence may be less likely to be industrially-supported; however this research is likely to improve the environment and is therefore beneficial to society. Government has a responsibility to solve current issues directly relevant to society without demanding immediate economic benefits.

There could also be a system in place to link research to problems that are not directed related to industry. Is it possible to have a LINK programme with agencies concerned with environmental problems, conservation issues, world food problems etc?
Movement between academia and industry should be further encouraged/resourced and regarded as the “norm” rather than as an exception. All academic institutions should have innovation capabilities, particularly individuals who “seek out” academics and discuss and take forward potential new innovations. There need to be robust, hard-wired mechanisms for collaboration between industry and academia. In particular, IP arrangements need to be clear and attractive to industry.

To what extent should publicly-funded science and technology research be focused on areas of economic importance? How should these areas be identified?

Economic importance is not the only criterion for public benefit. Research can produce results which improve the quality of life more generally. The role of DEFRA merits mention here. Their emphasis is on agricultural sustainability with minimal environmental impact highlighting an areas where an entirely “economic focus” would be simplistic. There are many applied problems where solutions will directly benefit society, but may also have indirect economic benefit.

Co-funding should be considered, by the Research Councils and Government Departments, of projects which are relevant to the environment, but are not aimed at solving a particular current policy problem or an immediate economic issue.

How does the UK science and technology research funding strategy compare with that of other countries? How does England compare with the devolved administrations?

In most respects, the process of funding S&T in the UK compares favourably with most other countries. Mechanisms of funding basic science emphasise quality and creativity; they offer plenty of opportunity for new researchers to propose and develop their own ideas and they require established scientists to keep being competitive in order to sustain their research programmes. Few other countries in Europe are as successful in supporting basic research, and the bottom-up approach to proposing research projects in the UK is an important contributor to that success. By comparison, in some European countries the research directions are more often than not determined by administrators and industry and not by the scientists themselves. The UK probably needs to be more involved in setting the agenda in EU science, and in helping UK academics to get their science onto the EU agenda.

In order to maximise value from research spend, the UK needs to establish robust international (especially non-EU) funding schemes (eg with USA, China) that provide financial support to underpin and nourish “natural” collaborations. There are a number of sources of funding for initial interactions/meetings, but little means of subsequent funding, which is quite frustrating.

The UK has adopted a relatively “flat” structure in which younger scientists can lead their own research groups independently from more senior scientists. That is not to say that there isn’t enormous competition for fellowships and tenure track positions for these creative and talented postdoctoral researchers.

BBSRC institutes such as the John Innes Centre are core-funded via Strategic Programme Grants, meaning that researchers can be pro-active and innovative in both fundamental and strategic research. We need to maintain the balance between cutting-edge fundamental science and work with strategic relevance, including that which is excellent in terms of the scientific method; excellent basic science drives innovation and excellence in strategic and applied science.

Comparing England with the devolved administrations, in the area of agricultural research, support in Scotland is provided in the form of Work Packages containing negotiated, defined programmes of research. This system in our view gives researchers much less flexibility and opportunity for innovation than those in England, funded via Strategic Programme Grants. Research becomes restricted by grant applications written several years previously rather than encouraging the scientist to address new opportunities or solve emerging problems.

Conclusion

Overall, getting the balance right is more important than ever before. The problems we face are larger and more immediate than in the past: fast-rising temperature, unpredictable climate change, the end of oil, and all of the downstream consequences of these issues for agriculture and industry in the UK and worldwide, and for social and political stability.

September 2009
Memorandum by Professor Michael J Kelly

1. I make this submission on a personal basis, having a background of service in academia, private industry and a government department. I am Prince Philip Professor of Technology in the University of Cambridge, having previously been Head of the School of Electronics, Computing and Mathematics at the University of Surrey. During 1981–92 I was a member of the research staff at the GEC Hirst Research Laboratory, where my team invented and developed one, and also developed a second, family of new generation microwave devices, still in production with e2V Technologies in Lincoln, forming, among other things, the basis of automobile radar. During 2003–05 inclusive, I was Cambridge Director of the £60 million Cambridge-MIT Institute (CMI), to which I refer below. Between July 2006 and June 2009, I was (part-time) Chief Scientific Adviser to the Department for Communities and Local Government, with a particular interest in how the built environment will come to meet the 2050 climate change targets. Since July 2006, I have been a Non-executive Director of Laird plc, a UK-based international electronics company. I am a Fellow of the Institute of Physics, and of the Institution of Engineering and Technology. I have been elected a Fellow of both the Royal Society and the Royal Academy of Engineering, and have been awarded prizes from both. I am also an elected member of the Academia Europaea. I have been a Principal Investigator or co-PI on over £15 million of public funded R&D, excluding CMI.

2. Statistics:
The facts on which I base my comments below are taken from the Office of National Statistic report “UK gross domestic expenditure on research and development, 2007” issued in March 2009. [http://www.statistics.gov.uk/pdfdir/gerd0309.pdf]

In 2007, the UK’s gross domestic expenditure on research and development (R&D) was £25.4 billion. This represented an increase, in cash terms, of 9 per cent from the level recorded in 2006. In real terms, gross domestic expenditure on R&D increased by 5 per cent between 2006 and 2007.

In 2007, expenditure on R&D was 1.79 per cent of gross domestic product, an increase on the previous year.

In 2007, government (including Higher Education Funding Councils and Research Councils) funded 30 per cent of all R&D performed in the UK, down one percentage point on 2006. It also funded 29 per cent of civil R&D and 43 per cent of defence R&D. Businesses funded 47 per cent of all R&D, up 1 per cent on the previous year.

The sectors of the economy carrying out R&D in 2007 in cash terms were:

- Business Enterprise: £16.1 billion, up 11 per cent on 2006.
- Higher Education: £6.5 billion, up 8 per cent on 2006.
- Government: £1.2 billion, down 5 per cent on 2006.
- Research Councils: £1.1 billion, down 1 per cent on 2006.
- Private Non-Profit (PNP): £0.6 billion, up 9 per cent on 2006.

Another useful document is cordis.europa.eu/erawatch/index.cfm?FuseAction=home.downloadFile&fileID=944

3. Q1: Overall Objective of Publicly-Funded Science and Technology Research

The taxpayers agree to spend some of their money on R&D with the aim of having the UK as good as possible a place to live and work in 20 years from now. This includes a minority element that would be classified as “cultural”, as in the support of particle physics or cosmology. Here we are satisfying our deep curiosity, and if there is any other return on investment (such as the internet or grid computing) it is a welcome bonus, but not an explicit precondition of the original investment. We are less than a fully civilized society without these efforts, just as we would be without some public support of the art. However the majority of the funding is expected to make an identifiable return to the UK in terms of the future health of one or more of the economy, citizenry, environment and defence of the realm.

4. Q1 ctd

The Cambridge-MIT Institute (2000–06) had £65 million (then $100 million) of public money supplemented by about £20 million private support. Its aim was to undertake bold experiments at the academic-industrial interface to improve the UK’s economy in terms of competitiveness, productivity, and entrepreneurship, a
subset of the reasons just given for public funding of research. The opportunity for CMI was well summarised by the US Council on Competitiveness in 1999 when it stated that:

“The nation that fosters an infrastructure of linkages among and between firms, universities and governments gains competitive advantage through quicker information diffusion and product development”. The final report of CMI contains a number of lessons learned that are of relevance to the organizing of research so as to get maximum pull-through of results for the societal benefits. In particular, delivering the deliverables became an essential part of the research agenda.


One cannot afford to concentrate solely on the setting of priorities, but at the same time neglect the way in which research is actually pulled through to end use.

5. Q2a: How are the public funds allocated?

Of the £7.5 billion public spend on R&D in 2007, about 50 per cent of that went to the Research Councils (£2.8 billion), and to the Funding Councils (~ £1 billion). The latter is spent in universities (QR) to ensure that research infrastructure is in place, as seed corn for new developments or for strategic research purposes. Over 90 per cent of the RC budget is spent in response to investigator-led proposals that range from being “blue sky” to applied research, the latter usually with strong industrial support. There is a small amount of HMG-mandated work done by NERC. Although there are top-level committees giving advice on technical opportunities and user demands which frame the calls and shape the budgets, this advice plays no role at the point at which funding decisions are made on actual projects. The vast majority of the referees whose opinions are sought on proposals received, and whose opinions are decisive in the funding decisions, are academics, who show a greater or lesser understanding of real industrial needs, and of national priorities. Members (who may in some cases be industrialists) of the panel that prioritise the proposals in terms of quality for EPSRC funding are required solely to adjudicate between the proposer, the comments of the referees and the reply of the proposer to the referees. They are not to add their own insight, even if they know that the proposer and/or referees are naïve. In fact the refereeing process is one of the weak points—in papers for a recent panel prioritizing 72 grants in the area of information and communications technologies, the return rate from 432 requests to referee was 60 per cent of useful reports, with 10 per cent replying that the proposal they were asked to review was outside their competence, 15 per cent saying they were too busy to help, 3 per cent citing conflict of interest, 10 per cent not replying and the remaining 2 per cent giving some other reason. Note that only 3 per cent of the referees approached had a company affiliation as their address, and 2 per cent of the usable reports came from them. Two out of the 13 members of the relevant prioritization panel were from industry. This does not represent a serious opportunity to input from industry about current trends, whether some proposed research is going more or less against the grain of current international industry trends, or even proprietary knowledge that others are far in advance or have encountered a basic flaw in the practical implementation of what is proposed! There remain strong tensions within the Research Councils that this money is for academics, and that academics should decide. There is an assumption that academics are well versed in the strategic national needs, which I don’t think is true enough. Indeed what is the mechanism by which an engineering lecturer at the University of X is supposed to have insight into the strategic needs of the MoD? As a concrete example, whereas I think that “manufacturability” is a perfectly good topic to study in university sector (ie make 100 of a newly invented widget and see what is the yield and reproducibility of the widget as a function of the ways of making it) most of many academic colleagues disagree, saying that is for industry. My own experience from industry is that it wants some modest indication of manufacturing viability before investing and tooling, which in the national scheme of things is more quickly and more cheaply done in a university: this does not accord with many of my academic colleagues and I and industry both lose out. Given further than much of what is researched today in the hope of better devices tomorrow seems to be in samples fabricated by methods that are intrinsically unsuited for high-volume low-cost production, I think the nation loses also.

6. Q2a (cont.)

A few Government Departments spend heavily on R&D eg MoD, DH, and BIS, accounting for the other 50 per cent of public funding. This money is sometimes handled by arms-length bodies, such as the Technology Strategy Board, the Carbon Trust, the Energy Technologies Institute, etc. Other departments spend very little, and what they spend is often with consultants, doing not research but scholarship—sifting through what is already known and synthesizing a tailored and up-to-date response to a particular set of questions. The maintenance of longitudinal surveys, such as the House Condition Survey, is book-kept as research. These latter departments sometimes collaborate with and support relevant academic work. I was involved in efforts
7. **Q2b: Who is involved at each level and what principles apply?**

This will be better answered by those directly involved now. For the Research Council budget, the Director General for Research in BIS (ex-DIUS) is important in setting the total research budget and committees including civil servants, academics and industry representatives advise of the splitting of the budget down into areas of individual disciplines or inter-disciplines. With the exception of some in-house research at the RCs’ own institutes mandated by HMG, all research projects are proposed and led by academic investigators. The level of research budgets in Departments is on a widely varying scale which seems historical, and I do not know when there was last a root-and-branch look that resulted in any significant research budgets changes and/or moves between departments. Figures indicate a decline in the total spend by Government Departments. What bedevils the Departmental moneys is the role of the Permanent Secretaries as accounting officers for their own department—there is little cross-departmental give and take, even on an item as small as research. In the last CSR, the CSAs in several departments did write to Treasury to ask that all counter-terrorism research money be given to, and be managed from out of, the Home Office in the interest of coherence. By contrast the measures required to meet the climate change targets, to improve energy efficiency (the Cinderella activity in the grand energy scheme of things) and to achieve a sustainable economy are emerging from DECC, BIS, CLG and DEFRA with less that optimal coherence. This applies at the policy and the research level. The CSAs are trying to do their bit for coherence, but it is the policy makers who need to up their game. I would argue now that there is enough climate data in that the emphasis should shift from yet more analysis to clear actions in mitigation and adaptation. Since nearly half the energy consumption is in buildings, and over a quarter in homes, CLG (with its responsibility for building regulations and planning) should have a major role to play—but it is almost absent at the R&D level.

8. **Q2c: Where appropriate is the Haldane Principle being upheld?**

If the Haldane principle is that scientists know best what to fund, it may be true as to what is the best science in front of a panel prioritizing proposals. What is far from clear is the extent to which strategic national needs play a role in encouraging or discouraging particular types of proposal coming forward. It certainly is not an explicit issue addressed by the proposers or the referees to date—it may become so as a byproduct of the impact predictions that are now being sought. I give a striking example of the misuse of scientific excellence as a criterion for funding from an experience in New Zealand some years ago. There, a Treasury concern that the Crown Research Institutes (sector divisions of the former DSIR) were not subject to enough competition for their funds was met with a response from the R&D ministry that the universities and the CRIs would bid into the same pot, with scientific stretch being the primary criterion of excellence. The universities won hands down: academics bid for advanced funding for third-generation chromophores to assist the future display industry—it was a low-risk strategy as they would hire students only if they their bids were funded. A CRI team with 30 man-years experience of computer vision systems that had given major new tools to the flax milling and meat processing industries, proposed to repeat the exercise for the NZ shellfish industry, where there was a shortage of labour to open the shells—a camera system could help orient oysters in a chuck and guide a knife faster than any human. Because the proposal did not represent science stretch, the team was given transition money to disband and do something else! This was a Treasury inspired own goal, not argued down by the relevant R&D ministry. As a member of an international review committee of the relevant CRI just after this event, I had the opportunity to protest, and I am pleased to see that computer vision remains a core competence.

9. **Q3: Are existing objectives and mechanisms for the allocation of research appropriate? If not, what changes are necessary?**

I wrote last year in Research Fortnight that the UK needed to move in the direction of an explicit Mission Agency system. I attribute much of the vitality of the US system to the role of the Mission Agencies, open to industry and academia, acting as independent sources of funds to the NSF. Note that a year ago the NSF and RCUK budget, both for academic-investigator led proposals, were both about $6 billion in spite of the relative size of the countries! The research money from Agencies is put out for investigators (in universities or big or small companies) to do R&D that provides an artifact that meets certain stretching operational targets or
perceived future requirements: there is an explicit element of demand-pull to complement the S&T budget of the NSF. The sponsor of that research within the agency has already established the need for the artifact and generally has an end-user lined up even before the call for the R&D is issued. The funds go to those that seem likely to succeed most effectively. Quite basic research can be supported: quantum computing has been funded by DARPA to ensure early warning of breakthroughs that might in future compromise security systems in the field. I think the UK would benefit greatly from the spirit of that system, but I do stress that any transition arrangements will be very difficult to manage, as we do not have in the UK a cadre of people skilled to fulfil the role of agency workers, in negotiating with end users what they will need in the mid-term future. [I tried, without success, to get Local Authority officials to articulate what they would like from £100 million pa of research in UK universities over the next five years. The process requires sustained interactions between research providers and local authority experts, a lesson from CMI.] Whereas agency staffers would worry for their jobs if the pull-through of their portfolio was not as it should be, no-one at the Research Councils would be in the same position if a major piece of research was not progressing, whether for noble or lesser reasons.

10. Q3. Cont:

In the area of technology research, there is a potential flaw in the Research Council model. If we consider the development of blue or ultra-violet solid-state lasers, we have a good tradition of semiconductor materials science in the UK, and of optical and other characterization techniques, but recently we have had no high quality research that focuses on optimal metal-semiconductor contact technology. In the responsive mode, no such research gets done, and we make the best of what contact technologies we have from other materials systems, likely to be sub-optimal in the new context, but a Mission agency would see that the requisite research does get done in terms of delivering an overall system. The Agency would cover the field, and not leave key elements to serendipity.

11. Q3 cont.

In the UK we put our public research cake disproportionately in the hands of the academic communities, whose rewards in terms of promotion and recognition are not as powerfully aligned to national economic growth and social improvement, as are those who work in industry or front-line service delivery. This is less than optimal. My suggestion in an article I wrote last summer in Research Fortnight was not for a root and branch reform of the Research Councils, but a process of engagement that gave the end-users of research a much greater say in the RCUK processes and investments, and having the end-users making forward commitments on co-funding and on take-up and pull through as a quid-pro-quo for having such an influence. Over time, we would get an agency ethos taking an appropriate hold in the Research Councils. Some will argue that this is a retrograde step, but I am unrepentant until the balance between curiosity and societal need is much closer to that which can be sustained in the national interest, so that the objectives outlined in the answer to Q1 are better met.

12. Q4 What drives allocation of policy-driven research in Departments? Are existing mechanisms adequate? What role for CSAs?

I think it is important to realize that in a department such as DCLG, there is a chief scientist, a chief economist (holder of the research budget), a chief social scientist and a chief statistician, the latter three being career civil servants. They form an analytical quartet, each with a say on the budget of about £25 million pa (and some of that committed to protecting longitudinal surveys) The CSA as an engineer was to see that Fire and Resilience and Building Regulations got a reasonable share of the budget. The funding for research on housing, communities, local government etc was the responsibility of other members of the quartet. Had the CSA been a social scientist, no doubt someone would have fulfilled the role of overseeing the fire, resilience and building budgets. I think that a conscientious effort was made to use those funds as effectively as possible, given the policy priorities of the Ministers. There were some historical anomalies, and efforts were being made to smooth them out. Even within the Department there was a continual effort to get the analysts working closer with the policy makers. The latter were usually working to tight deadlines, and often called in the former late in the day. My push was to try to get the policy makers and analysts to link more closely with academics. There were about 1,000 academics for each of the ~ 140 analysts in CLG, so the civil servants should be able to use their modest research sums to leverage much more from the Research Councils, by backing the academic research they had confidence in at the 10 per cent funding level. The time overhead of collaboration, even with those returns, was deemed too expensive! There is little appreciation within the Civil service that academics are under pressure to show the impact and uptake of their work, so that academics would welcome helpful steers of what is on the medium term agenda of the Department.
13. Q5: Coordination of science and technology research across HMG.

This is the role of the GCSA and the departmental CSAs and is one of their priorities. It is a role that is evolving, and has yet to get real traction, especially in the cross-departmental aspects. I support much greater coordination of research and its budgets through CSAs, but as long as the Permanent Secretaries interpret their roles as Accounting Officers in the narrow and parochial way they do now, progress will continue to be too slow. I do not think that the groups of CSAs has been going long enough, or have become sufficiently heavyweight as a group to be entrusted with the budgets and empowered by the rest of the Civil Service to fulfill this coordinating role.

14. Q6a: The overall balance of funding for targeted and response-mode research

With reference to Pasteur’s quadrant in the piece I had published in Research Fortnight in 2008, the motivation for research is not just a quest for fundamental new understanding, but also the consideration of use: while some research may be predominantly of one motivation or the other, there is ample scope to be motivated twice over. Pasteur was driven by the need to improve the public health of Parisians to acquire a deep understanding of the structure and functioning of microbes. I do not think in the UK we give enough explicit recognition for the consideration of use aspects. Applied research has been a Cinderella. In my answer to Paragraph 5 above, I showed how there was no lever that considered the balance between next year’s blue sky thinking and following up on last year’s blue sky results with the appropriate level of applied research. The Knowledge Integration Communities of the Cambridge-MIT Institute had a societal need at their core, such as removing 97 per cent of the sound energy from a landing aircraft, or circumventing two bottlenecks in drug discovery (the sheer number of trial drugs, and reliance on animal experiments). Whole communities of academics, industrialists, regulators, local authorities etc formed around the core idea, supplementing CMI funding and contributing to a genuine team effort that was inter-disciplinary and inter-institutional. The continuing impact of this CMI work has been reviewed recently and independently, two years after CMI finished. The Silent Aircraft is now the official N+2 airframe of the international civil aviation industry. Rather that cite further examples, the whole report is available at www.technopolis-group.com/cms.cgi/site/group/uk_group/uk_project_sheets/902_CMI.htm

It is gratifying that both EPSRC and the European Institute of Technology have adopted the KIC model to a greater or lesser extent.

15. Q6a. cont

The simple model in high-tech (think of a Harrier jump jet) is of a spend ratio of basic, applied, development and sales something like 1:10:100:1000. This spend will be divided between the public and private sector, particular at the beginning end, where the risks of failure are high and many ideas need investigation. However, if we see that the Technology Strategy Board has a ~£400 million pa budget compared with an RCUK/FC budget of nearly £4 billion, we can see that the balance is skewed inappropriately. The balance should be nearer the other way around if economic returns on high-technology investment were the priority, even when the private R&D budget is factored in.


I believe that R&D budgets should be protected wherever they are found. If there are major cuts in public spending, R&D will have to take its fair share, but one hopes that that fair share is less than the global fractional cut in public expenditure. This is because R&D investment is precisely to secure the future of the UK, as in the answer to Q1.

17. Q7: Alignment of public and private/charity funds, and greater involvement of industry in solving societal needs.

I have four comments. The first is that the CMI model of KICs where communities gathered round a grand challenge and shared vision helped align the investments and accelerate the progress on what are both industry and societal issues. The second is that if industry and other end-users have a genuine seat at the table in crafting research priorities, it will in their self-interest contribute to the budget and capability of the R&D teams being supported—such contributions could even be a quid pro quo for the seat. The third is that over the last 20 years, the amount of basic research carried out in industrial laboratories has dwindled—the direct returns on investment were seen too small and the originals of new knowledge were becoming global—and industry now looks to publicly funded research worldwide for what it formerly did in house, and focuses its internal effort on product development. Finally, whereas large companies can and should look to their future 10 years
out, small companies do not have that luxury—they want timely and appropriate answers tomorrow—another version of scholarship. Unless the small company is a spin-out from a continuing university research group, an effective interaction with academia can be hard to begin and sustain.

18. Q8: Focus on economic importance, and identification of issues.

I once suggested to colleagues in Cambridge engineering that, instead of being 120 equal and independent scholars, we should brigade ourselves into 10-15 teams, focus and become the unquestioned world’s best on what we chose to focus. I was disappointed that there were no takers, as they thought the wrong foci might be chosen, and opportunities be missed! This self-imposed focus is precisely why I think that electronic engineering at the University of Surrey has consistently punched above its weight on the national and international stage over two decades, so focus can and does work. I cannot help but feel that if most of the body of individual 134,000 academics in the UK there were 10,000 focused (multidisciplinary) teams, we would get more from them! Who chooses and what is chosen as the focus has bedeviled researchers in industry and academia down the ages, with no consensus to date. The growth and decline of corporate or central research laboratories in US industry is just one symptom of the lack of consensus on what and how best to research. Rather than pass on this issue, I would like to see academicians with day-to-day end-user management responsibilities in industry or service delivery agencies being sought out to give independent and disinterested advice. The subsequent system should always allow for research outside the confines of focus, but on a pre-ordained scale of budget, so that only the very best of the alternative thinking does get funded, and the next best does not in deference to national choices that have been made.


I have already cited the US and NZ in examples above. The role of MITI in orchestrating Japanese industrial research in the 1970–1990s is to be recalled. The role in economic development of the Japanese universities in those days was marginal. During 16–18 September 2009, I attended the meeting of the Australasian Research Management Society in Christchurch New Zealand. I have to report that presentations from Canada (CFI and NRC) and Australian (CSIRO) showed that considerations of strategic national need have a higher standing in the research community than is the case in the UK.

20. A Final Point

Rather that look just at the looming financial restraints of the level of research funding as a guide to action or change now, it is worth looking further ahead. After the first decade in human history of wide bandwidth global communications it is a litany of Malthusian problems besetting us that have come to centre stage: over population, energy security, resource depletion, climate change, financial chaos and the downsides of both poverty and affluence. When in 2050 the history of this time is being written, where will our sciences, engineering and institutional efforts of today appear in that history? Viewed from this perspective, I fear we are not joined up enough so that the total effort is greater than the sum of the parts, as will be needed if we are to have an impact on the entire planet. Ensuring impact at scale is our greatest challenge today, and our S&T priorities and the way we organize ourselves to deliver the deliverables is an important ingredient.

September 2009

Memorandum by the Linnean Society of London

The Linnean Society welcomes the opportunity to assist the Select Committee on Science and Technology with evidence on the setting science and technology research funding priorities in the United Kingdom from our perspective as one of the oldest learned societies dedicated to the study of natural history. The Society, because of its world-wide Fellowship, is able to take a broad view of the issues, and is not tied to any institution with its own particular agenda.

Data to answer questions posed by the Committee are hard to source, although we are ever mindful of the underlying issues that affect the state of science funding in the United Kingdom and abroad. Nonetheless, we have attempted to gather together best-available information to support our statements, whilst in other areas we provide only anecdotal evidence gleaned from the perspective of our Fellowship which represents a broad cross-section of the natural history community, both professional and amateur. From our perspective, the following points emerge:

— The basic science of natural history, including taxonomy and systematics, upon which much of more derived biology depends has suffered comparably more than other sectors of science.

— Integration of science across disciplines is critical for taking a truly comparative view of our changing world.
— Priorities in science need to take into account that science not apparently “useful” today may be of critical economic importance in the future.

SETTING SCIENCE AND TECHNOLOGY RESEARCH FUNDING PRIORITIES

1. What is the overall objective of publicly-funded science and technology research?

1.1 Publicly funded science and technology research has a dual purpose, both to contribute to the national economy and purpose and perhaps more importantly to facilitate discovery and innovation.

2. How are public funds for science and technology research allocated? Who is involved at each level and what principles apply? Where appropriate, is the Haldane Principle being upheld?

2.1 The scientific research undertaken by our Fellowship is funded in an incredibly wide variety of ways, both from UK-based funds and from others such as the European Commission and international bodies. Much funding obtained from UK financial sources comes through the UK Research Councils and in the institutions in which our Fellows work through Government Grant-In-Aid to institutions, but also our Fellows receive funding from the charitable sector and industry. Charitable funding has become extremely important in the support of natural history research (as broadly defined) as the Research Councils have narrowed their remits.

2.2 It seems to us that all research is broadly in support of Government policy, especially if one takes into account the establishment of a knowledge-based economy and scientific literacy, and that this research is broadly conducted independently. Many of our Fellows work in Government-funded institutions such as botanical gardens and museums—the research in these establishments is independent from the funding bodies concerned while following policy and priorities laid out for these institutions in collaboration with their Government funding bodies.

3. Are existing objectives and mechanisms for the allocation of public funds for research appropriate? If not, what changes are necessary?

3.1 Mechanisms and objectives for the allocation of public funds for research should of course be independent and subject to scrutiny through peer-review where appropriate. Research councils, of course, allocate their funds based on varying systems of peer-review through committees and independent reviewers; these systems, by and large, work as well as peer-review can be expected to function. Research related to the provision of infrastructure or with long term policy or strategic goals will necessitate an appropriate system of peer-review related to the objectives of the exercise and with reference to the public good.

3.2 Government-funded research institutes set priorities internally and in reference to their particular funding body; many of our Fellows are employed in such institutions, where public funds for natural history related research are concentrated. In the experience of our Fellows, peer-review is also employed in such institutions and the existing mechanisms are appropriate.

3.2 We believe that the allocation of funds to many of the institutions in which our Fellows work by Government, then the use of these funds without interference by Government at an institutional level is a critical and basic principle, followed in many cases, but care must be taken that in a climate of tightened economic circumstances, these institutions must remain independent.

4. What governs the allocation of funding for Government policy-directed research through Government departmental and agency initiatives? Are existing mechanisms appropriate? What is the role of Departmental Chief Scientific Advisers?

4.1 Although we currently are not involved in a great deal of research directly related to Government policy one of our strategic aims as a Society is to “be an informed, independent voice in matters relating to natural history” (for the Society’s Strategy see http://www.linnean.org). We see our role here as providing a neutral and broadly based voice for natural history issues that cross policy and scientific objectives.

5. How are science and technology research priorities co-ordinated across Government, and between Government and the relevant funding organisations? Who is responsible for ensuring that research gaps to meet policy needs are filled?

5.1 The recent House of Lords Science and Technology Select Committee inquiry into Systematics and Taxonomy (see http://www.parliament.uk/parliamentary_committees/lords_s_t_select/systematics.cfm) provided an excellent case in point for a lack of coordination, and highlighted a distinct problem in ensuring that research gaps to meet policy needs are filled. The Select Committee’s suggestion that DUIS provide an
Setting research and funding priorities: evidence

Overview (not co-ordinating) function was not taken up by Government, but no alternative was proposed. This will be revisited (website for debate) after the review being undertaken by NERC (see 5.3 below) is completed.

5.2 Ad hoc groups looking at the future of a subject that contain both practising scientists and institutional managers would, in our view and given the current funding structure, be a more effective way of coordinating and organising research priorities in a flexible and proactive way than the establishment of a top-down, centralised coordinating body with no funds to disburse. Complete coordination of priorities across funding bodies and policy bodies would be likely to stifle diversity and innovation, both key to the production of top quality science.

5.3 We welcome the current review of taxonomy in the UK commissioned by NERC and hope that this will provide the evidence needed to stimulate the significant new funding of research gaps and skills base deficits that were identified in evidence to the Science and Technology Select Committee’s inquiry into systematics and taxonomy. We hope that many of the recommendations made in the Committee’s report will help to establish the need for including natural history based sciences such as systematics and taxonomy in the setting of UK research priorities.

6. Is the balance of Government funding for targeted versus response-mode research appropriate? What mechanisms are required to ensure that an appropriate and flexible balance is achieved? Should the funding of science and technology research be protected within the Research Councils or Government departments? How will the current economic climate change the way that funds are allocated in the future?

6.1 A balance between directed and responsive mode funding is always difficult. Responsive mode funding is critical to innovation and discovery, and there is always a danger that prevailing paradigms will fossilise thus stifling new ideas. Peer-review is critical for the proper allocation of public funds, but there should be regular turnover of peer-review bodies. Our own experience in allocating our small funds for research has shown us that diversity in such assessment committees allows us to see, and therefore fund, novelty better.

6.2 In our area of science we welcome the recent NERC strategic review that has realigned the balance of response-mode to targeted funding. This review involved consultations with the scientific communities engaged in NERC-related research, which greatly strengthened the credibility of this exercise.

6.3 The funding of science and technology needs to be protected both within the Research Councils and in Government departments. In our area of natural history, this protection is especially important in respect of the Government funding of our national taxonomic institutions such as the Royal Botanic Gardens at Kew and Edinburgh and the Natural History Museum.

7. How is publicly-funded science and technology research aligned and co-ordinated with non-publicly funded research (for example, industrial and charitable research collaborations)? How can industry be encouraged to participate in research efforts seeking to answer societal needs?

7.1 Our role as a small disburser of charitable grants has meant that we have increasingly been faced with the challenge of aligning or not aligning our priorities with those of Government and other funding bodies. We have taken the view that out funding is dedicated to the furtherance of the aims of the Society, whether or not these are directly aligned with current Government priorities.

7.2 Co-ordination of research with publicly-funded bodies is of course another matter, and we feel that better integration across science (as is our strategic goal across natural history) will be critical to the success of the UK science endeavour in the future.

8. To what extent should publicly-funded science and technology research be focused on areas of potential economic importance? How should these areas be identified?

8.1 There is always a risk of stifling innovation if funding is unduly concentrated in areas of potential economic importance. What is potentially important today might be irrelevant tomorrow, and vice versa. Identification of areas of funding priority must be developed in consultation with a broad cross-section of the scientific community.
9. How does the UK’s science and technology research funding strategy and spend compare with that in other countries and what lessons can be learned? In this regard, how does England compare with the devolved administrations?

9.1 In the recent inquiry into the systematics and taxonomy, we submitted detailed evidence with respect to the level of funding for our area of research. This is repeated and updated in sections 9.2 and 9.3 below.

9.2 The Linnean Society, with the Systematics Association, operates a competitive grants scheme for work in taxonomy (in the broadest sense). These grants, though small, are extremely competitive (see table below). The Systematics Research Fund (SRF: with £20,000 from the Linnean Society, £6,000 from the Systematics Association, £5,000 from the Bentham-Moxon Trust and £5,000 from NERC) funds small projects, the average request in 2007–08 was £1,026. Applicants to the SRF for the current round were from 33 countries (USA, 36 applications, UK 35 applications), up from 22 countries in the previous year. The BBSRC Collaborative Scheme for Systematics Research (Co-Syst—also managed by the Linnean Society and Systematics Association) was a three-year programme (£75,000/year, £225,000 total) to fund collaborative research between systematists and non-systematists that is judged will lead to full Research Council proposals in due course. The programme has now been upgraded (SynTax, to be launched at the Linnean Society in November 2009) and funded for a further three years, with an allocation of £300,000 per annum, which we greatly appreciate. The scheme does not allow institutions to claim overheads, and although we appreciate the scheme’s aims in general, we would like to point out that the total sum per year is only slightly more than the average single three-year BBSRC responsive mode grant (£245,000 in 2006; see BBSRC 2006 report at http://www.bbsrc.ac.uk/organisation/structures/council/2006/0610hei.pdf).

9.3 If we consider that the funding the Society and its partners provides constitutes the only real source of dedicated grant funding for primarily taxonomic projects in the UK, the competitive grant funding for taxonomy per se has amounted to less than £500,000 per year. In contrast, in the United States, the National Science Foundation through its Division of Environmental Biology programmes dedicated to taxonomy (eg, Biotic Surveys and Inventories cluster (including the Planetary Biodiversity Inventory [PBI] and Partnerships in Enhancing Expertise in Taxonomy [PEET]; REV SYS [supporting revisionary taxonomy] etc.) provides more than $12 million per year to the taxonomic community (not including the $14 million of new money dedicated to the Assembling the Tree of Life project [AtoL] all data provided by NSF in 2008). In Australia, the ABRS (Australian Biological Resources Study) currently provides some Aus$ 1.5 million per year for taxonomic research, in addition to the funding of infrastructure in systematics institutions such as herbaria and museums (http://www.dest.gov.au/NR/rdonlyres/031861A1-5FA2-45A0-8037-F7244657C680/2853/ABRS.doc). The Swedish government has made a significant long-term investment in the documentation and publication of the Swedish flora and fauna through the Swedish Taxonomy Initiative, a 20-year programme that has been fully funded since 2005 (http://www.artdata.slu.se/svenskaartprojektet/svenskaartprojektet_eng.asp).

9.4 With respect to the setting of strategic priorities in science, from the experience of our overseas and UK based Fellows, it appears that in the UK the scientific community at large contributes less than in other countries such as the USA. The National Science Foundation in the USA funds broad community participation in priority setting, while in the UK this is left up to individuals and institutions, which in our view, may contribute to swings in priorities due to the prevalence of particular interests.

9.5 The secondment of scientific staff for short periods to NSF (the “rotator” system, comprising more than half of the program directors at NSF across all areas of science, see for example http://www.nsf.gov/mps/mpsneedsyou/) also provides continuous injection of current scientific expertise into the NSF; a functioning system like this could not help but benefit the UK Research Councils if each of them were to implement it in a similar fashion.

September 2009

Memorandum by the Ministry of Justice (MoJ)

The following response to the House of Lords Science and Technology Committee inquiry into the setting of research funding priorities within Government has been prepared by the Research and Analysis Unit of the Ministry of Justice (MoJ). As stipulated by the inquiry we have prepared responses to those questions most pertinent to our business.

The nature of the MoJ Research and Analysis Unit’s business is to provide research and analysis to underpin evidence based policy and delivery across the Department. Consequently, our main focus is social science, not natural science. Research is defined as all social research projects, policy evaluations, outcome studies, economic research, and market research.
1. **What is the overall objective of publicly-funded science and technology research in the Ministry of Justice?**

As outlined in the Ministry of Justice Corporate Plan (http://www.justice.gov.uk/publications/corporate-plan-09-11.htm) the overall objective of research and analysis within the Ministry of Justice is to ensure that policy and delivery is based on robust evidence. Analytical resource will be deployed from the start of policy development to ensure that our policies are firmly based on evidence of what works. Policies will be informed by a better understanding of their consequences for the whole of the justice system. We will invest more and take a more systematic approach to building our overall evidence base, including ensuring we learn more from the experiences of our international partners.

2. **How are public funds for science and technology research allocated? Who is involved at each level and what principles apply?**

Since appointing a new Director of Research and Analysis, the Ministry of Justice has developed an overarching plan of research and analysis across the Ministry of Justice. The overall cross-cutting priorities for analytical services for 2009–10 are:

(a) assessing whole system impacts of policy, operational, and external changes including assessing the impact of the recession on, and aligning supply and demand across, the whole justice system;

(b) improving public confidence in the justice system by understanding better its drivers in the community and ensuring that we understand what value the public puts on the different purposes of sentencing and what trade-offs the public are willing to pay for;

(c) developing a better understanding of how to improve diversity by analysing race and gender disproportionality in the CJS and the judiciary;

(d) informing public sector reform by understanding better what drives efficiency and effectiveness in the civil, family and criminal justice systems. This will support further reform of the legal aid system, legal services and offender services; and

(e) learning from across government and international experiences.

The following criteria have been used to prioritise analysis projects for the following year:

(i) alignment with the four DSOs and the ministerial priorities outlined in the Departmental Plan: reform of public services; building a justice system that inspires public confidence; listening to victims and the vulnerable; and involving communities in justice;

(ii) whether projects address the big questions which govern the success of our business as a whole eg evaluation of pilots that are likely to have a substantial impact on client outcomes or cost/save a substantial amount of money;

(iii) achievability and value for money of the research design. For example, where initiatives have not been designed to support a robust research and evaluation strategy, we have not recommended that we devote scarce resources in attempting to evaluate them, because of the minimal likelihood of providing robust conclusions; and

(iv) the need to maintain and build our capacity to deliver good analysis through developing robust and linked data sets, maintain high quality and consistent data studies, develop our analysts, and ensure a good and varied set of external suppliers.

This plan has been agreed by the Policy Sub Committee of the Corporate Management Board. Individual projects have been agreed at Director level in each group. The overall resource devoted to research and analysis within the Ministry of Justice has been protected during a period where the Ministry is delivering significant efficiency savings, reflecting the importance that Ministers and Senior Officials attach to research and analysis.

We are committed to increasing the effectiveness and efficiency of our research budget, and this includes ensuring robust arrangements are in place for assuring the quality of research and analysis methods and the value of conducting individual projects.

3. **To what extent should publicly-funded science and technology research be focused on areas of potential economic importance? How should these areas be identified?**

A key priority for the Ministry of Justice is to ensure that resources are utilised as effectively as possible. The last capability review recommended that there is a need to improve the Ministry’s ability to make prioritisation and resource allocation decisions on the basis of robust data and evidence. Part of our approach to addressing this point is to significantly increase the ministry’s economics capability.

*September 2009*
Memorandum by the Office of the Vice Provost for Research, University College London

SUMMARY

Any consideration of research funding priorities should take account of the whole of the research base, including the arts, humanities and social sciences.

Research funding must:

— deliver excellent research which improves people’s lives;
— support a sustainable and agile research base in the UK, including supporting talented students and researchers;
— support curiosity-driven basic research; and
— recognise the importance of research in universities and the vital role of major research-intensive universities in fostering a wisdom culture.

The Haldane principle should continue to form the central element of research funding policy.

Research policy should be coordinated to sustain the health of the research base as a whole, and should strike an appropriate balance between investigator-driven research and needs-driven research, recognizing the importance of maintaining the UK’s research strengths across a broad disciplinary base.

UCL emphasises its strong support for the dual support system and the importance of sustaining QR funding. Coordination between publicly-funded and industry-funded research can be encouraged through university-led business research collaborations.

Research policy should focus on broad areas of strategic importance to which research—from all disciplines—can contribute, rather than simply emphasising perceived economically important areas of research. UCL’s Grand Challenges strategy takes this approach, identifying key research themes to address global challenges, recognising that these require a multi-faceted, multidisciplinary response that can be best provided by major research-intensive universities.

The UK is facing increasing competition as emerging and established competitor countries make unprecedented investments in research. Now is the time to maintain the investment in the UK research base, so that the UK can grow out of the current downturn.

1. UCL is pleased to make a submission to the Science and Technology Committee’s inquiry into “Setting science and technology research funding priorities”. We would like to make a number of introductory comments before responding to the specific questions that the Committee has identified.

2. We note that the Committee refers to “science and technology research”. We would emphasise that to ensure the continued health of the research base any consideration of research funding priorities should take account of the whole of the research base, including disciplines in the arts, humanities and social sciences, rather than considering particular disciplines or areas of research separately.

3. Recent reports by the British Academy, the AHRC and the ESRC have highlighted the value of arts, humanities and social sciences research, which contributes to cultural capital and public policy making, supports innovation and creativity in our research base and beyond, and is vital in “underpinning the quality of life and hence the wellbeing of society”. Support for research in the arts, humanities and social science also supports interaction with international businesses (in terms of promoting cultural awareness and understanding, knowledge of language) as well as ensuring a cultural and intellectual life in the UK that is attractive to business, international students and tourists. The AHRC has emphasised the importance of art and humanities research for the UK’s “culture ecosystem” and for economic and civic capital, as well as for the international success of the UK research endeavour.

4. We would stress that it is especially inadvisable to consider science and technology research in isolation from research in the arts, humanities and social sciences, given that such research also underpins many areas of research in scientific disciplines. Indeed, research is becoming increasingly a multidisciplinary endeavour,

68 If arts, humanities and social sciences research is also implicit in this term, we would urge the Committee to make this explicit.
69 British Academy, Punching our weight: the humanities and social sciences in public policy making, 2008.
70 AHRC/NESTA, Arts and Humanities Research and Innovation, 2008.
71 ESRC, Innovation: learning from ESRC research, 2008.
72 AHRC, Arts and Humanities Research Landscape, 2008.
73 Arts and Humanities Research Council, Leading the World: The economic impact of UKL arts and humanities research, June 2009. An analysis of publications, citations and RAE results was used to demonstrate the excellence of arts and humanities research in the UK.
74 The Academy of Medical Sciences has emphasised the importance of “a multi-disciplinary approach to health research”, including the social sciences and humanities (Academy of Medical Sciences, Letter to Lord Drayson, 30 March 2009); likewise the Wellcome Trust provides significant funding for research into the medical humanities and public engagement in recognition of their importance for promoting understanding of medical history and ethics and public engagement with science.
with the acknowledgement that many of the great research challenges the UK faces can only be addressed through research drawn from a wide range of disciplines. Any consideration of research funding priorities should explicitly recognize this point. We would therefore suggest that the Committee's inquiry should consider research funding priorities for the research base as a whole, recognising that the arts, humanities and social sciences are a vital component of the UK's research base.  

What is the overall objective of publicly-funded science and technology research?

5. The objective of publicly-funded research is, first and foremost, the creation of new knowledge, which enables fundamental advances in our understanding of problems and drives the progress of humankind. In the global knowledge society, the creation of new knowledge is key to our prosperity and wellbeing. Simply put, the objective of research should be to improve people's lives, whether by improving understanding, producing new technologies, developing new products or applications, providing innovations in healthcare, or the myriad other ways through which the funding and undertaking of research can enhance quality of life. In this context, it is important to remember that the "social importance" of research is as important as "economic importance"—and indeed may have equally significant economic benefits, although this are often more difficult to precisely determine or quantify.

6. Research funding must support a sustainable research base in the UK. Public funding has enabled the UK to become a global leader in research (second in the world behind the US). It is vital that funding is sustained to maintain our world-leading position and international competitiveness (the importance of the UK’s research base in supporting economic competitiveness and the “innovation ecosystem” was noted by Lord Sainsbury); ensure that the UK remains a destination of choice for the most talented scholars and researchers; and ensure that our leading research-intensive universities are able to compete with the best in the world. In an increasingly competitive global context, sustainability means more than just standing still; rather we must be continually improving and increasing investment to maintain the UK’s leading position. Funding must also ensure that the research base remains sufficiently agile and responsive to new challenges and research needs; stagnation in the research base will quickly breed mediocrity, not excellence.

7. Public funding of research must also support talented students and researchers. The education and training of highly-skilled researchers is one of the key outputs of investment in research, both in terms of supporting the workforce of the UK generally, and in sustaining our research base. It is essential that we continue to invest in the most talented researchers to ensure that we have the skill and ability to continue to undertake world-class research. In particular, it is important to ensure adequate support for early career researchers, who are the future of our research base.

8. Public funding also provides crucial support for the curiosity-driven basic research that underpins the UK’s research base but which may not find funding elsewhere. This complements business investment in R&D, which tends to be targeted at research which is closer to market, rather than that which is exploratory. (It should be noted that the outcomes from basic research are also highly desirable to industry—their own R&D programmes draw on the knowledge generated from the basic research conducted in universities). Given that curiosity-driven, basic research forms the bedrock of our research base and produces the new knowledge that in turn can be translated into new applications, this essential objective for public funding cannot be over-stated.

9. We would also emphasise the importance of public funding of research in universities. Universities are uniquely placed to not only generate new knowledge, but also to ensure the judicious application of knowledge for the good of humankind. This goes beyond a knowledge culture to a culture of wisdom—where new knowledge is tensioned, unforeseen consequences are considered, and new technology is filtered to ensure that it is applied wisely. Such a wisdom culture draws from and capitalises on the expertise of all research disciplines and is fostered in research-intensive universities which cultivate multidisciplinary research excellence. It is vital that this is recognised in research policy and funding in order to maintain excellence in research and innovation and ensure the UK’s ability to solve global problems.

75 The report of the National Committee on Higher Education (1997) identified “adding to the sum of human knowledge and understanding” as the primary function of research. http://www.leeds.ac.uk/educol/ncihe/nr165.htm
77 Many firms that do not invest in their own basic research do invest in basic research in universities, in order to have general access to new knowledge, the latest thinking and trained researchers (Lim, K., The relationship between research and innovation in the semiconductor and pharmaceutical industries (1981-97), Research Policy 33 (2004) 287-321; a study of businesses that invested in Engineering Research Centres (ERCs) in the United States found that industry valued university activity in basic research because it created new knowledge and was a source of leading research—80 per cent of businesses were involved in ERCs to gain access to new ideas (Feller, I., Ailes, C. P. and Roessner, J. D., Impacts of research universities on technological innovation in industry: evidence from engineering research centres, Research Policy, 31 (2002) 457-474.)
How are public funds allocated? Who is involved at each level of the decision making process? Where appropriate, is the Haldane Principle applied?

10. UCL fully endorses the Haldane principle and welcomes the Science Minister Lord Drayson’s comments that:

   It’s vital that we stick to the Haldane principle in setting our research priorities. Peer review, the judgments of the science community and the independence of the research councils are all key to our continued success.79

However, we are concerned that, as Government takes a greater interest in high-level direction of funding,80 the Haldane principle is being eroded and would caution against this. Researchers, rather than politicians, remain best-placed to make decisions about research priorities and funding and the Haldane principle should continue to form the central element of research funding policy. It may also be appropriate to consider the Research Councils’ mechanisms for developing policy—in particular we would emphasise that the majority of Research Council staff should have a strong background and training in science and research. More staff exchange (such as secondments) between academia and the Research Councils might help to enhance a mutual understanding of the respective priorities and drivers of these two sectors.

11. In terms of the allocation of public funds for medical research, we would suggest that consideration could be given to the governance of NIHR funding in NHS Trusts; we are aware of concerns that the ring-fence does not always function effectively below the NIHR level. An alternative might be to allocate NIHR money directly to universities, ensuring that it is ring-fenced for NHS research. It will also be important that the NIHR continues to develop its peer review processes to ensure they are of the highest quality and are funding the very best research.

How are science and technology research priorities coordinated across Government?

12. As emphasised above (paragraphs 2–4), it is essential that policy is coordinated to sustain the health of the research base as a whole, across all research disciplines. In particular, research policy should reflect the increasing importance of inter- and multi-disciplinary research collaborations and the necessity of sustaining the breadth of the research base.

13. There appears to be a lack of sufficient coordination of policy and priorities across Government, and between central Government and funding agencies. We would urge the Government to ensure that high-level research policy is coordinated and consistent between different agencies. With regard to medical research in particular, following the creation of OSCHR, it may be appropriate to consider the extent to which the strategic coordination provided by OSCHR filters down to lower levels, and the extent of joined-up working between the MRC and the Department of Health. It is also unclear how well the respective departmental Chief Scientific Advisers (CSAs) work together and remains a matter of concern that some Government departments (notably the Treasury) have not appointed a CSA. We welcome the commitment of Professor John Beddington, the Government CSA, to ensure greater coherence of science professionals within government and to promote the importance of departmental CSAs.81

14. UCL is also concerned that research commissioned by Government departments is not always funded at fEC rates, as noted by the RCUK/UUK review of fEC82 which found that fEC recovery from Government departments was in the region of 75, rather than 100, per cent. The Review also found that “major differences exist between and within departments”. This points to a lack of coordination and clarity of policy within Government departments; in the case of fEC, this has significant consequences for the financial sustainability of university research. We echo the review’s recommendation that Government departments should support research at 100 per cent of fEC where universities are contracted as sole providers of research.

Is the balance of Government funding between targeted and curiosity-driven, response-mode research appropriate? How will the current economic climate change the way funds are allocated in the future?

15. We would suggest that this question establishes a false dichotomy between targeted and response-mode research by implying that curiosity-driven research is synonymous with response-mode funding. Undoubtedly, response-mode funding plays a vital role in supporting curiosity-driven research; however it should be emphasised that (in theory at least) targeted funding still presents many opportunities for curiosity-driven research. We would urge the Research Councils to ensure that a significant proportion of targeted funding is

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80 For example, the House of Commons Innovation, Universities and Skills Select Committee observed that “in the 2007 allocations process the Government has had a significant influence on how this Science Budget will be spent.” (Science Budget Allocations, 2008).
81 House of Commons Select Committee on Innovation, Universities, Science and Skills, Minutes of Evidence, 12 December 2007.
directed to curiosity-driven research, recognising that multiple responses will be needed to the challenges identified through targeted research funding. We are concerned that at the moment funding for targeted research appears to be too heavily weighted towards research that is very applied, disregarding the enormous importance of basic research to addressing targeted themes.

16. Additionally, it is important to recognise that response-mode funding is not the only mechanism by which curiosity-driven research can be supported; other means of doing so (such as funding for institutes, within which lead researchers have some discretion in how to allocate funds; institutional strategic development funds (often provided through QR funding); or large programme grants which include elements of curiosity-driven research) are also important. We would emphasise that it is essential that all Research Councils continue to offer a substantial proportion of response-mode funding as part of their portfolio and also that support for curiosity-driven research should not be limited to response-mode funding but should also be provided through other parts of their portfolio.

17. Research funding should strike an appropriate balance between investigator-driven research and needs-driven research, recognizing the importance of maintaining the UK’s research strengths across a broad disciplinary base. UCL agrees that it is appropriate to establish a number of broad themes that meet societal need (as our own Grand Challenges strategy does—see paragraphs 26–27 below) but emphasises that this should not mean over-heavy direction of research priorities or funding. Rather, such a strategy should recognise that addressing societal need requires multidisciplinary responses and that researchers themselves are best able to identify research needs or current research activity that is relevant to societal need.

18. UCL also emphasises its strong support for the dual support system. Public funding of research through the dual support system underpins the sustainability and dynamism of the UK research base, ensuring stable core funding combined with competitively-awarded project and programme funding. By providing distinct sources of funding for university research it ensures that there are multiple decision points for determining research funding. QR funding in particular is vital to provide the stable, un-hypothecated funding stream that enables universities to invest sustainably and flexibly in research activities and infrastructure. QR is also vital for facilitating strategic investment, supporting emerging areas of research and curiosity-driven research, and underpinning or pump-priming other research grants, including those from business. We would emphasise that research funding policy in Government must maintain QR funding for universities.

19. We note recent indications from Government that they are considering increasing contestability in funding for universities, and emphasise that, although it is allocated as a block grant, QR funding is already contestable, allocated competitively according to research excellence, as determined by the RAE. Its allocation as a block grant distributed selectively both promotes research excellence and, importantly, enables universities to invest strategically and sustainably in their research. Crucially, allocating QR as a block grant to universities ensures that support is provided for all research, rather than “picking winners” among particular research areas and directing funding primarily to those. With the increased focus on impact in the new Research Excellence Framework, it will be important to ensure that QR nevertheless continues to support curiosity-driven research and that funding allocations continue to be determined primarily by research excellence.

20. UCL is very concerned that the current economic climate will mean a reduction in funding for universities generally, and for research funding in particular, in future spending rounds. Whilst we recognize that there are significant economic pressures, we would urge that any reduction in research funding should be kept to an absolute minimum. In particular, it will be important to safeguard the ring-fenced science budget and QR funding (we note with concern that HEFCE are already planning a reduction in QR for 2010–11). Investment in research (and in universities more broadly) represents the way to stimulate economic recovery and ensure that the UK is able to fully benefit from recovery by continuing to support the most talented researchers and generate the best ideas. We would also emphasise that funding pressures should not mean greater top-down direction of research (or an undermining of the Haldane principle), which risks simply stifling the agility and creativity of the UK’s research base.

83 Evidence shows that the dual support system has played a key role in achieving the resurgence of UK research of the highest quality and that the RAE has driven up the quality of UK research since its introduction in the 1980s. (See, for example: Evidence Ltd, The Role of Selectivity and the Characteristics of Excellence, 2000; Higher Education Funding Council for England, Fundamental Review of Research Policy and Funding: Sub-group to consider the nature and purpose of HEFCE funding: Final report, 2000; Higher Education Policy Institute, What future for Dual Support?, 2004.) Successive RAE cycles have driven improvements “at all grades and across subject areas” (Evidence Ltd, Impact of selective funding of research in England, and the specific outcomes of HEFCE research funding (Report to HEFCE and the Department for Education and Skills), 2005).
How is publicly-funded research aligned and coordinated with research that is not publicly funded? How can industry be encouraged to participate in research seeking to answer societal needs?

21. In recent years there has been greater coordination between charities and the Research Councils in offering large joint funding programmes and to a lesser extent, between Research Councils and business. This is a positive development in facilitating high-level alignment between strategic priorities in funding, although the importance of public and private funding for research operating as complementary but distinctive sources should also be noted. A recent report reaffirmed that public and private funding for research are complementary and that public funding stimulates further private investment in R&D.

22. Fostering successful university-business research collaborations is the best way to ensure coordination between publicly-funded and industry-funded research, and to promote industry engagement in research seeking to answer societal needs. For example, UCL’s collaboration with the biopharmaceutical group Pfizer has secured funding and clinical expertise from Pfizer to support research to advance development of stem cell-based therapies for age-related macular degeneration (AMD) and UCL’s spin-off company Pentraxin Therapeutics Ltd is collaborating with researchers from GlaxoSmithKline to develop the world’s first dual drug-antibody treatment for the rare and often fatal condition amyloidosis. Other means of promoting industry engagement with university research include:

- matched funding schemes for research collaborations;
- support for venture capital funding;
- support for proof-of-concept schemes within universities (such as the University Challenge Seed Funds);
- minimising regulation to remove unnecessary barriers to collaboration.

23. Although the Technology Strategy Board (TSB) offers a valuable forum for promoting industry engagement with research, we are concerned that this has resulted in very few successful interactions and collaborations with universities—particularly given the large amounts of public funding (including some from the Research Councils which is therefore diverted from other budgets) channeled through the TSB. We would urge the TSB to give greater consideration to facilitating interactions between industry and universities; public funding for business research should be aimed at primarily incentivising increased business investment in research. It is important that the TSB considers the scope for innovation across the whole of the research landscape, including in the arts and humanities. Industry should also be incentivised to invest more directly in universities, for example in supporting post-doctoral researchers through relatively small grants (building on the successful model of the co-funded CASE studentships). This would be relatively inexpensive for industry but would ensure that they had access to leading-edge research and would be an important way of promoting university-business engagement.

24. Finally, we note that industry R&D budgets are vulnerable in a recession. The current economic downturn makes public funding of research all the more important as funding from industry may decrease; it will therefore be important to consider how research policy can stimulate future investment from industry following an upturn.

To what extent should publicly-funded science and technology research be focused on areas of economic importance? How should these areas be identified?

25. We would caution against an over-emphasis on “economic importance” in determining research funding and policy, not least because of the difficulties in determining what constitutes economic importance (and who should decide what is economically important). “Economic importance” can and should be a broad term, incorporating everything from research which directly creates wealth, to global health research (because a healthy population is economically important), to research which improves quality of life, through to research which has cultural impact. Rather than thinking about “economic importance” or trying to determine...
economically important areas of research when considering research policy, it may be helpful to consider broad areas of strategic importance to which research can contribute. A vital role for research is to address the global problems and challenges of the future; this necessitates identifying those areas where research can make a real and meaningful contribution and recognising that solutions will be multiple, varied in type, and will need to be drawn from across the discipline base.

26. UCL’s Grand Challenges strategy\(^9\)\(^8\)\(^9\) takes this approach, identifying key research themes to address global challenges, recognising that these require a multi-faceted, multidisciplinary response. The aim is for UCL to apply collective strengths, insights and creativity to generate new solutions to overcome problems of global significance. The Grand Challenges act as a synthesis for research across UCL’s multidisciplinary research strengths, harnessing expertise, promoting ways of working that transcend traditional disciplinary boundaries, and stimulating external partnerships.

27. The strategy ensures that UCL maintains a flexible and responsive research base so that, as a university, we are able to adapt to changing priorities and new challenges, building on our existing strengths and developing and enhancing new ones. The Grand Challenges do not, in themselves, drive UCL’s investment in research activity to any great extent (although some investment has been made in specific Grand Challenges initiatives) but rather harvest relevant research activity from across the institution to address challenges and provide solutions. Importantly, the Grand Challenges encourage and provide an opportunity for researchers themselves to think about how their work intersects with the Grand Challenges, rather than directing the scope or course of research.

28. It is important to distinguish between demonstrating the benefits of publicly-funded research through economic impact (as well as through other outcomes) on the one hand, and making funding and policy decisions based on economic impact or perceptions of economic importance on the other. Whilst highlighting the considerable economic benefits that result from undertaking research is important, to use this as a driver of policy (rather than an outcome) risks undermining the strength of our research base. Research policy must aim to support and secure the long-term health and sustainability of the research base, capitalising on our strengths, but not to steer research into areas of current economic importance (at the expense of others) which do not guarantee long-term success.

**How does the UK science and technology research funding strategy compare with that of other countries?**

29. It should be remembered that research is a success story for the UK—we have universities and researchers that are among the best in the world, and we punch well above our weight. In addition to a strong research 28. It is important to distinguish between demonstrating the benefits of publicly-funded research through economic impact (as well as through other outcomes) on the one hand, and making funding and policy decisions based on economic impact or perceptions of economic importance on the other. Whilst highlighting the considerable economic benefits that result from undertaking research is important, to use this as a driver of policy (rather than an outcome) risks undermining the strength of our research base. Research policy must aim to support and secure the long-term health and sustainability of the research base, capitalising on our strengths, but not to steer research into areas of current economic importance (at the expense of others) which do not guarantee long-term success.

**How does the UK science and technology research funding strategy compare with that of other countries?**

29. It should be remembered that research is a success story for the UK—we have universities and researchers that are among the best in the world, and we punch well above our weight. In addition to a strong research performance (with 1 per cent of the world’s population, the UK produces 9 per cent of publications and account for 12 per cent of citations and in terms of citation impact is ahead of the US in health, biology, environment and physical sciences\(^9\)), the UK is number one in the G8 of advanced industrial nations for research productivity\(^9\)—a particularly good return given that the UK is ranked seventh in the G8 for public funding for research\(^9\). The UK’s research strategy therefore compares well with other countries in that it has secured us a position as a global leader in research and ensured that we are the most scientifically productive country in the G8.

30. That being said, there is no room for complacency. UK universities are relatively under-funded compared to our major international competitors, many of whom have made significant commitments to further increase investment in research and universities.\(^9\) The UK is facing unprecedented competition as emerging and established competitor countries continue to make significant investments in research. China, India and South Korea, among others, have greatly increased the proportion of GDP spent on research;\(^9\) Brazil is making record levels of investment in R&D\(^9\) and has become one of the fastest-growing countries in the world in

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\(^{9}\) UCL’s Grand Challenges are: Global Health; Sustainable Cities; Intercultural Interactions; and Human Wellbeing. See http://www.ucl.ac.uk/grand-challenges/.


\(^{9}\) Ibid.

\(^{9}\) The UK spent 1.82 per cent of GDP on R&D compared to an average of 2.24 per cent, according to a study of 21 comparator nations (Evidence Ltd/Office of Science and Innovation, *PSA target metrics for the UK research base*, 2007).

\(^{9}\) In 2006 the UK invested 1.78 per cent of GDP in R&D—less than France (2.09 per cent), Germany (2.53 per cent), Sweden (3.73 per cent), Japan (3.52 per cent in 2005), and the US (2.61 per cent (excluding capital expenditure)). The UK’s investment is also below the figure for the EU as a whole (1.84 per cent) (Eurostat, *Science, Technology and Innovation in Europe: 2009 Edition*, September 2009).

\(^{9}\) Since 1999, China’s spending on R&D has increased by over 20 per cent every year. China is now the second higher investor in R&D in the world after the US, and aims to spend 2 per cent of GDP by 2010 and 2.5 per cent by 2020 (Demos, *The Atlas of Ideas: China, The next science superpower?*, 2007). India is rapidly increasing its science budget (by 24 per cent in 2005 and 16 per cent in 2006) and aims to increase R&D expenditure from 0.8 per cent of GDP to 2 per cent of GDP by 2011; in addition, it has established a $2.30 billion National Science and Engineering Foundation for fundamental research. Since 2000, South Korea’s R&D investment has grown from 2 per cent to 3 per cent of GDP—the 6th highest rate of R&D investment in the world. In 2008, South Korea’s R&D spending increased by over 10 per cent from the previous year to 3.37 per cent of GDP.

\(^{9}\) Currently around 1 per cent of GDP, to be increased to 1.5 per cent by 2010, with a commitment to then maintain spending at double 2006 levels.
terms of scientific publications. In addition, European peers are increasing their focus on strengthening research performance—with, for example, the Swedish Government’s commitment in October 2008 to increase R&D funding by 20 per cent over the next four years, and France’s introduction of a four-year national science and innovation strategy from March 2009.

31. The UK also compares poorly to international competitors in terms of the proportion of business investment in R&D.96 Trends in business expenditure on R&D as a percentage of GDP over the past two decades show that the UK significantly lags behind the OECD average as well as spending by the US and Japan.97 The Government has set a welcome target in the Science and Innovation Framework to spend 2.5 per cent of GDP on R&D by 2014; to meet this, increased investment from business will be necessary, as meeting the target from further public investment alone is not realistic (particularly given the current economic downturn).

32. The UK has a policy of allocating research funding selectively according to excellence which has delivered a resurgence in success for the research base. However, many of our international competitors are developing explicit strategies to concentrate resources to develop or sustain research-intensive universities, recognising their importance for world-class research and international competitiveness.98 The UK may have to give serious consideration to how it will continue to sustain world-class research in our leading universities in the context of increasing global competition and pressure on resources.

September 2009

Memorandum by Dr James Ren

The report outlined some comments/evidence in response to the Call for Evidence on the funding priorities and, some critical discussion on how to empower/motivate people and research communities to develop a diverse way of funding generation with more cost effective way of conducting research through better/fairer research assessment. This will be crucial to maintain the science and technology development under the current financial condition.

1. What is the overall objective of publicly-funded science and technology research?

In general, the objectives of publicly-funded science and technology research should be the drive of innovation, sustainable economic growth and special well-being. To achieve these objectives, it is important to empower the right group of people. This is the key to have a sustainable development that balances these main objectives. In fact, ensuring sustained development of human resources in science and technology has been a main focus in recent years for many governments, including the UK. Several schemes, such as KTP, Industrial CASE, engineering PhDs and support for funded PhD students have proven to be very successful to achieve this goal. However, I feel that some current practice in particular the funding mechanism has failed, to certain extent, to empower the right group of people. The public funding should be used to empower young people who are aiming at an engineering or technology career, rather than a group of students who have better performed academically but later take up a career path totally outside engineering and technology. Any supports to these students are not an effective use of money from the limited public funding resources. A viable way is to balance the funding between different types of universities. Currently, most of the research fund has been supporting the top few universities but, it is a commonly known fact that a large proportion of science/engineering graduates (including PhDs) from the top universities actually go into a career outside the science and technology regime. This is a worrying situation and a mechanism has to be sought to change the situation in order to achieve the overall objectives of publicly funded science and technology research.

2. How is publicly-funded science and technology research aligned and co-ordinated with non-publicly funded research (for example, industrial and charitable research collaborations)? How can industry be encouraged to participate in research efforts seeking to answer societal needs?

Under current financial circumstance, it is very important to develop a balanced role of public-private partnerships in increasing the effectiveness of science and technology policy. Several program such as the KTP and industry CASE studentship program have been very successful to achieve this. These programs should be protected from the current funding cut.

96 Currently, of the 1.76 per cent of GDP that the UK invests in R&D, 34 per cent is publicly-funded and 42 per cent is spent by the business enterprise sector (DIUS, SET Statistics; http://dius.ecgroup.net/files/48-08-I on.xls# Table of content!’A1).97 Lord Sainsbury of Turville, The Race to the Top: a Review of Government’s Science and Innovation Policies, 2007; Chart 2.1: international comparisons of BERD as a percentage of GDP.98 For example, Germany’s Excellence Initiative; China’s 211 and 985 projects; South Korea’s World-Class University project and Taiwan’s increase in funding for its Academic Sinica Institution (around 12 per cent of the annual R&D budget in 2009).
To further enhance this, more emphasis should be given to encourage University organisation and the research communities to reaching out rather than heavily rely on the government fund. As an academic, I feel one main obstacle for achieving this has been the current research assessment mechanism, in which industrial funding has not been rated to the same weight as the funding from research councils. This has grossly discouraged the research community to conduct industrial based research. In addition, over weighted emphasis on publications (in particularly pure science oriented) is also breaking the common ground for mutual benefit between the academia and industries. Understandably, protecting technology advantage is very important for industrial partner, however this naturally put some limitation on the publication side such as what can be published and when to publish, which may affect adversely the willingness of academics to conduct industry based researches.

Another factor serious affecting the academic-industry collaboration is the emphasis on the amount of public funding as an indication of research excellence. Research funding should be used to ensure the research priorities of the society being covered rather than used as a critical mean to differentiate/rank researchers. A suitable mechanism should be developed to encourage a more cost/resource effective way to conduct research. A research is better assessed by its true contribution to the society rather than by how much money a researcher has given by the society to support the work. Under the current assessment mechanism, a researcher has the same research output without using any public research funding will be rated much lower than another academic who has produced a similar outcome, but, with public funding. This is apparently not fair to the researcher and obviously not going to encourage more effective use of resources. This is one potential reason that the research council are under enormous pressure and overloaded with funding applications. In some cases, the main drive to apply for funding from the research council is to try to raise the research profile rather than acquiring the necessary money for doing the research.

3. To what extent should publicly-funded science and technology research be focused on areas of potential economic importance? How should these areas be identified?

UK has to identify its own priorities for the benefit of the welfare of its own people rather than try to competing for a superficial rank position in the world. Only by doing this, UK can maintain a sustainable development path. I feel that the publicly funded science and technology should be firmly focused on the areas of potential economic importance as well as social benefits. Otherwise it will not be sustainable and may lose the public support in a longer term. In some cases, the economic gain and social benefits could go hand in hand with a proper mechanism. For Example, medical research will directly benefit the healthcare system in the UK; the outcome of the research fund development is more than likely to be able to directly bring in income by transferring the technology developed initially for social benefit into other sectors or countries.

4. How does the UK’s science and technology research funding strategy and spend compare with that in other countries and what lessons can be learned? In this regard, how does England compare with the devolved administrations?

Compared to other countries, the UK system has been too heavily biased towards science rather than technology. Indeed, science and technology always go hand in hand but there are many differences and they also impact on the society in a different way and timeline. For example, science is to enhance our fundamental understanding of processes/systems while the technology side should be focused to use these understanding to develop solutions to serve the society. Many countries have a clear funding mechanism for both sides and the work will be assessed in a different way. For science, it will be focused on adventurous and long term effect, while the technology side will be assessed by the direct economic benefit. But these are not clearly define in the UK system. In fact, to certain extent, the system is encouraging the competition for who is cleverer rather than who is making more contribution. This is clearly demonstrated by how the research is assessed. In the current research assessment, the quality of a researcher is assessed by only a limited number of selected publications. The main focus is how good the journal is (rated by the impact factor) and how many science citation the paper has generated. There is no clear reference to the engineering index which is more directly related to the engineering field. This will apparently encourage people to move to more science oriented field to explore things irrespective of where their strengths are and interests lies rather than to develop practical solutions that the UK society needs.

September 2009

Letter from Resource Efficiency Knowledge Transfer Network

The Resource Efficiency KTN would like to express the views of our membership on the questions posed by the inquiry into the setting of research funding priorities within Government and other responsible bodies for the allocation of public funds for science and technology research. The 4,500 + membership of the Resource Efficiency KTN consists of a broad cross-section of industrial, academic and public sector individuals with a
common interest in the issues around a resource efficient and low carbon economy. These topics cut across a range of science and technology areas and are heavily involved in many of the current funding programmes in order to develop and prove the new technologies required to enable the UK to be at the forefront of this arena.

SUMMARY STATEMENT

Since the Industrial Revolution there has been a trend towards a broadening and extension of the education system. In the 1960's some people still left school at 14 with only a rudimentary education. In Europe it is now common for young people to continue their education into their mid-20s. As societies develop the extension of the period of the education and development of the young seems to be part of an evolutionary process. According to UNESCO figures the number of students pursuing tertiary education has grown from 28.6 million in 1970 to 152.5 million in 2007 (an annualised growth rate of 4.6 per cent).

All around the world there is competition to attract investment for the development of new science and technologies. If the UK is to continue to participate in the fields of science and technology we must continue to invest in the development and the harnessing of the talent of future generations. Through the STEM programme, the Science and Innovation Investment Framework (2004–2014) and other initiatives the Government has taken steps in the right direction. Investment in enhancing the education system should continue to be made—the aim must be one of continuous improvement—if the UK is to be in a position to be able to make a global impact on S&T research.

The UK should continue to build on the STEM programme and other innovations in educational to provide the broad base of knowledge and skills that are required to be in a position to explore long term “blue skies” ideas and initiatives. In addition it is important that sufficient funds are provided to build on existing areas of excellence and to ensure that they maintain the “critical mass” that can make them “self-sustaining”. Through engagement across the spectrum of society it is important that the science and technology community are able to recognise important areas for research and development that can deliver societal impact and bodies like the Technology Strategy Board and research councils should be empowered to continue to facilitate this process. For example significant investment should be assigned for R&D that can contribute to the development of a low carbon economy and for the effective utilisation of resources. This would enable the UK to continue to show leadership—not only in talking the talk but also walking the walk—in sectors that are of critical global significance.

What is the overall objective of publically-funded science & technology research?

The UK has a relatively high population density and a limited supply of high grade natural resources. In the past the UK has relied on international trade for obtaining resources that are not readily available within its borders. As global trade becomes more competitive and the demand for resources in other parts of the world increases (Eg China, India, etc) competition for scarce resources will increase. It is important that publically-funded research in science and technology should keep in touch with developments around the globe that can impact on society in the UK. Science and technological (S&T) developments in the UK have had global impact in the past and if the UK is to remain competitive in the future it must continue create the conditions that will enable scientists and technologists of the future to continue to do so.

Privately funded investment in S&T is primarily driven by commercial considerations.

Publically funded research in S&T should focus on the following:

— Fostering a high level of engagement in science, technology, engineering and mathematical education programmes.
— Ensuring that the UK continues to create and maintain centres of excellence in the teaching of STEM subjects at the tertiary level to produce researchers that can deliver new S&T breakthroughs.
— Support investment in then pilot and demonstration facilities that are necessary to prove the value and viability of new technologies.

The UK research resources are clearly finite but have a high global reputation. Although it is important that the UK continues to cover a very broad range of education in S&T it does not have the resources to support extensive research programmes in every field. Of course it is not good for Governments to try to pick “winners” for research funding but it makes sense for some specific areas of importance to UK society should be promoted through targeted funding. Where the UK has or can create research of global significance it should concentrate resources to nurture centres of excellence that are recognised globally as world class.

The EU has extensive S&T research programmes and it is vital that policy in the UK is aligned so that we are in a position to maximise the benefits that the UK can derive from these programmes.

Are existing objectives and mechanisms for the allocation of public funds for research appropriate? If not what changes are necessary?

One concern that researchers have is that objectives can be subject to political fashions. S&T research programmes are by nature medium to long term programmes and to be effective they really need to have the security of access to long term funding programmes. Many of these programmes have the potential to deliver benefits to the economy of the UK and if they are to be effective they should not be subject to the vagaries of political fashions.

How are science & technology research priorities co-ordinated across Government, and between Government and the relevant funding organisations? Who is responsible for ensuring that research gaps to meet policy are filled?

The Resource Efficiency KTN works closely with the Research Councils (particularly EPSRC), the Technology Strategy Board and the Energy Technologies Institute. These organisations have priority areas that have been established to be of importance to the UK economy and society. There appears to be a good co-ordination developing between these organisations. It is important that there is good communication between the relevant Government departments and agencies to ensure that new technologies can be developed from the beginning to the end of the innovation supply chain (from the initial idea to the practical application). Unless the fundamental research is supported in the early stages of development, TRL 1–3 (Technology Readiness Level), the concepts will not be developed to the pilot scale.

Is the balance of Government funding for targeted versus response-mode research appropriate? What mechanisms are required to ensure that an appropriate and flexible balance is achieved? Should the funding of science & technology research be protected within the Research Councils or Government departments? How will the current economic climate change the way that funds are allocated in the future?

It is important to have a flexible balance. Perhaps a defined split between responsive and targeted research, leaving a balancing percentage that is available for enhancing targeted programmes or supporting potential new breakthrough technologies. This “strategic reserve” could be used for large projects that offer high potential for societal benefits (accelerate deployment of breakthrough or enabling technologies).

The funding of S&T research should be increased rather than reduced—the UK is still lagging behind its competitors in this field (see below). It is essential that the UK invests in the development of Low Carbon technologies to gain a share in this growing global market.

Former Chairman of the House of Lords Science & Technology Select Committee, Lord Alec Broers (2004–07), believes that government investment in science and research would be better informed if there was a more widespread acknowledgement that science and engineering are two sides of the same coin.

“I would like to see Britain get back into some other big technology projects,” says Broers. “There is an opportunity for us to play a major part in fusion, there are also big opportunities in plastic electronics and exciting energy projects such as plastic solar cells, hydrogen storage, electric cars and so forth.

“There is so much exciting science that is around all of these projects. People think that is engineering, but engineering is science these days.”

Broers calls for scientists advising government to have a better understanding of the relationship of science and society. “In many cases in government departments, it’s not necessary to have a chief scientist, because, instead, a chief engineer should know the science, but understand better the context of the science in relation with society—whether it is beneficial to society, or might be too expensive or unsafe. I do not wish to question the importance of science, but we have the balance wrong.”

And he says that government needs to invest in big science projects if it is not to miss out on significant commercial opportunities. “If we go into something like plastic electronics we’re not going to do it with just three small companies and a bit of research funding in the universities,” he says.

“We need to build a big laboratory or institute. At the moment, we really don’t have the mechanisms to do that because nobody strategises that way. I was disappointed in some ways when Lord Drayson came out with the £1 billion early stage fund for technology start-ups. I would like to have seen that spent on four large specialist organisations. You can count the number of decent sized companies that have been founded in this country on one hand.”

http://www.publicservice.co.uk/feature_story.asp?id=11376
A recent study has shown that a declining level of Government support will result in a comparatively low level of R&D:

*In their review of 11 broad manufacturing industry groups over the period 1993–2000, Becker & Pain found that the main developments associated with the comparatively low level of R&D seen during the 1990s appear to be weak output growth, the declining level of government funding for private industry and the appreciation in the real effective exchange rate since 1996. Taken together these factors have largely outweighed the stimulus being offered by the decline in long-term interest rates during the 1990s, the growing share of R&D expenditure being undertaken by foreign-owned firms, the rising level of competition in product markets, and the increase in skilled labour employed on R&D in the latter half of the decade.*

*The Manchester School Vol 76 No. 1 January 2008 1463–6786 66–87*

In particular it is important to support interdisciplinary, cross-cutting and strategic research needs to support the UK sustainable development strategy.

*How publically-funded science & technology researched is aligned and co-ordinated with non-publically funded research (for example, industrial and charitable research collaborations)? How can industry be encouraged to participate in research efforts seeking to answer societal needs?*

We have to remember that many of UK’s larger businesses are now owned by organisations with headquarters outside the UK. If we are to persuade them to investment in S&T R&D in the UK we must demonstrate that they can get good returns from this investment. The current mania for applying what is mistakenly referred to as Full Economic Costing (FEC) in Universities is tending to price some of these UK institutions out of the global research market.

Government policy must be designed to give clear signals to non-governmental organisations on the strategic directions that Government intend to follow. The taxation strategy, grants and allowances should all be aligned to encourage R&D in areas identified as critical to the UK economy (such as low carbon technologies and materials security).

*To what extent should publically funded science & technology research be focussed on areas of potential economic importance? How should these areas be identified?*

Whilst it is correct to have a split of funding some being assigned to focussed areas it is important to maintain a significant proportion of funding for longer term and more speculative programmes that may not have a visible outcome but that do make a contribution to the expansion of knowledge.

Investment in the development of a world class education system for the development of scientists and engineers must be seen as part of a critical enabling process for new discoveries in the future.
How does the UK’s science & technology research funding strategy and spend compare with that in other countries and what lessons can be learned? In this regard, how does England compare with devolved administrations?

Although a little dated now the DTI/HM Treasury publication on R&D Intensive Industries in the UK (DTI Economics Papers No 11 March 2005) gives some useful background information. In particular the graph reproduced below gives an indication of the trends in the important R&D sectors between 1980 and 2003:

![REAL TERMS UK BUSINESS R&D BY BROAD PRODUCT GROUPS (£ MILLION)](image)

This showed a general trend for increasing significance of R&D in Chemical (Pharmaceuticals) and the Services industries. Going forward it is important that the UK should look to develop new knowledge and many of the points raised in the policy briefing prepared by NESTA in 2007 are still relevant today:

*Science is about the creation of new knowledge, and frequently leads to insights that form the basis of breakthrough new products and processes. Currently the UK is improving in three important areas, but not fast enough. Expenditure on R&D lags behind international competitors, STEM graduates are increasing but demand is likely to outstrip supply and links between businesses and universities are still challenged by universities funding streams and cultural differences. In a world where the UK is competing not only with the United States and Europe but with emerging science powerhouses like China and India, science policy needs to become more prominent, but more importantly it needs to become more sophisticated.*

*NESTA S&I/08/Published June 2007*

In May 2008 in their policy briefing on “Total Innovation” NESTA suggested that:

*Policymakers and industry should work together to develop Total Innovation Strategies for the UK’s most important industries, informed by new measurements that capture total innovation. Governments should ensure that people have the opportunity to develop the capabilities needed for contemporary innovation, including interdisciplinary skills and strategic business expertise.*

*NESTA, TI/24/Published May 2008.*

When he delivered the 2009 McLaren lecture at Aston University, David Smith, the CEO of Jaguar Land Rover, pointed out that the R&D spend by single companies like Bosch were higher than the whole of the UK motor industry.

A study by the Anglo German for the Study of Industrial Society compared the levels of industrial R&D in the UK and Germany and delivered the following in the executive summary:

— Investment in R&D has long been recognised as being among the main determinants of economic growth and prosperity. Analysing the factors that affect R&D is, therefore, a crucial issue for the economic understanding of what affects growth and competitiveness, and for the provision of public incentives that could help to increase the stock of knowledge of the society.
— Research and development intensity has risen significantly and consistently in Germany in recent
years, while declining in the UK. The aim of this project is to contribute to the understanding of the
reasons behind the R&D intensity gap between the two countries and to suggest possible policies that
may be employed in order to increase the amount of investment in R&D undertaken by business
enterprises.

— Our analysis shows that output is an important determinant of R&D expenditure. An increase in
industry output leads to an increase in R&D both in the short run and the long run. However, output
movements are significant only in the high-tech industries and their impact is much stronger in the
UK than in Germany, particularly in the long run.

— The larger output effect in the UK could be the outcome of different institutional settings in the two
countries—i.e. more flexibility in the UK compared to Germany and, hence, greater ability to adapt
R&D investments to final demand.

— Another, and perhaps more plausible, explanation for this result could be the different R&D strategies
in the two countries. In Germany, there is more emphasis on generating new technologies and this
objective is less likely to be determined by output movements. In the UK, the focus is on imitation
and technology transfers, which are probably more responsive to changes in demand.

— Among the main factors behind the decrease in R&D expenditure in UK manufacturing is the
concentration of R&D in a few key sectors, the decrease in military R&D after the Peace Dividend,
the insufficient supply of skills and the slowdown in government R&D subsidies to business
enterprises. The R&D carried out by foreign affiliates positively affects total R&D in the UK,
compensating for the decline in other sources of R&D expenditure in the business sector.

— Additional measures are needed in order to improve the innovative capacity of the UK. Policies
should aim at increasing the supply of skills, particularly at the intermediate skill level, and promoting
direct government funding of high-tech/high-risk projects. Benefits could also be attained by more
widespread investment in R&D across all manufacturing sectors.

For example, one conclusion was that the German government devotes a large amount of resources to basic
research. Furthermore, we find a positive impact of government-financed R&D in the high-tech industries for
Germany. It is in fact a practice of the German government to directly finance specific high-tech projects, which
are likely to be more risky but also characterised by higher returns.

The following table gives the latest OECD figures (2006) for R&D spend as a percentage of GDP.

Table 1

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<th>2006 GROSS DOMESTIC EXPENDITURE ON R&amp;D (GERD)</th>
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<td>% of GDP</td>
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<td></td>
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<td>Australia</td>
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<td>United Kingdom</td>
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<td>United States</td>
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OECD in figures 2008,14 and OECD Science, Technology and Industry Outlook 2008, p 72
Setting Research and Funding Priorities: Evidence


Looking at the % of GDP classified as R&D is one way of comparing the relative priorities that different nations put on R&D. However it is also important to consider the absolute levels of expenditure. For example in 2006 the totals spent on R&D were:

<table>
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<th>Country</th>
<th>R&amp;D as %GDP</th>
<th>R&amp;D in MS*</th>
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<tr>
<td>Australia</td>
<td>1.8</td>
<td>11,510</td>
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<tr>
<td>Finland</td>
<td>3.5</td>
<td>5,516</td>
</tr>
<tr>
<td>France</td>
<td>2.1</td>
<td>33,737</td>
</tr>
<tr>
<td>Germany</td>
<td>2.5</td>
<td>56,595</td>
</tr>
<tr>
<td>Italy</td>
<td>1.1</td>
<td>17,076</td>
</tr>
<tr>
<td>Japan</td>
<td>3.4</td>
<td>120,156</td>
</tr>
<tr>
<td>Korea</td>
<td>3.2</td>
<td>33,773</td>
</tr>
<tr>
<td>UK</td>
<td>1.8</td>
<td>32,018</td>
</tr>
<tr>
<td>USA</td>
<td>2.6</td>
<td>404,662</td>
</tr>
</tbody>
</table>

* GDP taken from OECD figures, US$, constant prices, constant PPPs, OECD Base Year

For example:

UNESCO has published data that considers global R&D expenditure patterns, their summary table for the source of R&D funds in Europe is copied below, this shows that a higher proportion of R&D funding comes from business enterprizes in Germany, Sweden, Belgium, France, etc.


In his seminal paper published in 2004 Sir David King studied the scientific impact of nations. He concluded that:

*A strong science base need not lead directly to wealth generation. For instance, although the strength of the UK science base has long been acknowledged, it has only recently begun to translate this into the development of high-tech clusters accompanying knowledge transfer between higher education and industry. However, strength in science has additional benefits for individual nations, and for the world as a whole. From global terrorism and the spread of disease to the dangers of global warming, we are increasingly facing the sorts of threats for which governments everywhere will need to turn to their scientists.*

*(Nature, Volume 130, 15 July 2004).*

The UK has traditionally had strength in medical and pharmaceutical research. In a review of the future of research universities, Paul Horn, Senior Vice President and former Director of Research, IBM, Armonk, NY, USA, stated that:

*Developed countries around the world are facing the challenge of remaining competitive in an environment in which economies are becoming more knowledge-based. In such an environment you simply must be more educated to be competitive. This alone is a motivation for governments to fund universities. The best place for society to invest its money is in educating the next generation; that’s how you secure your future.*

*European Molecular Biology Organization EMBO Reports, Vol 8, No 9, 2007, p805–810*

With regard to the devolved authorities it would make sense for them to focus on areas where they have some potential in terms of developing new technologies and businesses. In Scotland there has been a clear focus on utilising their assets for renewable energy systems. However it is important that these efforts are co-ordinated across the UK so that we do not produce too many versions of the wheel! The successful funding of one marine energy system in Scotland has recently been announced:

*The company behind the Oyster wave-powered generator has raised £10m in its first round of fund raising. One of Aquamarine Power’s devices was recently installed at the European Marine Energy Centre in Orkney. It will be connected to the national grid as part of sea trials, with the first commercial wave-power station, scheduled to be ready in 2014. A further £40 million will be required to develop Oyster before it becomes commercially viable.*

http://news.bbc.co.uk/1/hi/scotland/8267492.stm

The development of prototypes and demonstrators in this area is expensive and it is important that where these have global potential the UK is able to identify opportunities and promote deployment—the UK missed the opportunity for “first mover” opportunity in the wind turbine business. Effective co-ordination across the Innovation Supply Chain’ (EPSRC, TSB and ETI with major energy producers, users and policy makers) will ensure that the UK can reap some rewards from the global markets for low carbon technologies. The company that developed the Oyster technology, Aquamarine Power has received significant funding and support from Scottish Enterprise, Highlands and Islands Enterprise, the Technology Strategy Board, the Royal Academy of Engineering, the Engineering and Physical Sciences Research Council (EPSRC) and the Scottish Government. The Scottish Government is showing leadership and strategy through their support in the development of Marine Energy (see their Marine Energy Roadmap, published in August 2009).\(^\text{103}\)

In Wales the Technium centres were founded in 2001. Technium is an environment where science and technology businesses can flourish—and turn their potential for high-growth into reality. They aim to help new and early-stage science and technology businesses overcome obstacles to success and provide an environment where they can prosper. They also act as a base for international companies looking for a foothold in the UK market.\(^\text{104}\)

Over the years Wales has been successful in attracting inward investment and a Japanese company, Sharp Manufacturing established a PV manufacturing facility in North Wales in 2004 and the OpTic Technium at St Atalphs is supporting R&D in the development of PV systems.\(^\text{105}\) The Welsh Assembly Government has also published a renewable energy strategy\(^\text{106}\) and Wales is backing up policy through the planning system having approved the development of the 750MW Gwynt y Môr off-shore wind farm.\(^\text{107}\)

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103 http://www.scotland.gov.uk/Publications/2009/08/14094700/12
104 http://www.optictechnium.com/
105 www.matuk.co.uk/docs/PV%20solar%20energy%20SJCI.pdf
106 http://wales.gov.uk/about/cabinet/cabinetstatements/2008/routemap/?lang=en
107 http://www.guardian.co.uk/environment/2008/dec/04/wind-farm-wales
setting research and funding priorities: evidence

This is supporting ambitious plans for renewable energy in Wales. The aim is to generate more renewable energy than the energy demand for the whole of Wales by 2020. They have also set a target for all new buildings to be zero carbon by 2011.\textsuperscript{108}

September 2009

Memorandum by Roche

Executive Summary

1. Roche welcomes the House of Lords Science and Technology Committee’s inquiry into science research funding priorities and the opportunity to contribute to it.

2. Roche’s submission will focus on the areas where we believe our experience as the world’s biggest biotech company gives us particular insight.

3. In answering the questions posed by the Committee, Roche’s submission will make four key recommendations:

   (a) Cuts to Research Council budgets will impact the whole biotech sector and must be resisted.

   (b) A strong focus must be maintained on the development and implementation of innovative technologies.

   (c) There is a need for stronger collaboration between government and industry. Specifically, the establishment of a Horizon Scanning Unit for Biotechnology would be a significant step forward. The work of the Office for Life Sciences, the Department for Business, Innovation and Skills and the Office for Strategic Coordination of Health Research must also be fully coordinated if research funding is to be spent effectively.

   (d) Barriers to further industry participation in research must be removed.

Introduction

About Roche

4. Headquartered in Basel, Switzerland, Roche is one of the world’s leading research-based healthcare groups in the fields of pharmaceuticals and diagnostics. As the world’s biggest biotech company and an innovator of products and services for the early detection, prevention, diagnosis, and treatment of diseases, the Group contributes on a broad range of fronts to improving people’s health and quality of life.

5. Roche is the world leader in in-vitro diagnostics and drugs for cancer and transplantation, a market leader in virology and active in other major therapeutic areas such as autoimmune diseases, inflammation and metabolic disorders. The group employs about 79,000 people around the world and operates in over 150 countries. Further information is available at www.roche.com

6. Roche invested almost nine billion Swiss francs in R&D in 2008. We are systematically using the growing understanding of the differentiated causes of diseases, of the varying individual characteristics of patients, and in particular of the human genome to develop personalised healthcare and are committed to the significant effort and investment that this requires.

7. Roche provides cutting-edge research equipment to the life science community, as well as novel treatments to patients. We have been at the forefront of innovation in this area for many years and have worked with research laboratories of all kinds.

Roche’s Submission

8. Roche’s submission will concentrate on three of the questions raised by the Committee in the terms of reference for this inquiry:

   — What is the overall objective of publicly-funded science and technology research?

   — How is publicly-funded research aligned and co-ordinated with research that is not publicly funded?

   — How can industry be encouraged to participate in research seeking to answer societal needs?

\textsuperscript{108} http://www.ibwales.com/business-sectors/sustainable-technologies/renewable-energy/
What is the overall objective of publicly-funded science and technology research?

9. Maintaining the UK’s global leadership in life sciences: The Government’s 18th annual edition of the R&D Scoreboard confirms that pharmaceuticals and biotechnology companies remain the biggest investors in R&D worldwide. The life sciences industry in the UK, which ranks second in the world after the US, has a vital role in driving growth and prosperity, as well as meeting key healthcare challenges. One of the key objectives of publicly-funded research funding must be to ensure that the UK remains a global leader in this area.

10. Genomics is one area where the UK has a unique opportunity to take such a leadership role. We hope that the Government will accept the Committee’s recommendation in its report earlier this year that a white paper on genomic medicine should be developed as a matter of urgency.

11. Resources are under serious pressure as a result of the current economic downturn. The 2009 Budget announced that £118 million of savings must be found through increasing the effectiveness of research activities funded by the Research Councils; an additional £106 million of savings must be found within the science and research budget to be re-invested to support key areas of economic potential. Furthermore, the Association of Medical Research Charities revealed in May that more than three quarters of its members fear that levels of charity research funding over the next two years will come under significant pressure as a result of the recession.

12. Any cuts to publicly-funded research budgets will have a dramatic impact on the whole biotechnology sector. This risks jeopardising the contribution that the life sciences industry currently makes to the UK’s economic competitiveness and to continued improvement in health and wellbeing.

13. Ensuring the development and implementation of innovative technologies: A second key objective for research funding must be the development and implementation of innovative technologies. Welcome progress has been made in this area through two main channels:

   — The Health Innovation Challenge Fund (HICF): the HICF will stimulate the creation of innovative healthcare products and technologies. We are very pleased that the Fund’s first theme is Advancing Genetic Discoveries into Clinical Practice, which is a key focus for Roche.

   — Academic Health Science Centres (AHSCs): through partnership between healthcare providers and universities, AHSCs will help promote the application of new discoveries in the NHS and beyond.

14. The NHS has a vital role in the uptake of innovative medicines and technologies, a key link in the chain from research to improved patient care. Array-Comparative Genomic Hybridisation (a-CGH), a technology that has changed the Cytogenetics landscape completely (further details are provided below), illustrates this point. The cost of a-CGH has decreased significantly over the last few years. At the same time, resolution and flexibility to detect CNVs have increased to ~500bp. While a-CGH is now being used extensively within the research community, it is not being used in the same way within the NHS, despite the impact it could have on patient care. We believe that the time has come to replace Karyotyping with a-CGH testing, and would urge all SHAs and PCPs to include provision for it in their Operational Plans and Local Development Plans for 2010–11.

Array-Comparative Genomic Hybridisation (a-CGH): The impact on patient care of moving from conventional to high-resolution genomic analysis

Scientific development in Cytogenetics is fundamentally changing the diagnostics landscape

Cytogenetics is the study of the whole genome for chromosomal abnormalities, their aetiology and risks. It investigates general phenotypic abnormalities such as mental retardation and developmental delay, dysmorphism, infertility and reproductive problems, as well as a range of congenital abnormalities. Cytogenetics investigates the presence of chromosomal abnormalities that are constitutional (germ-line) and acquired (somatic in cancer), and provides both diagnosis and prognosis.

The conventional technique for identifying the presence of gross chromosomal abnormalities is Karyotyping. Karyotyping has been used for several decades to identify chromosomal abnormalities in both germline and cancer cells. It allows scientists to visualise chromosomes and identify abnormalities in both number (aneuploidy) and structure. An example of the latter is trisomy 21 (Down’s syndrome), in which there is an additional copy of chromosome 21. The problem with Karyotyping is that the resolution of the image it produces is relatively coarse (the detection limit is 5–10Mb), which can lead to missed diagnoses.

The recent development of whole genome cytogenetic analysis by microarray technology—in the form of Array-Comparative Genomic Hybridization (a-CGH)—has changed the landscape completely. a-CGH measures DNA copy number variation between two genomes. Examples of DNA copy number variation
detectable by a-CGH include: Deletions (loss of genetic material) Duplications (gain of genetic material) and Translocations (a section of genetic material is moved to another part of the genome). In this way, a-CGH allows the detection of abnormalities not visible by eye.

The impact that a-CGH could have on patient care

The improved levels of detection available through a-CGH could have an impact on a huge number of patients. In the UK, 3.5 million people (one in 17 of the population) will be affected by a rare genetic disorder at some point in their lives. In 50–80 per cent of cases, the underlying genetic cause is currently unknown.

Future applications of the technology also include:

— Pre-implantation Genetic Screening for IVF. This will increase the chance of a successful pregnancy by identifying and selecting chromosomally normal embryos for implantation.

— Pre-natal screening. As one example of the benefits of pre-natal screening with a-CGH, 2–3 per cent of infants are born each year with mild to severe learning disabilities and visual birth defects, both of which are detectable through the new technology. A genetic diagnosis of this kind could be of great value to individuals and families, allowing optimal clinical management of the condition, genetic counselling and access to special needs.

How is publicly-funded research aligned and co-ordinated with research that is not publicly funded?

15. The need for stronger co-ordination: Much progress has been made in recent years to ensure co-ordination between Government and the life sciences industry. The Office for Life Sciences (OLS), with which Roche has been fully engaged, has played a particularly helpful role in facilitating co-operation. Further progress should also be achieved through the UK Life Sciences Super Cluster, announced in the OLS’s Blueprint, which will co-ordinate work across industry, Higher Education and the NHS.

16. There is a need to build on this work to ensure that the collaboration between government and industry continues to grow and develop. This will require the OLS, the Department for Business, Innovation and Skills and the Office for Strategic Coordination of Health Research to cooperate even more fully than they have up to this point.

17. Horizon scanning: The Medical Research Council’s (MRC) invitation in December for proposals for high-throughput sequencing hubs, and the £7.5 million in funding that was announced at the same time, was very welcome. It is vital that appropriate levels of funding are made available to allow British scientists to compete with those elsewhere in Europe in genomic research, and we are engaged with both the MRC and the Biotechnology and Biological Sciences Research Council (BBSRC) to ensure that they are aware of the work we are doing to develop new technologies in this area.

18. One option that deserves particular scrutiny, and that we have discussed with the MRC and BBSRC, is the establishment of a formal system for horizon scanning: a Horizon Scanning Unit for Biotechnology. This could be structured along the same lines as the successful National Horizon Scanning Centre for healthcare, and could provide advanced notice to the Research Councils and national policy makers of selected new and emerging health technologies that might require research funding. This would help the Research Councils to keep abreast of leading edge technologies, assisting with their planning and facilitate with the development of long-term strategies.

How can industry be encouraged to participate in research seeking to answer societal needs?

19. In the life sciences sector, industry is already investing huge amounts of money on R&D. Further investment will be stimulated by removing the remaining barriers that prevent companies seeing an appropriate return on investment.

20. Three such barriers were considered as part of Roche’s submission to the Committee’s inquiry into genomic medicine, and remain in place. They concern issues around pricing and reimbursement, the lack of incentives for companies to undertake further research into the existing pharmacopeia in order to stratify patient populations, and the lack of high quality clinical samples available for research purposes through biobanks.

21. Copies of Roche’s two submissions to the Genomic Medicine inquiry are enclosed for the sake of reference.
CONCLUSION

22. There is an urgent need to ensure that research funding in the UK remains at a high level, and that it is spent as effectively as possible. The temptation to cut Research Council budgets as part of a broader spending squeeze must be resisted, and a stronger focus must be given to the development and implementation of innovative technologies. At the same time, stronger collaboration between government and industry would help ensure that research funding is targeted in the most appropriate areas.

23. Finally, the current economic climate has emphasised the need to stimulate research funding from all available sources. In the case of the private sector, this will require the removal of the remaining barriers that exist to further industry participation in R&D.

24. We would be very pleased to clarify any of the points made or to provide further information on request. September 2009

Memorandum by the Roslin Institute

1. The Roslin Institute (www.roslin.ed.ac.uk) is a BBSRC Institute incorporated with the Royal (Dick) School of Veterinary Studies (R(D)SVS) of the University of Edinburgh. The Institute undertakes research within the framework of BBSRC Institute Strategic Programmes focussed on the health and welfare of animals, and applications of basic animal sciences in human and veterinary medicine, the livestock industry and food security.

2. In 2011, The Roslin Institute will be moving to a new £60.6 million research building, funded in large part by the BBSRC, on the R(D)SVS Easter Bush campus. As part of the redevelopment of the Easter Bush campus The Roslin Institute is seeking additional, phase II, funding in the region of £20–30 million. This funding will facilitate the construction of new state-of-the-art large animal and poultry facilities at Easter Bush as well as providing the potential to construct a veterinary clinical trials capacity and specialist laboratories to support animal science research. Through cooperation with EBRC109 partners, The Roslin Institute will also support construction of high level containment facilities in the Easter Bush precinct, to enhance the UK capacity to study infectious diseases that threaten food security. This expertise and facilities will place The Roslin Institute as a world leader in Animal Health research

3. The principal research objectives of The Roslin Institute are:

   — Improved animal health and welfare through knowledge of genetic factors affecting susceptibility and resistance to disease.

   — Improved sustainability of livestock production systems and food supply chains through an understanding the biological, economic, environmental and social factors that apply, and their interactions.

   — Translation of discoveries into veterinary clinical practice, and translation of veterinary clinical observations and opportunities into basic science discoveries.

   — Improved food safety based upon understanding interactions between disease causing organisms and animals.

   — Improved human health through an understanding basic mechanisms of health and disease through comparative biology of animal species.

   — the identification of new and emerging zoonoses and an improved understanding of how pathogens might cross from animals to humans.

   — Improved quality of life for animals by studying the mechanisms and behaviours associated with optimising their environment and life experiences.

4. This response to the Call for Evidence: Setting science and technology research funding priorities is on behalf of the research leaders at The Roslin Institute.

5. The Director of The Roslin Institute is Professor David Hume.

6. Please direct any contact to Professor Hume and Dr Patricia Hart, Scientific Administrator.

109 EBRC is the Easter Bush Research Consortium and comprises The Roslin Institute, the Moredun Research Institute, the clinical researchers of the Royal (Dick) School of Veterinary Studies and the Animal Science researchers of the Scottish Agricultural College.
QUESTIONS:
— What is the overall objective of publicly-funded science and technology research?
— How are public funds for science and technology research allocated? Who is involved at each level and what principles apply? Where appropriate, is the Haldane Principle being upheld?
— Are existing objectives and mechanisms for the allocation of public funds for research appropriate? If not, what changes are necessary?
— What governs the allocation of funding for Government policy-directed research through Government departmental and agency initiatives? Are existing mechanisms appropriate? What is the role of Departmental Chief Scientific Advisers?
— How are science and technology research priorities co-ordinated across Government, and between Government and the relevant funding organisations? Who is responsible for ensuring that research gaps to meet policy needs are filled?
— Is the balance of Government funding for targeted versus response-mode research appropriate? What mechanisms are required to ensure that an appropriate and flexible balance is achieved? Should the funding of science and technology research be protected within the Research Councils or Government departments? How will the current economic climate change the way that funds are allocated in the future?
— How is publicly-funded science and technology research aligned and co-ordinated with non-publicly funded research (for example, industrial and charitable research collaborations)? How can industry be encouraged to participate in research efforts seeking to answer societal needs?
— To what extent should publicly-funded science and technology research be focused on areas of potential economic importance? How should these areas be identified?
— How does the UK’s science and technology research funding strategy and spend compare with that in other countries and what lessons can be learned? In this regard, how does England compare with the devolved administrations?

GENERAL RESPONSE:
7. The preamble to this call for evidence takes the view that cuts in overall public spending must lead inevitably to “prioritisation” of research funding. The agenda would appear to be that cuts in research expenditure are also inevitable. The Roslin Institute believes that is precisely the wrong conclusion. Given the massive challenges facing humanity, and Britain’s current position of leadership in Life Sciences (including agriculture) research, and the withdrawal of both industry and charity from funding due to the economic downturn, Government funding needs to be protected and indeed increased. The US Government’s stimulus package and major investment by countries like China provide both the model and the threat. If Britain does not protect its investment in research, its economic future at this time is bleak.

8. Britain has long been acknowledged to be one of the world’s foremost pioneers in terms of invention and development in all the scientific disciplines. This has never been more so than today when the UK has a world class research base. Even though the UK represents only 1 per cent of the world’s population it undertakes 4.5 per cent of the world’s research and publishes 8 per cent of the world’s scientific publications.110

9. With the rapid expansion of the world’s population comes a series of issues and threats that must be addressed in order to sustain mankind and ensure its survival. Solutions are found in the diversity of the scientific disciplines, and often in marrying them together.

10. The strength of British research lies in its diversity and its capacity to solve problems through the application of basic science found in the rich knowledge base available through public funding. The objective of publicly funded science and technology research must be to maintain and advance Britain’s key role in developing a sustainable and healthy international population.

RESPONSE TO QUESTIONS
11. From The Roslin Institute’s perspective, research funds are allocated within the government departments between research councils and a number of knowledge transfer, innovation and skills related bodies. Funds are distributed in part in response to specific aims, goals and requirements and in part to fund so called “blue skies” research at the discretion of the various funders.

12. We have in recent months been happy to have had the opportunity to respond to consultations aimed at establishing where we believe funding appropriate to The Roslin Institute’s research should be directed and how it might best be allocated. We hope that close and independent analysis of the various consultation responses will take place to ensure that those responsible for allocating funds to the research community do so in the most efficient, practical and effective manner. It is important that the proportion of funding retained for reactive, policy-driven research is weighed up against funding for so-called responsive mode funding.

13. Economic stringency and the need for cuts cannot be the justification for directing a greater proportion of funding towards “targeted” research.

14. We consider it important to retain the capacity to provide reactive funding during crisis periods. Identifying criteria for deciding priority areas is an inherently complex process. Even within the relatively short term periods that funders allocate funds over, there may be a sea change in the UK’s priority areas depending on what issues may arise. Infectious disease outbreaks cannot always be predicted (for example the 1986 BSE crisis, 2001 FMD outbreak, or the 2009 swine flu) but they most certainly must be addressed urgently when they do. At such times, allocated funding should be safe from being redirected thus securing new and innovative projects.

15. The existing funding mechanisms are appropriate and work within the limitations of funding level. It is important that the boundaries between the different research council responsibilities are clearly defined however. For example, the recent consultation regarding the BBSRC’s proposed Strategic Plan (2010-2015) highlighted what appeared to be a significant overlap between what is currently funded by the MRC and what the BBSRC proposes to fund (Bioscience for Health). The “Health” seemed to be human health rather than animal health as has been previously part of the BBSRC’s remit whereas human health fell to the MRC.

16. In the event that there is a lack of distinction between the funding priorities of public funders, there is a danger that many important areas of science, key to the UK’s economy and scientific knowledge base (for example animal science) will find themselves in a funding no-man’s land.

17. There should be a research council available for every internationally competitive grant written, regardless of subject area.

18. The UK government funding can also be improved by expanding the relative support for people, rather than projects, for example by providing the highest achievers with career awards. It might also consider funding fellowships to attract the best young international talent to the UK.

19. When discussing the enhancement of national capability through major infrastructure and facilities it is important to note that not all capabilities are found within the government funded core Institutes. Many organisations of strategic value to the UK government are Institutes such as The Roslin Institute with their associated resources and infrastructure. Through the BBSRC, the UK government invested significant amounts of money in organisations such as The Roslin Institute and it is vital that the government should claim the infrastructure of The Roslin Institute as part of its national capability. For example, The Roslin Institute hosts ARK Genomics, which is a key genomics and bioinformatics centre open to all. Equally The Roslin Institute must also be considered when discussing centres for the study of infectious diseases of animals. The Institute has existing containment facilities for small animal, sheep and poultry-based studies. In addition to these facilities it has access to the high level containment facilities (small and large animal) based at the Moredun Research Institute. Once The Roslin Institute moves to its new, BBSRC-funded, building in 2011 its own small animal containment facilities will be state-of-the-art and access to the Moredun facilities will be more practical by virtue of geography.

20. One of the key areas in which the UK government can ensure the future success of UK science is through development of a clear, strong career development structure of up and coming scientists. It is incredibly important to support young scientists throughout their training and one obvious way of supporting this aim would be to fund postdoctoral trainees based on industrially linked projects. This provides “hands on” training in respect of the industry environment, leads to a broader learning experience and would fast track outcomes of research through to practical application.

21. A sudden cut in research funding, or a change in priorities, in response to the economic stringency has the associated risk that a generation of scientists unfortunate enough to graduate in the UK at this time will be lost to science, or will leave the UK, due to the lack of career opportunities.

22. When endeavouring to ensure the UK’s skills and capability are maximised it is important to ensure that recruitment numbers are appropriate and that the staff are retained in science. The career structure in science is uncertain through the necessity to work from grant to grant over three to four year periods thus offering no career security. It is all too easy for research staff to be lost through completion of funding. This can lead to loss of key staff from organisations and these staff may then, through necessity, have to leave science altogether; in such circumstances skills and training are wasted. The mechanism for improving this situation will be
developed by the funding agencies, but the UK government should be supportive of any changes made and accept that longer term funding commitments may be required.

23. Through the downturn, it is actually crucial to increase the number of fellowships available for those wishing to start up their own groups. Many talented postdocs leave science through lack of fellowship funding and the current system does not work for older postdocs. Greater flexibility in postdoctoral funding may enable retention of skilled scientists even if their first fellowship applications are not successful.

24. Maximum value from UK science funding would be easier to achieve if an improved interface was developed between funders, particularly in developing new funding initiatives on topical issues (e.g., influenza). Since research programmes also increasingly involve international partnerships, consideration should be given to developing initiatives jointly with other international funding agencies. For example, food security is very much an international issue and would benefit from international links. This was achieved with BSE and there is a joint funders initiative on avian flu. Key to such international liaison would be developing funding networks across the EU, with the United States and establishing links with countries such as China and India in advance of a likely expansion of their scientific research capacity.

25. From the perspective of Scotland based research organisations, such as The Roslin Institute, funding opportunities would be more effective if the UK funders and the Scottish Executive would work together to create increased opportunities for joint funding. The devolution issue has led to duplication and delay in decision making, especially in the agriculture and biotechnology-related research sectors.

26. It is crucial that there be a UK-wide science strategy that engages the devolved governments, especially in the area of food security where large infrastructure is required.

September 2009

Memorandum by The Royal Academy of Engineering, The Institution of Chemical Engineers, The Institution of Civil Engineers, The Institution of Engineering and Technology, Engineering Council UK and The Engineering and Technology Board (ETB)

The Royal Academy of Engineering, the Institution of Chemical Engineers, the Institution of Civil Engineers, the Institution of Engineering and Technology, Engineering Council UK and ETB are pleased to submit a joint response to the House of Lords Science and Technology Select Committee inquiry into “Setting science and technology research funding priorities”.

The response was formulated by consulting with experts in the field representing the membership of all the organisations listed above as well as building on the organisations’ previously expressed policy positions. It approaches the Committee’s questions from the point of view of the professional engineering community and, accordingly, concentrates on engineering research in particular and more applied research in general.

1. Introduction

1.1 There has been significant debate during 2009 over the potential impact of recession and the scale of public spending on stimulating the economy on the science budget in future years. In addition, there have been a number of high profile political speeches pointing towards a Government desire to see more economic benefit from research spending.

1.2 This response to the Committee’s call for evidence is based partly on work that the Royal Academy of Engineering carried out in partnership with the Royal Society and the British Academy, precipitated by Lord Drayson’s speech to the Foundation for Science and Technology on 4 February.

1.3 A speech by Rt Hon John Denham, MP, Secretary of State (DIUS), at the Royal Academy of Engineering on 19 February built on Lord Drayson’s speech by catalysing a debate about the balance of investment in science and innovation to favour those areas in which the UK has a clear competitive advantage. The Secretary of State also defined the nature of the debate as not whether a balance should be sought but how it should be achieved. The Prime Minister contributed to the debate with his Romanes Lecture in Oxford on 27 February, emphasising an increasingly economic role of scientific research as well as its potential contribution to tackling and mitigating climate change.

1.4 There appears to be a strengthening of the long-standing desire by Ministers to take advantage of a decade of investment in the science base by encouraging the commercialisation of the scientific ideas and concepts produced by it. All these political speeches to date on the subject have stressed that this vision is about reaping the benefits of research already funded and that the commitment to curiosity-driven research funding remains unaffected.
1.5 We believe that there will always be serendipitous economic benefit from some blue sky research conducted primarily for the purpose of the pursuit of knowledge and it is important to ensure that curiosity driven research remains healthy and attractive to new entrants. However, the scale of the challenges we face as a society and economy calls for much closer alignment of research with clear objectives and better processes for creating products and services from ideas. In general, there is a continuing funding gap from the point where research ideas move out of universities through to their becoming commercially-ready technologies that industry sees as sufficiently developed to take on. Translational research bridges the gap between pure research and applied research and much has been achieved to improve this transition, particularly in the biomedical fields. However, the bridge between applied research and commercially exploitable products and services remains weak. The same applies to research which supports existing UK industrial strengths.

1.6 Publicly funded research forms the basis of a particular innovation pathway and its success, or otherwise, should therefore be examined in the wider context of the UK’s success in generating wealth from scientific research. One of the biggest obstacles to getting innovation moving “up the chain” is the way the stock exchange and investment community behave with small and medium size technology companies in the UK. In the USA, where small companies routinely grow into big companies, this happens because of a more tolerant and supportive investment philosophy (coupled with easier flow of funds and Government support through schemes such as SBRI). This has never been the case in the UK and even Vice-Chancellors are focused on relatively short-term investments with IPO or trade-sale. Similarly, there can be a mismatch between the timescales in which investors require a return and the development period needed for the product whereas more US investors are prepared to take a longer view. These factors are probably a bigger issue than the university technology transfer gap which, in recent years, has improved greatly with the help of funds such as HEIF and the TSB schemes.

1.7 While our comments make generic points it is also important to note that innovation models can differ between engineering sectors. If Government’s overarching goal is to improve UK economic performance as part of an active industrial strategy which includes a strong connection with scientific research strategy, policy needs to be flexible enough to reflect these differences.

2. What is the overall objective of publicly-funded science and technology research?

2.1 The long-term overall objective should be to generate wealth and enhance the quality of life in the UK but the benefits should not be exclusively for the UK.

2.2 In order to achieve this long-term objective, there is a need to ensure that the vibrancy of the research base is maintained, that the pipeline of researchers can deliver the numbers and skills required and that world class research activities attract inward investment from international technology companies. As well as ensuring the supply and quality of researchers, it is the quality of the intellectual infrastructure within our universities and infrastructure that encourages international companies to wish to take advantage of it.

3. How are public funds for science and technology research allocated? Who is involved at each level and what principles apply? Where appropriate, is the Haldane Principle being upheld?

3.1 There should be at least two ways of allocating funds: a formula-driven allocation and a competition-driven allocation. The former is history orientated and provides for a stable research base which allows the free exploration of ideas. The latter funds specific projects which may be proposed in a response mode or as a result of managed programmes. Independent (ie non-governmental) Higher Education Funding Councils and Research Councils are best placed to administer both types of allocation.

3.2 There are many and varied interpretations of the Haldane Principle and these were exposed in the recent House of Commons IUSS Select Committee report “Putting Science and Engineering at the Heart of Government Policy”. All strict interpretations of the Haldane Principle, including the currently accepted interpretation from the 1993 OST White Paper “Realising Our Potential”, task research councils with day to day decisions on the scientific merit of different strategies and projects, but give a higher, overarching strategic role for government. Therefore, it can be argued that it is in fact observed.

3.3 In practice, the line between where government overarching strategy and research council decisions meet is ill defined and can lead to valid criticisms that the Haldane Principle is not always observed in spirit. Government priorities reflected in an overarching strategy will, inevitably, favour areas of research or inquiry

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111 http://www.publications.parliament.uk/pa/cm200809/cmselect/cmdius/168/168i.pdf
that chime more strongly with those priorities and there is nothing wrong with this, provided Government is open and takes responsibility for its directions. While there is stability, this may not present a problem either for government or researchers, however, political priorities are likely to change on a faster timescale than academic research priorities.

4. Are existing objectives and mechanisms for the allocation of public funds for research appropriate? If not, what changes are necessary?

4.1 The current system of funding research with some imposition of research themes appears to be fit for purpose, but there is no structured mechanism for feedback. The Research Councils are required to fund research which contributes to UK competitiveness and quality of life and while impact is assessed and reported on, particularly in the periodical international reviews of research sectors commissioned by Research Councils, there seems to be little assessment as to whether these are more likely to be achieved sponsoring research in, say chemistry than computer science. The establishment of priority research areas for the Research Councils in areas such as energy and living with environmental change are useful in supporting the general challenges of wider Government policy.

4.2 The mechanisms by which research funding is directed through the Research Councils to individual researchers or groups and the top-down imposition of research priorities work well and have the confidence of most researchers. However, some feel that the Research Assessment Exercise, administered by HEFCE to allocate block grant to universities in support of research infrastructure, has a strong distorting effect on the range and types of research carried out in the UK. It is asserted that this is because it is a competitive system between universities and could discourage collaboration between institutions even though collaboration is often sought and rewarded by the Research Councils and Regional Development Agencies. The replacement Research Excellence Framework will seek to address some of these perverse incentives, however, whatever system is ultimately put in place, universities will naturally attempt to maximise their funding by tailoring what they are assessed on to match assessment criteria.

4.3 The competitive “call for proposals” method is often useful but there are some instances where another method would be more suitable for use by research councils or TSB. For example, it should be possible to agree to co-fund company or university work where the company has already selected its preferred partner; or to scope out centrally what’s required and then go and commission/implement it, systematically, on the basis of an objective analysis of who is best placed to conduct the work.

5. What governs the allocation of funding for Government policy-directed research through Government departmental and agency initiatives? Are existing mechanisms appropriate? What is the role of Departmental Chief Scientific Advisors?

5.1 It seems appropriate that government departments should have budgets allocated to funding research addressed at specific policy issues within their portfolios. As the requirement in these cases is often assessments of existing knowledge, evidence and best practice designed to fill knowledge gaps in the understanding of individual departments and the maintenance of longitudinal surveys, government departments have been known to rely on consultants rather than engaging with the academic community.

5.2 The needs of individual departments for research differ greatly from department to department with some, such as the MoD, spending significantly more on research than others. The objectives also differ from research funded through the research councils and where research is commissioned to answer specific questions, the commissioning mechanisms are adequate. However, there is evidence that the level of technical understanding among the civil servants responsible for framing and commissioning departmentally sponsored research is generally low, leading to over-reliance on consultancies and a lack of critical judgement of the work delivered.

5.3 Coordination of science and technology research across HMG is one of the roles of the Government Chief Scientific Advisor (GCSA) and the Departmental Chief Scientific Advisors (CSAs), and is one of their priorities. The role and influence of Chief Scientific Advisors within departments is still evolving, faster in some departments than others. As yet, CSAs do not generally have effective control of departmental research budgets but do have the role of advising on the effectiveness and use of the research advice sought.
6. Is the balance of Government funding for targeted versus response-mode research appropriate? What mechanisms are required to ensure that an appropriate and flexible balance is achieved? Should the funding of science and technology research be protected within the Research Councils or Government departments? How will the current economic climate change the way that funds are allocated in the future?

6.1 The arguments about the balance of targeted versus response-mode research are often polarised, particularly when funds are tight. Arguably, the focus should be on research that addresses priority areas provided that those areas have been correctly identified. Priority areas can be funded through response-mode and managed programmes and in an ideal world, the two funding mechanisms should attract equal attention from researchers. The opportunity to support curiosity driven research that addresses the general themes of targeted programmes should not be ignored. It should be noted, however, that response-mode panel success rates are often less than 10 per cent while some managed mode programmes have success rates in excess of 70 per cent, indicating a general imbalance between the two modes. Whether this is a supply and demand side issue or an administrative issue is not clear.

7. How is publicly-funded science and technology research aligned and co-ordinated with non-publicly funded research (for example, industrial and charitable research collaborations)? How can industry be encouraged to participate in research efforts seeking to answer societal needs?

7.1 In the area of pre-commercial technologies, there are two forces at work. Researchers in universities are keen to push their technologies out of the lab and into the commercial world where they can become or contribute to commercial products. At the same time, commercial companies are looking for emergent technologies to fulfil particular needs. It is an area where solutions looking for problems and problems looking for solutions could be better managed to converge productively. Companies will not invest in ideas for which there is no market or the timing is not right.

7.2 If research with application to perceived societal needs is to be taken up by industry, research priorities need to be made with a much broader understanding of how industry makes its investment decisions. There would be significant value in the establishment of an office of technology assessment, drawing on the expertise in Government departments, the TSB and other bodies and industry to promote understanding of and provide advice and support for the productivity of UK based research and development activity. It would be important that this function were at the core of the responsible department so that its expertise is fully embedded in the policy-making process.

7.3 Official statistics show a real terms increase in industrial R&D expenditure in manufacturing 1999–2007. However, within that there were significant decreases in “electricity, gas and water supply” and associated “electrical machinery”, as well as “transport equipment”. There are concerns where issues associated with climate change might be expected to have some impact, indeed urgency. There are areas where regulations would have some influence, and indeed Ofgem have taken some action to encourage R&D expenditure, although it is unclear whether it has been effective. On the other hand, Ofwat seems to have ignored calls for action in their latest regulatory review despite responses to their consultation “setting Price Limits for 2010–15” from ICE and others arguing strongly for the regulator to allow increased R&D spending in the sector.

7.4 Industry, by and large, is well focused on the technologies it needs and wants to pull through. Academics, however, are less focused on the potential commercial uses of their discoveries. Efforts to improve the alignment of research priorities and industry needs therefore need to be fully informed by the industries and business sectors which seek to make use of and commercialise the fruits of academic research. Closer communication between stakeholders will help the alignment and coordination of the different research programmes. Better tax incentives could encourage greater industrial participation in research.

7.5 The Research Councils are engaging with industry and the professions to inform their strategy. However, it is too soon to assess the fruits of this and in the case of civil engineering it has revealed how difficult it is to produce a simple match between disciplines and expenditure; EPSRC’s definition of civil engineering is effectively structural and geotechnical engineering, although it is often funding research in a cross-disciplinary way, for example, by its Sustainable Urban Environments (SUE) programme. This multidisciplinary research has a significant relevance for civil engineering practitioners, and has led to successful industry-academic collaboration, but is not captured well by the sectorally driven definitions.

7.6 The 2008 EPSRC Review of the UK materials research base witnessed some excellent examples of collaboration between academics and industry. The report raised concerns that closeness of university research to industrial interests led to short term economic advantage but at the expense of universities being able to sustain longer term innovation at a time when globalisation is restricting the ability of businesses to do that. This created a paradox, which was best addressed by a university research portfolio that was balanced.

8. To what extent should publicly-funded science and technology research be focused on areas of potential economic importance? How should these areas be identified?

8.1 Economic impact is not the only kind of impact that publicly-funded science and technology research should generate. Beneficial social and environmental impacts are also of value and, indeed, are already acknowledged in the assessments which are now being made by the Research Councils, in agreement with the Treasury.

8.2 It is notoriously difficult to identify the potential impact of speculative, blue-sky scientific research carried out with the primary aim of the pursuit of knowledge. As research in particular areas or sectors becomes more applied, the potential uses of those discoveries become more apparent.

8.3 Areas of true economic potential become apparent from addressing a perceived need for a better or more efficient process or product and scientific ideas are then brought together once the problem has been defined. Business and industry are usually well equipped to identify and exploit such areas of potential economic impact for their own purposes. It therefore seems appropriate that areas of research with potential economic benefit should be identified by government in partnership with industry. However, some of the biggest economic impact areas are in the public sector or societal such as transport, defence, climate change and Government must have a role in identifying these.

8.4 In evidence gathered by the Stern Review the stark collapse in R&D funding (tenfold in the UK over 25 years) in the energy sector led to calls for a major ramping up of expenditure to address issues of climate change. Issues to do with differential in incentivisation to address differences in maturity of technologies, eg, onshore/offshore wind were raised, but have yet to be addressed. The scale of output of necessary low carbon technologies (twentyfold) requires an advanced skills base currently lacking.

8.5 However, in cases where the financial risk of investing in research outweighs the potential returns, mechanisms must be available for government to reduce risks through public funding. Mechanisms by which to achieve this de-risking are numerous and include the work of the TSB and various methods of supporting company R&D though UKTI programmes.

October 2009

Memorandum by the Royal Astronomical Society

The Royal Astronomical Society (RAS), founded in 1820, encourages and promotes the study of astronomy, solar-system science, geophysics and other closely related branches of science. The RAS organises scientific meetings, publishes international research and review journals, recognises outstanding achievements by the award of medals and prizes, maintains an extensive library, supports education through grants and outreach activities and represents UK astronomy nationally and internationally. The Society has more than 3,000 members (Fellows), including scientific researchers in universities, observatories and laboratories as well as historians of astronomy and others.

The RAS is pleased to offer the Committee written evidence on this important topic and would be happy to give oral evidence on request.

1. What is the overall objective of publicly-funded science and technology research?

The Society strongly endorses the vision for science set out in 2008 by the then Science Minister in the DIUS “Science and Society” consultation. We agree with the need for a society that is excited by science; values its importance to our social and economic wellbeing; feels confident in its use; and supports a representative well-qualified workforce. We would add the broad cultural value of science to this vision. Scientists endeavour in the broadest sense to establish our place in the Universe, whether in distant galaxies, the heart of the nuclei of atoms or the development of life. These endeavours are at the heart of public engagement with and enthusiasm for science.

Publicly funded S&T is required to meet these aims since other sources of funding, especially in the commercial sector, are tied to specific and usually shorter-term objectives. Through research which is not linked to near market outcomes, in addition to social and public benefits, there are longer term economic benefits from applications resulting from discoveries arising from fundamental research. The areas of science that will deliver these long-term benefits cannot reliably be predicted, so, because investment returns in any one area are highly unpredictable, governments must provide most of the funding. By the same token governments should avoid choosing which areas of basic science to fund on the basis of perceived or potential benefits; instead they should continue to rely on the traditional criterion of scientific excellence as judged by peers.
2. **How are public funds for science and technology research allocated? Who is involved at each level and what principles apply? Where appropriate, is the Haldane Principle being upheld?**

The Society does not wish to comment on the facts of the allocation process. However there is ongoing concern amongst Fellows regarding the way in which research funding is aligned (or not) to the Haldane Principle, particularly in light of the requirement to cite economic impact in applications for research grant funding from the Science and Technology Facilities Council (STFC). Some reassurance on this has been provided by senior staff in the Council, but it nonetheless seems to demonstrate that there is an erosion of scientific excellence as the highest priority in decisions on funding. There is also the argument that the apparently emerging “top down” approach to science funding is very much at variance with the classical Haldane Principle.

The RAS also urges the Committee to recognise the need to support long term large international consortia such as the Integrated Ocean Drilling Programme (for geophysics), the European Southern Observatory (ESO—a key astronomy facility) and space programmes. If the UK withdraws from these consortia because of funding constraints or related considerations, then the facilities themselves may be vulnerable and British scientists are likely to be denied access to the data they produce.

3. **How are science and technology research priorities co-ordinated across Government and between Government and the relevant funding organisations? Who is responsible for ensuring that research gaps to meet policy needs are filled?**

One specific area the RAS wishes to comment on is the funding of space activity. As a loosely defined partnership the British National Space Centre (BNSC) has not been an effective body in its promotion or coordination of this work. The RAS therefore believes that an independent space agency would be an appropriate response, provided it is not set up in a way that reduces funds that are currently directed towards research.

4. **Is the balance of Government funding for targeted versus response-mode research appropriate? What mechanisms are required to ensure that an appropriate and flexible balance is achieved? Should the funding of science and technology research be protected within the Research Councils or Government departments? How will the current economic climate change the way that funds are allocated in the future?**

Commenting on the overall balance in the science budget is outside of the remit of the RAS. However, we believe that the decision making process for that funding balance should be open and transparent and the reasoning behind the strategies adopted should be made public. The RAS endorses the key principles set out in Lord Drayson’s recent speech to the Royal Society and would suggest that what follows from those excellent principles is not that UK science investment should “favour those areas in which the UK has clear competitive advantage” but that it should favour those areas that are essential for the development of UK science and particularly those in which the UK needs to be competitive in the long term.

A healthy research base requires a balanced portfolio of investment, including adequate resources for pure, fundamental science. This certainly applies to astronomy and astrophysics, which is an area of enormous public interest (demonstrated by the global success of the current International Year of Astronomy), attracts young people at all levels into science (not just astronomy—direct evidence for this was supplied in the RAS contribution to the recent RCUK Review of UK Physics led by Professor Wakeham), draws on a wide range of scientific disciplines, has a superb record of technical innovation and, above all, is an area in which the UK continues to excel.

Geophysics, the other area of interest to the RAS, has a clear and direct impact on the UK economy in areas including mineral resources, energy supply, and mitigation of the effects of global warming.

The present economic climate is already having an impact on research activity. The recent detrimental shift in the sterling/euro exchange rate and change in Net National Income that together determine international subscription rates (for example to CERN or the European Southern Observatory) have had a direct and negative impact on the funds available for UK-based research at STFC and NERC, at least.

Looking forward, the RAS welcomes the decision of the Government to ring-fence the science budget but is concerned that this commitment may not last into the future. We urge the Government to continue to use scientific excellence as the principal consideration for decisions on research funding and to consult fully with the scientific community on the allocation of resources.
5. How is publicly-funded science and technology research aligned and co-ordinated with non-publicly funded research (for example, industrial and charitable research collaborations)? How can industry be encouraged to participate in research efforts seeking to answer societal needs?

Astronomy and space science attracts little non-public funding, although the Leverhulme Trust has given welcome support to planetary science.

In general, much geophysics research requires a very long term (multi-decadal, at least) view of global and local processes, which is unlikely to receive reliable support from charitable or industrial sources and so requires public funding. Some geophysics attracts industrial funding of research. The fiscal conditions under which oil companies may bid to exploit UK petroleum resources should encourage long-term funding. Some oil-industry funding has been long-term, for instance the Edinburgh Anisotropy Project, via a large consortium of oil-industry partners. Initiation and maintenance of such consortia is, though, a burden on the project scientists. Shorter-term projects such as the 2002 NERC Ocean Margins LINK programme provided welcome co-ordination of basic science and industrial interests in a strategic area in which the UK excels. Outside the oil industry, funding is closely tied to the immediate needs of the funders and is usually short-term, so academics have difficulty making an educational opportunity of it. Non-oil commercial geophysics enterprises have limited and unpredictable finances, often linked to tight-deadline civil engineering projects or minimum-cost efforts to comply with environmental legislation. Incentives to research in vital areas of environment and natural hazard must come from the government, via both regulatory conditions and targeted financial support, and with minimum bureaucracy.

The value of government-funded research by students is not just in the actual outcome but in the development of skills desired by the industry. The 2006 Khan Report into geophysics education found that employers valued twice as highly skills in theoretical and practical geophysics as “transferable” skills such as team working.

6. To what extent should publicly-funded science and technology research be focused on areas of potential economic importance? How should these areas be identified?

While it is HMG’s responsibility, following consultation with stake-holders including the scientific community, to set strategic priorities for science investment, we do not believe that an overly prescriptive top down approach will necessarily be effective in identifying research that will meet immediate economic goals. Funding scientific research is not like investing to win Olympic medals, where specific short-term objectives can be set and achieved. In contrast, science advances on a broad front and has indefinite horizons that require a long-term vision. Short-term strategies tend to be backward looking and targeted funding does not guarantee success when the goal is to be “ranked no 1 or no 2 in the world”.

The Society believes that it is better to concentrate on funding excellence and on ensuring that the funding is sufficient to achieve the ambitious scientific goals that should be set. We also draw the attention of the Committee to the economic impact of curiosity-driven research, where serendipitous discoveries are made that cannot be foreseen at the outset of these research programmes.

Former researchers use their training to contribute in many sectors of the economy. In a survey recently initiated by the Society, more than 80 former postgraduates in astronomy and space science came forward, explaining how their training has been of enormous benefit in their careers—from teaching and science communication to start-up software companies, defence, business consultancy, climate change research, medicine and finance.

Within the fields of astronomy and space science, the UK is a member of large international collaborations including the European Space Agency (ESA) and the European Southern Observatory (ESO). These give UK businesses access to worldwide markets at the cutting edge of technology. Examples include e2v Charge Coupled Devices (CCDs) and other imaging devices used by all major collaborations and space agencies (as well as in digital cameras and medicine), Surrey Satellite Technology and EADS-Astrium, a major global player in the world satellite business.

Data handling, storage, management and access are areas of growing importance in all fields, and astronomy is no exception. The international astronomical community is developing advanced tools through the Virtual Observatory (and the UK AstroGrid project) with the goal of making the world’s huge astronomical data banks transparently useable, in just the same way that the World Wide Web makes documents all over the world feel part of a single interlinked system.

In geophysics much of the technology used has an immediate economic and societal benefit. As well as the familiar examples of resource exploration and management, any geoengineering proposals (such as to mitigate climate change) will depend on the work of geophysicists.
7. How does the UK's science and technology research funding strategy and spend compare with that in other countries and what lessons can be learned? In this regard, how does England compare with the devolved administrations?

In the area of astronomy, space science and geophysics the UK has benefitted from increased investment over the last decade and took some positive steps such as joining ESO. However, in common with most other European states the UK investment in Research and Development is still well below the 3 per cent target set at Lisbon in 2007.

The last published guide to comparative expenditure in astronomy and space science was made by Woltjer in 2006 and suggested that the UK spent somewhat less on research in this area than France, Germany and Italy. However, it remains difficult to make confident international comparisons on investment, particularly by subject area, as the structure of funding bodies varies so much between countries. In the process of preparing evidence for the RCUK Review of Physics, the RAS contacted organisations including UNESCO and the OECD and was not able to obtain this information. The RCUK Review panel attempted to do this too and were also unsuccessful. It would be helpful for the Committee to pursue this line of inquiry so that in future sensible comparisons between nations can be made.

In comparing England with devolved administrations it would seem that the Scottish Government has been particularly pro-active in encouraging scientific research and generating new synergies amongst Scottish universities and research centres by establishing joint research pools such as ECOSSE (subsurface science and engineering); SCCS (carbon storage); SAGES (geosciences, environment and society) and SUPA (covering many areas of physics and astronomy).

September 2009

Memorandum by the Royal College of Paediatrics and Child Health

What is the overall objective of publicly-funded science and technology research?

1. We consider the overall objective must be the health and wellbeing of the nation. The “call for evidence” refers to science and technology, but much of what is important in health research also concerns social, psychological and quality of life issues. Many scientists may not consider themselves expert within these areas. Publicly funded science and technology research must include integration with social sciences research.

2. Basic or blue skies research is also clearly important, and in the health sciences, collaboration between investigators from across age domains (paediatric and adult) and between non-clinical and clinical scientists is crucial, though insufficiently promoted.

3. Applied health research should be prioritised to those areas which pose the biggest calls upon the NHS. In both basic and applied research, paediatric priorities are 1) Preterm birth (mechanisms, reduction and management of short and long-term sequelae), 2) Obesity (biological determinants and prevention), 3) Developmental origins of adult health and disease, 4) Child maltreatment (psychosocial determinants and prevention), 5) Young people and personal responsibility for health and wellbeing; better parenting, 6) Teenage cancer (age-specific therapies).

4. A life course approach to health and wellbeing is essential, though all too often policy is focused upon short term goals. The pressing health issues of our time require a cross-generational perspective.

How are public funds for science and technology research allocated? Who is involved at each level and what principles apply? Where appropriate, is the Haldane Principle being upheld?

5. The Haldane Principle has been seriously eroded. Allocation of public funds does not currently appear to be based on robust dialogue with scientists and other experts.

Are existing objectives and mechanisms for the allocation of public funds for research appropriate? If not, what changes are necessary?

6. No. Allocation of public funds must be balanced between basic and applied research; and rigorous assessment of need, feasibility and value for money. In relation to health sciences research, regular and timely consultation with the Royal Colleges would be informative. Paediatric health issues are a major determinant of the health of the nation; children comprise some quarter of the UK population, yet research directed at infant, children’s and young people’s issues attract a disproportionately small proportion of total science and technology funding.
What governs the allocation of funding Government policy-directed research through Government departmental and agency initiatives? Are existing mechanisms appropriate? What is the role of Departmental Chief Scientific Advisers?

7. Funding through Government departments and agencies often arises late in the financial year without wide consultation or an open, well publicised call. Research specifications are frequently less than precise, with little opportunity for methodologically detailed submissions, and consequentially, weak outputs that provide poor value for money.

How are science and technology research priorities co-ordinated across Government, and between Government and the relevant funding organisations? Who is responsible for ensuring that research gaps to meet policy needs are filled?

8. Co-ordination of health research between different arms of Government and different agencies is fragmented.

9. There is poor recognition of the need for infrastructure development, particularly in the health services; development, eg of robust infection surveillance, or other population based outcomes, is often the essential first step upon which further research (eg randomised trials, assessment of need, epidemiological inference) relies. Yet because such development is not a tangible output, the need to resource it frequently goes unmet.

10. It is by no means the case that research gaps to meet policy needs can necessarily be met through targeted funding. The role of Government must be to provide clear evidence of research gaps; the role of scientists and health service researchers is to evaluate whether targeted funding in specific areas is likely to be both successful and cost effective.

11. The Boards of the MRC and NIHR remain disproportionately representative of adult health research to the detriment of paediatric priorities.

12. The Office for Strategic Coordination of Health Research (OSCHR) though successful in several respects, has not helped redress the disparity in paediatric funding.

Is the balance of Government funding for targeted versus response-mode research appropriate? What mechanisms are required to ensure that an appropriate and flexible balance is achieved? Should the funding of science and technology research be protected within the Research Councils or Government departments? How will the current economic climate change the way that funds are allocated in the future?

13. The idea that governments or national committees can “manage” or “co-ordinate” research is not well evidence based in biomedical research. Unlike nuclear fission or the race to the moon, many important advances in biomedicine have been initiated by individuals or small groups of researchers following self-initiated goals. This is true of penicillin, the double helix and in vitro fertilisation. Within neonatal medicine virtually all important advances have come from small research groups (eg prenatal steroids, respiratory support, surfactant, hypothermia, phototherapy) and not as a consequence of targeted research. These important advances have been driven by investigators who perceived the need, the gap in knowledge, and worked, often with limited resources, to answer important questions leading to therapeutic advances. Thus the “targeted” mode of funding has been very little help in paediatrics.

How is publicly-funded science and technology research aligned and co-ordinated with non-publicly funded research (for example, industrial and charitable research collaborations)? How can industry be encouraged to participate in research efforts seeking to answer societal needs?

14. The implication that science and technology research should be linked to industry, including the pharmaceutical industry, puts children at a major disadvantage because serious illness in children is much less common than in adults and therefore is not of interest to firms who need a huge global market to justify the costs of product development. Furthermore, the regulations governing the conduct of research have been written assuming the resources of large commercial organisations. The resultant high costs limit research in paediatrics where traditionally funding has come not from industry, but from specialist charities. Recent incentives to paediatric drug development have had only limited impact on the totality of the poor evidence base of paediatric practice.

15. When politicians consider finance, science, technology and industry, they tend to think of opportunities for business to make money and not of the economic advantage of preventing disability and ill health. The annual research budget for new projects for the two major UK paediatric research charities is about £4 million which is the lifetime cost of one child with severe cerebral palsy.
To what extent should publicly-funded science and technology research be focused on areas of potential economic importance? How should these areas be identified?

16. If economic importance is defined in terms of life-long costs and benefits, paediatric research has been woefully neglected.

How does the UK’s science and technology research funding strategy and spend compare with that in other countries and what lessons can be learned? In this regard, how does England compare with the devolved administrations?

17. Other countries (e.g., the USA, Germany) have prioritised paediatric research. The US Congress initiated development of priorities for the Department of Health and Human Services (2009) includes paediatrics. The UK has not prioritised paediatric research needs. This is not to say that the UK research community does not provide value for money. Despite considerably lower health research funding in relation to the US, the UK punches well above its weight.

**September 2009**

**Memorandum by the Royal College of Physicians**

The Royal College of Physicians (RCP) plays a leading role in the delivery of high quality patient care by setting standards of medical practice and promoting clinical excellence. We provide physicians in the United Kingdom and overseas with education, training and support throughout their careers. As an independent body representing over 20,000 Fellows and Members worldwide, we advise and work with government, the public, patients and other professions to improve health and healthcare.

1. **Summary**

1.1 The College is pleased to contribute to this inquiry. We believe this to be an important moment for NHS-based research, much of which contributes markedly to academic medicine, and to the home grown pharmaceutical innovation upon which improved patient outcomes, and the UK’s balance of trade substantially depend.

1.2 There has never been more investment, stronger scientific leadership and greater political support for the biomedical research community than at any other time in recent history. However UK-based clinical researchers are still hampered by a lack of muscular research leadership within the NHS—clinically and managerially, along with a culture of mistrust that can militate against fruitful partnership across sectors. This submission elaborates on those two key points.

2. **How are science and technology research priorities co-ordinated across Government?**

2.1 The 2006 *Best research for best health* strategy promised a great deal: planned integration with other systems and providers (universities, research funding bodies etc); more money for research; reduced red tape and more appropriate governance systems; and improved management of knowledge resources through the creation of the single IT system and the planned national electronic patient record system. All were features that welcomed.\[115\]

2.2 Three years on, progress is inevitably mixed. It appears that the creation of a single health research budget has helped to create a framework which means that partnerships among clinical research groups that stretch across universities, NHS organisations and the pharmaceutical industry are no longer uncommon (though there is evidence that such relationships can be strained).\[116\] However feedback from our Academic Medicine Committee also suggests that the Medical Research Council Boards have not become more representative of the broad spectrum of health research. It is too early to tell whether the creation of the Office for Strategic Coordination of Health Research (OSCHR) will improve the situation.

2.3 More positively however, it does not appear that BRBH, and its successor strategies have led, institutionally speaking, to a concentration on research that is politically (but not scientifically or clinically) attractive. This was one of the main concerns at the time of its launch.

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3. How is publicly funded research aligned and co-ordinated with research that is not publicly funded? How can industry be encouraged to participate in research seeking to answer societal needs?

3.1 Today, the NHS, academic medicine and the pharmaceutical industry have a symbiotic relationship. Each depends on the others for success. The concept that links all three entities is innovation: creating new ideas and new medicines, translating and implementing research findings, and finding new ways of working to enhance patient care, patient outcomes and patient satisfaction.

3.2 Meetings in 2005 between the RCP and pharmaceutical industry representatives identified several factors critical to the future of the pharmaceutical industry and to pharmaceutical research in the UK. Among other things, these included the need to create new partnerships between industry, academia, clinicians and the public, the need to improve engagement in “grass roots” pharmaceutical research, and the need to address education and training issues at medical student and junior doctor level. In an attempt to confront these and associated matters more formally, the College convened a Working Party with a remit to review partnerships with industry.

3.3 The RCP Working Party met representatives from the largest pharmaceutical companies in the UK on several occasions. The messages we heard were clear and stark. There had been a palpable fracture in the relationship between industry and medicine in recent years. The government’s decision to reopen negotiations on the Pharmaceutical Price Regulation Scheme (PPRS) in the middle of an existing five-year agreement, following a critical 2007 Office of Fair Trading report, created unwanted instability for companies deciding where to locate future research investments.

3.4 It was also claimed that the UK’s competitive advantage in clinical research has been lost, partly because other countries (Russia, Poland, India, China, Turkey) have caught up with the UK, and partly because the UK has created an often adversely bureaucratic (slow, expensive and unreliable) environment to conduct research. In written evidence provided by GlaxoSmithKline, for example, we were told that the NHS and academia remained “ambivalent” towards working with industry. Clinicians too often displayed “suspicion” about industry activities.—Phase II and III clinical trials being viewed as inferior to other fields of academic research.

3.5 Although the view that the pharmaceutical industry is losing its innovative edge does not stand up to careful scrutiny,117 the unhappy and unproductive polarisation that currently exists between the pharmaceutical industry and the NHS is not helpful for patients or the public. Companies assertively defend their commitment to innovation, research and development, excellence and the contribution they make to the public’s quality of life. Some critics, including some doctors, prefer to portray industry as being concerned only with excessive profit, corporate exploitation, overpricing, secrecy and too much power. We need a new covenant between industry, the NHS and academic medicine to take us beyond these caricatured positions.

3.6 The first step is admitting that there has been a lack of productive strategic dialogue between the parties. In the research sector, the UK government has done a great deal to try and remedy this. The DH’s Research and Development Directorate which leads policy development in this area and, together with the NIHR (created after the publication of *BRBH*), is creating a better environment to foster collaboration—for example, through the UK Clinical Research Networks. But there remains some way to go to achieve culture change. Instead of being defensive about collaboration, all actors should be more confident about cooperating. The evidence we received led the Working Party to recommend the following (we believe they are pertinent for your own deliberations):

- NHS leaders, regulators, research funders, industry and academia must endorse and encourage more strongly and publicly a research culture in the NHS that is centred on improving the quality of patient care.

- Every NHS and primary care trust should have a designated “research champion” on its board. This individual’s objective would be to advocate for research within their organisation and to encourage a culture where research is fruitfully and productively completed, including with industry.

- The MRC and the Economic and Social Research Council (ESRC) should join together to fund the monitoring of outputs from different research funding models, especially those with industry, in order to optimise conditions for research and development of new medicines to fulfil unmet clinical need.

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Memorandum by the Royal National Institute for Deaf People

1. We’re RNID, the charity working to create a world where deafness or hearing loss do not limit or determine opportunity, and where people value their hearing. We work by campaigning and lobbying, raising awareness of deafness and hearing loss, promoting hearing health, providing services and through social, medical and technical research.

2. There are more than nine million people in the UK who are deaf or hard of hearing; this means that one in seven people in Britain have some sort of hearing loss. This number will continue to rise as the “baby boomer” generation begin to pass the age of 60. There are around 50,000–70,000 British Sign Language users.

3. Hearing loss and deafness is usually measured by finding the quietest sound someone can hear using tones with different frequencies—which are heard as different pitches. Using this test we break deafness down into four categories:
   - Mild Deafness—those who have some difficulty in following speech, mainly in noisy situations,
   - Moderate Deafness—those who have difficulty in following speech without a hearing aid,
   - Severe Deafness—those who rely a lot on lipreading, even with a hearing aid, and
   - Profound Deafness—those who are profoundly deaf and who communicate by lipreading or by use of BSL.

What is the overall objective of publicly-funded science and technology research?

4. The overall objective of publicly-funded science ought to be to improve quality of life through technological advances and improved healthcare. Research can benefit the economy by lowering healthcare costs and strengthening business.

Are existing objectives and mechanisms for the allocation of public funds for research appropriate? If not, what changes are necessary?

5. Existing objectives and mechanisms for allocating public research funds currently favour areas with a high critical mass of researchers. In medical research these tend to be areas associated with high rates of mortality (eg cancer and cardiovascular disease). Conditions associated with low mortality rates, yet high levels of disease burden are often neglected.

6. Hearing loss is a prime example of this. It affects nine million people within the UK and, with an ageing population, is projected to be one of the top 10 leading causes of disability adjusted life years (DALYs) globally by 2030. Already, hearing loss is estimated to cost the UK economy £13 billion in lost earnings. However, despite this significant economic and social burden only about 1 per cent of the Medical Research Council’s (MRC) budget was directed towards hearing research in 2007–08.

7. More needs to be done to prioritise medical conditions associated with high levels of disease burden, particularly those currently being under funded. Initiatives to build critical mass in research should be directed towards these areas to ensure that they can compete effectively for funding in the future.

8. Eligibility criteria for public research funding needs to more actively encourage participation by large charities. Large charities are often not eligible for UK public research funds or full European funding at the same level as universities or smaller companies because they are not designated as research organisations or Small and Medium Enterprises (SME). However, large charities often have in-house research groups able to undertake research projects of national interest or external research partnerships with academics that can deliver substantial research agendas.

How are science and technology research priorities co-ordinated across Government, and between Government and the relevant funding organisations? Who is responsible for ensuring that research gaps to meet policy needs are filled?

9. A major problem in the UK is the lack of academic clinical researchers linked to basic research departments to drive translational research. This is a particular issue for hearing research. The establishment of the Office for Strategic Coordination of Health Research (OSCHR) provides an excellent opportunity to better coordinate basic and clinical research, and we welcome initiatives from the National Institute for Health Research (NIHR) to strengthen clinical research, eg the UK’s first Biomedical Research Unit in Hearing, which opened in 2008. However, it is vital that such initiatives are built upon and expanded.

119 Evaluation of the social and economic costs of hearing impairment. October 2006, Hear-it AISBL.
10. Many areas of medical research are multidisciplinary, yet the existing units tend to have a narrow research focus. For example, the Biomedical Research Unit in Hearing is focussed on the auditory brain with no provision for molecular or pharmacological approaches to tackling hearing loss. The Government must continue targeting funding at under resourced areas of clinical research.

How is publicly-funded science and technology research aligned and co-ordinated with non-publicly funded research (for example, industrial and charitable research collaborations)? How can industry be encouraged to participate in research efforts seeking to answer societal needs?

11. The UK’s reliance on charitable funding to support national medical research is far too high and needs to be addressed. The Wellcome Trust funds around £600 million worth of medical research each year, which is comparable to the MRC’s total annual budget. The British Heart Foundation invested £72.3 million in research in 2007–08, almost four times as much as the MRC’s spend on cardiovascular research.

12. This reliance on charitable funding to complement core public funding makes it difficult for researchers investigating diseases and conditions which are not traditionally supported by large medical research charities. For example in 2008, the UK’s hearing research charities spent only 15p on research for every person with hearing loss compared to £29 by the British Heart Foundation for every person living with heart disease and £166 spent by Cancer Research UK for every person living with or beyond cancer.

13. This situation is exacerbated for conditions such as hearing loss, where there is lower public awareness of the impact that medical research can have compared to life threatening conditions such as heart disease and cancer. In the last five years RNID has had to turn down 73.4 per cent of the good applications for research funding that we have received, as we are unable to provide the over £9.5 million that this research required. See appendix A for more information.

14. For such neglected areas, public funding bodies need to work in partnership with relevant medical research charities to build capacity and provide an overarching funding strategy to develop new therapies. It should not be left to the voluntary sector to support research that will underpin the future health and economic prosperity of the nation.

15. The UK’s pharmaceutical industry invests around £3 billion a year on Research and Development and plays a key role in the translation of basic research into medicines to benefit society. However, there are few incentives for the pharmaceutical and biotechnology sectors to invest in new streams of Research and Development, where the markets are not yet established. Commercial entities tend to avoid unproven markets that carry with it a perception of high risk, yet it is precisely these markets that offer the greatest societal need as there are simply no real treatments available. Public funding needs to be better aligned to support translational research that is perceived as too risky for commercial investors.

16. Government-backed initiatives to encourage industry into neglected areas of healthcare Research and Development are also needed. RNID has researched and published a series of market reports on different types of hearing loss that provide companies with essential information on market size, segmentation, value, and background biology. These reports have been extremely helpful in promoting hearing loss as a viable market to investors, pharmaceutical and biotech industries. By working with patient groups representing neglected areas and market research organisations the Government could support the production of such reports to encourage commercial investment in research into neglected conditions.

September 2009

120 Good applications are defined as receiving an average peer review score of four or higher on a scale of 0–6 during our external peer review process, where four is defined as “good, with some original and timely research that will be conducted in a scientifically robust way. Outcomes will be of some interest to the field.”
APPENDIX A

GOOD* RESEARCH FUNDING APPLICATIONS THAT RNID HAS BEEN FORCED TO TURN DOWN

Figure 1

TOTAL APPLICATIONS FOR RESEARCH FUNDING RECEIVED BY RNID, GOOD APPLICATIONS* RECEIVED, APPLICATIONS FUNDED AND GOOD APPLICATIONS* REJECTED SINCE 2005

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<th>Good Applications*</th>
<th>Funded</th>
<th>Good* rejected</th>
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Figure 2

VALUE OF TOTAL, GOOD* AND ACCEPTED FUNDING APPLICATIONS RECEIVED BY RNID FOR EACH YEAR 2005–09

![Graph showing total applications, good applications, and funded applications from 2005 to 2009.](image-url)
Figure 3

OVERALL VALUE OF TOTAL, GOOD* AND ACCEPTED FUNDING APPLICATIONS RECEIVED BY RNID SINCE 2005

* Good applications are defined as receiving an average peer review score of four or higher on a scale of 0–6 during our external peer review process, where four is defined as “good, with some original and timely research that will be conducted in a scientifically robust way. Outcomes will be of some interest to the field.”

Memorandum by the Royal Society of Chemistry

SUMMARY

1. The RSC would like to highlight the following points:
   - The key objectives of publicly-funded science and technology research are to produce high-quality, innovative research which contributes to the advancement of fundamental knowledge and facilitates the comprehensive training of scientists and engineers.
   - The RSC believes that the appointment of Chief Scientific Advisers should be extended to all departments to ensure evidence based policy-making throughout Government.
   - Funding of blue-skies research must be maintained even where the short-term economic benefit of research is not obvious. The breadth of science and technology research will be compromised if too much emphasis is given to short-term goal orientated projects at the expense of blue-skies research.
   - The RSC recommends that funds within the science budget should be ring-fenced specifically for curiosity-driven research and that this should not be adversely affected by economic conditions.
   - The RSC advocates collaboration within the EU in order to remain competitive in the international arena.

INTRODUCTION

2. The RSC welcomes the opportunity to comment on the House of Lords Science and Technology Committee inquiry into Setting science and technology research funding priorities.

3. The RSC is the UK Professional Body for chemical scientists and an international Learned Society for advancing the chemical sciences. Supported by a network of over 46,000 members worldwide and an internationally acclaimed publishing business, our activities span education and training, conferences and science policy, and the promotion of the chemical sciences to the public.

4. This document represents the views of the RSC. The RSC’s Royal Charter obliges it to serve the public interest by acting in an independent advisory capacity, and we are happy for this submission to be put into the public domain. Our response focuses on five key areas.
Setting Research and Funding Priorities: Evidence

What is the overall objective of publicly-funded science and technology research?

5. The RSC believes that the key objectives of publicly-funded science and technology research are to produce high-quality, innovative research which contributes to:
   — the advancement of fundamental knowledge; and
   — facilitating the comprehensive training of scientists and engineers who will in turn contribute to society by increasing economic competitiveness, and the effectiveness of public services, thus increasing the overall quality of life.

A suitable balance of funding between applied and curiosity-driven research is crucial to ensure a strong research base, and accordingly funding for “blue-skies” research must be maintained. The RSC asserts that increased interdisciplinary research and international collaboration will further strengthen the research base, and will enable the UK to provide a number of centres of excellence in Europe.

What governs the allocation of funding for Government policy-directed research through Government departmental and agency initiatives? Are existing mechanisms appropriate? What is the role of Departmental Chief Scientific Advisers?

6. The RSC commends the appointment of Chief Scientific Advisers to many Government departments to encourage the use of evidence-based policy making and believes that science should be embedded in all Government departments by the appointment of Chief Scientific Advisers in every department.

7. The RSC supports the application of the Haldane Principle in research funding. The Haldane principle is increasingly under threat for example by the establishment of numerous cross research council initiatives which influence how the budget is distributed; the RSC believes that this principle, by which scientists determine how research funds are spent, must be preserved. In the case of curiosity driven research, scientists remain in the best position to determine the detailed research agenda through the established method of peer review. Government needs to recognise that no direct economic benefit may be identifiable for blue skies research in the short and medium term. However, funders and the research community should not lose sight of the fact that any publicly funded research will help to improve the knowledge base and also serve to train researchers, which in itself will have a positive economic benefit.

8. The RSC acknowledges the need for scientists in receipt of public money to be accountable and for their research to be seen as working for the benefit of the public and society, however the temptation for Government to direct an increasing proportion of the science spend into areas which appear to give short term benefit should be resisted.

Is the balance of Government funding for targeted versus response-mode research appropriate? What mechanisms are required to ensure that an appropriate and flexible balance is achieved? Should the funding of science and technology research be protected within the Research Councils or Government departments? How will the current economic climate change the way that funds are allocated in the future?

9. The RSC believes that a balance in public-funding between applied and blue skies research is of the utmost importance in ensuring a strong research base. The RSC is concerned that if too much emphasis is given to short-term goal orientated projects, the breadth of science covered by curiosity driven research will be compromised. It is vital that public funding provides support for research that would not otherwise be carried out in industry, and thus acts to ensure a flow of new ideas.

10. There are many examples of curiosity driven research in the chemical sciences that have led to economic strengthening, and provide a strong justification for the continued support of basic research, including several well known cases that are still of considerable economic significance:
   — The chance discovery of liquid crystals in the 1880s, has led to significant advances in the technology behind television and computer displays. In 2008 the sale of liquid crystal display (LCD) televisions surpassed the sale of cathode ray tube (CRT) units.
   — The foundations for the invention of light amplification by stimulated emission of radiation (LASER) were laid in 1917; however application was not immediately obvious. In the last 50 years lasers have become a multi-billion dollar industry with applications ranging from optical storage and fibre-optic communication, to laser printing and barcodes.
   — Rapamycin was originally developed as an antifungal agent before its properties as a potent immunosuppressant were realised.
   — The serendipitous discovery that acetanilide possesses analgesic and antipyretic properties led directly to the development of Paracetamol.
11. The RSC acknowledges and supports the initiatives in place to promote innovative basic research within the research councils, for example the EPSRC sandpits, and urges Government similarly to ensure that a specific amount of money is set aside to facilitate basic research.

12. The RSC commends the Government for having ring-fenced the science budget, and further recommends that funds for blue skies research should be protected within the science budget to ensure that such funding remains significant irrespective of economic conditions. It is particularly important, given the recent fiscal downturn, that the amount of funding devoted to blue skies research is maintained. Given that Research Councils do not maintain budgets for applied and blue skies research it may be necessary to ask the Research Councils to estimate the balance of spending between the two areas, possibly by classifying individual funded projects. Applied science and technology research is by its very nature responsive to current scientific challenges. These challenges dictate short and medium-term goals with the aim of strengthening the economy in the relatively near future. Curiosity driven research is a longer-term goal, with less obvious immediate benefit; it is important that it should not be neglected especially given the current economic climate.

13. Each stage of the research process, from blue-skies ideas to final production, requires funding. The Science and innovation investment framework 2004–14 identified a target of 2.5 per cent of GDP by 2014, while the Lisbon Strategy set a target to boost research development across Europe to 3 per cent of GDP by 2010. In order to meet these targets, the research funding contribution made by industry will need to be increased. Given the necessary involvement of industry in the R and D process, to convert ideas into tangible products, the most significant contribution from industry will be in applied research. This requires blue-skies research to be funded by the Government science budget. The more ideas investigated in the preliminary stages, through blue-skies response-mode research, the more ideas that will filter through to industry and eventual commercialisation.

To what extent should publicly-funded science and technology research be focused on areas of potential economic importance? How should these areas be identified?

14. The fact that science and technology will be instrumental in tackling global challenges is exemplified by the research conducted by Norman Borlaug, the American agricultural scientist who died recently, who won the 1970 Nobel Peace Prize for developing high-yielding crops. It is estimated that this technology saved the lives of over 245 million people world wide by averting a predicted international crisis in food production.

15. The advancement of fundamental scientific knowledge through support for excellence in science and technology research is vital in order to increase the number of future technological breakthroughs, and interdisciplinary research in particular should be encouraged to maximise this advancement.

16. A recent publication by the RSC presents the key areas in which the chemical sciences can support society in the changing world.121 The key areas were identified by over 150 experts, together with representatives from the wider community. The report presents 41 significant challenges that will need to be addressed through scientific research. To achieve the breakthroughs necessary to meet the challenges and drive innovation, a long-term commitment to areas of underpinning science, including analytical science, catalysis, chemical biology, materials chemistry and synthesis is required.

How does the UK’s science and technology research funding strategy and spend compare with that in other countries and what lessons can be learned? In this regard, how does England compare with the devolved administrations?

17. Science and technology within the UK is recognised throughout the world as being at the forefront of research. The International Review of Chemistry conducted by the EPSRC in April 2009 described UK chemical research as “World Class and World-leading in many fields”.122 The UK’s approach to stimulating innovation is more mature and superior to that of most countries, with schemes like the Foresight programme, which aims to bridge the gap between long and short term priorities, and establish the key areas of importance for funding in the future.

18. A key improvement recommended by the International Review, was to ensure an open dialogue between research funders and the research community to review the balance of funding.

19. In recent months several countries have announced their commitment to increasing funding for science and technology, including the USA (3 per cent of GDP), Japan, Sweden, Switzerland and Australia. The Lisbon Strategy, which aims to make Europe the “most competitive and dynamic knowledge-based economy in the World,” set a target to boost research development to 3 per cent of GDP by 2010. The Science and innovation investment framework 2004–14 emphasised the importance of harnessing innovation in Britain to improve the country’s future wealth and creation prospects. The RSC believes that the commitment to

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122 EPSRC International Review of Chemistry, April 2009.
investment set out in the investment framework should not be jeopardised by the current economic climate. Indeed it is vital that investment in science and technology is maintained so that Britain is well placed as the economic climate improves. The RSC also recommends that collaboration within the EU should be encouraged in order to remain competitive in the international arena.

20. A fundamental difference in the funding strategies between England and the devolved administrations is the existence of multiple regions compared with single regional bodies in Wales, Scotland and Northern Ireland. The inconsistencies observed in different regions within England is an issue that needs addressing, and while the RSC believes that regional needs must be served with relevant regional policies, it is important that this is monitored centrally to ensure consistency and quality control. An evidence based approach to policy-making should be applied in all cases, throughout central Government, devolved authorities and the Regional Development Agencies (RDAs).

October 2009

Memorandum by the Russell Group of Universities

The Russell Group is an association of 20 major UK research-intensive universities. Collectively Russell Group universities receive around two thirds of Research Council grant income and QR funding123 and the 2008 RAE showed that nearly 60 per cent of the world-leading 4* research was undertaken in Russell Group universities. Russell Group universities also educate around 308,000 FTE undergraduates each year in a research-led teaching environment and support around 60 per cent of the UK’s PhD students.

Russell Group universities are international institutions, whose research and teaching has a major impact on the UK economy. Russell Group universities;124

- Have an estimated total economic output of £25.3 billion per annum
- Are responsible for supporting 237,000 jobs UK-wide
- Are a successful UK export industry, with overseas earnings of £3 billion per annum

Research is an international endeavour. Leading universities across the globe not only collaborate with each other on a huge range of projects, but also compete with each other for academic talent, the brightest students and increasingly for R&D investment from the private sector, charitable and other sources. Whilst the UK is second only to the US in terms of research productivity and punches well above its weight, this position is increasingly being challenged as a result of very substantial increases in investment in research across Europe and in Asia.

The Russell Group believes that maintaining an environment within the UK which is conducive to science, research and innovation is essential not only for the success of the UK economy but for maintaining the UK’s international standing and position as a global research leader. As such UK research funding policy needs to take account of international as well as national and regional drivers.

1. What is the overall objective of publicly funded science and technology research?

Science and technology research generates many beneficial outputs and impacts which underpin the UK’s long-term economic growth, economic well being and quality of life.125 These include:

- Generating new knowledge and understanding
- Training and continuing professional development of highly-skilled people
- Capacity building in new and emerging disciplines, as well as sustaining progression in well established areas
- The development of new or improved products and services
- Establishment of new businesses
- New or improved public policy and public services
- Attracting inward investment from global business

123 The most recent figures for Research Council grants in 2006-07 show that 69 per cent of grants were awarded to Russell Group universities (source: HESA); data from HEFCE shows that Russell Group universities received 66 per cent of QR funding in 2008–09.
124 Data derived from the Universities UK report “The Economic Impact of HEIs”
Examples of quality of life impacts include the benefits of medical research on improving public health, research to understand, prevent and mitigate environmental risks and hazards, and social research contributes to improving social cohesion.

Research, particularly basic research, is a speculative and high-risk endeavour. The time period between investment in research and economic impact can be lengthy, often of the order of decades.\textsuperscript{126} The Government therefore has an important role to play in the funding of research, and particularly basic research, which the private sector is less inclined to fund due to the distance from market. Provision of public funds ensures that the widest breadth of research disciplines can be supported. This is important not only because we do not know where the opportunities and challenges of tomorrow may arise but because many multinational companies believe that effective, integrated interdisciplinary research offers the greatest potential for innovation—“future innovation is particularly likely at the interface between traditional disciplines”.\textsuperscript{127}

Government support is also important in creating the right conditions, regulatory environment and incentives to enable excellent research and innovation to flourish. This in turn enables the UK’s leading universities to provide world-class teaching and invest in world-class research attracting talent and investment to the UK.

As the recent CBI’s recent report “Stronger Together: Businesses and Universities in Turbulent Times” shows, employers are increasingly looking for high-quality graduates with good employability skills. Public investment in research enables Russell Group universities to provide distinctive research-led teaching which encourages a culture of enquiry-based, independent learning in a world-class environment. Research-led learning actively engages students in their learning experience, encouraging them to pursue new knowledge and to develop independence of thought, critical thinking, entrepreneurial skills and the ability to handle a wide range of challenges.

As the Secretary of State for Business, Innovation and Skills has said in the current economic climate investment in research and science “should be at the centre of the Government’s economic recovery plans for a prosperous, sustainable future”.\textsuperscript{128}

\textbf{2. Are the existing objectives and mechanisms for the allocation of public funds for research appropriate? If not, what changes are necessary?}

The Russell Group believes that adequate, sustainable public funding for research allocated via a dual support funding model is essential for maintaining the diversity, breadth, and quality of research in the UK. The current allocation of funding to the higher education funding bodies and Research Councils on a three year spending cycle, coupled with a Research Assessment Exercise (or Research Excellence Framework exercise) every six to seven years provides a degree of stability enabling universities to plan their research activities effectively. This model also provides a sound basis on which universities can forge research collaborations and partnerships, with other universities in and outside of the UK and with businesses, charities and other partners. As a report by the Higher Education Policy Institute noted “The close alignment between the money allocated to universities via the Funding Councils and the Research Councils shows that that the dual support system is working to support the best research in those universities best placed to undertake it.”\textsuperscript{129}

Dual support provides separate and distinct sources of funding for university research, which are highly complementary:

- Research Council funding supports world-class research across all academic disciplines, with grants awarded for specific research projects based on independent, expert peer review. This funding supports innovative, excellent research, as well as sustaining progression in established disciplines, capacity building in emerging areas, training of researchers, investment in strategic priorities and maintaining national capacity

- QR funding,\textsuperscript{130} as an un-hypothecated funding stream, complements the ring-fenced project—and programme-based funding allocated via the Research Councils. Awarded as a block grant to universities it enables institutions to invest strategically, providing the stable, core funding base for novel research. QR funding facilitates institutional flexibility which, as a World Bank report observes, is “vital if institutions are to adapt to the changing environment.”\textsuperscript{131}

\textsuperscript{126} MRC, Wellcome Trust and AMC funded study “Medical Research: What’s it Worth?”

\textsuperscript{127} Council for Industry and Higher Education “International Competitiveness” (2006)

\textsuperscript{128} June 2009 Speech by Lord Mandelson at the Science Museum.


\textsuperscript{130} Quality-related research funding.

As Lord May of Oxford has said, “without some form of such a dual support system...effective management of a university’s overall research programme is impossible.” Likewise the former Secretary for Innovation, Universities and Skills said “The dual support system is the foundation of the UK’s excellent international standing in research—something that can only be more important in the future. We have consistently underlined its importance.”

In an environment of increasing international competition, the Russell Group continues to emphasise its strong backing for the dual support system.

Earlier this year Research Councils UK and Universities UK published a review of the impact of the introduction of full economic costing (FEC) of the HE sector. This concluded that measures of HEI sustainability (financial, physical and human resources) have improved, in major part due to the introduction of FEC, although it is too early to determine the full impact. Specifically, imbalances between the QR block grant funding for research and project-based research (from the Research Councils and others) have been stabilised.

The report also explored in detail issues around the charitable funding for research, which comprises around 22 per cent of research income to UK HEIs. Charitable research funders have a clear principle of funding the directly incurred costs but not the indirect costs of a research project, such as the salary of the principal investigator, estate and support costs. Whilst many charities have adopted a flexible approach and shown a willingness to contribute to some indirect cost elements, there remains a shortfall in FEC payments for such research. This is addressed via the Charities Research Support Fund in England and similar support funding in Wales, Scotland and Northern Ireland, which provides an additional element of QR funding for excellent research funded by the charitable sector. This Government funding is essential to ensure that research charities continue to invest leading UK universities.

The results of the 2008 RAE demonstrated that Russell Group universities continue to excel both in terms of the consistently high quality of researchers and also in the sheer volume of excellent research. However, the new methodology introduced in the 2008 RAE and subsequent allocation of QR funding in England saw a much wider dispersal of research funding across the HE sector than in earlier RAES. A number of Russell Group universities saw a decrease of QR funding in cash terms of between 1 per cent and 13 per cent. In real terms, in 2009–10 half of the Russell Group of universities saw either a flat or reduced allocation of QR research funding compared to 2008–09. This means that despite a 5.6 per cent increase in QR funding, only half of the Russell Group universities received any benefit from this increase despite the fact that most improved their performance, in some cases significantly eg LSE and the University of Manchester.

Now more than ever the UK’s research-led institutions have a crucial role to play in helping the country to survive the economic downturn and stimulate a recovery. It is vital that they are given the right conditions and level of funding to continue to flourish. The Russell Group welcomes the proposals published this week to support and incentivise excellent research which delivers benefits to the economy and society through the new Research Excellence Framework. We will be responding to the proposals in due course.

3. Is the balance of Government funding for targeted versus response-mode research appropriate? What mechanisms are required to ensure that an appropriate and flexible balance is achieved? Should the funding of science and technology research be protected within the Research Councils or Government Departments? How will the current economic climate change the way that funds are allocated in future?

As indicated above, the Russell Group believes that an effective and balanced dual support system is fundamental to ensuring an appropriate and flexible balance in research funding. The creation of the Department for Business, Innovation and Skills, which brings together the responsibility for the two sides of the dual support system within one Government Department should provide a more effective means to manage funding for research. The ring fencing of the Science Budget is a key feature of the national research funding landscape, protecting long-term investments in research from short-term political pressures. A commitment to maintaining the ring fence will be fundamental to demonstrating the Government’s continuing commitment to basic research and maximising the longer-term economic and societal benefits that this research generates.

Research funded by Government Departments is primarily commissioned for specific policy purposes and funded on a contractual basis. Whilst Departments and Research Councils collaborate to co-fund basic research in key policy areas, it is important to continue to maintain departmental R&D budgets to avoid further erosion of Science Budget funding for basic research.

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133 http://www.dius.gov.uk/speeches/denham_uuk_110908.html
134 RCUK/UUK Review of the Impact of the Full Economic Costing of the UK HE Sector (April 2009)
Research Councils employ a spectrum of research funding methods from entirely responsive mode to more targeted or strategic initiatives. A diversity of funding approaches is necessary and important. Responsive mode funding provides a means to pursue new and novel ideas which are entirely investigator driven, whereas more directed funding supports basic, investigator driven research in areas where there is a need to grow national capacity or respond to user-driven needs for fundamental research.

The challenge is to maintain an appropriate balance of research funding between these different approaches. It is the Research Councils who determine the balance of their investments between different disciplines and different modes of delivery. The Councils, and their strategic advisory bodies, include representatives from the university community who alongside user representatives provide advice on the balance of investment. A high-level of academic engagement in this decision-making process is essential given the varying structures, sizes and needs of different academic communities and the different areas of research. In this context we welcome the recent re-affirmation by the government of its commitment to the Haldane principle— that decisions on how to spend research funds should be made by researchers, rather than Government.

However, the continuing decline in Research Council success rates indicates that there is increasing pressure on the Research Councils’ responsive mode funding and an increasing proportion of excellent proposals are going unfunded. As the UK public sector faces a time of financial constraint, there are concerns that there could be pressure to further target Research Council funding towards areas of research which could deliver short-term economic benefits at the expense more fundamental, unfashionable or unorthodox research.

Curiosity-driven research has generated some of the most significant returns to the UK economy and society. We have conducted an analysis of analysis of 123 case studies from 16 Russell Group universities and these show that the direct and measurable returns on basic research can be tremendous, and that for the case study examples the economic returns associated with basic research appear to be greater than those associated with applied research, or research targeted at a specific outcome.

Some examples include:

- **Avacta**—University of Leeds: Basic biotechnology research led to the development of expertise in molecular detection technologies, which is now commercialised through Avacta. Avacta’s technologies are at the forefront of drug invention, and the company has achieved considerable commercial success, currently valued at £57 million.

- **Cambridge Display Technology and Plastic Logic**—University of Cambridge: Fundamental research into the physics of conducting organic polymers led to the unexpected discovery of organic electroluminescence from polymers.

- **Cambridge Display Technology Ltd** was founded on the basis of this discovery, and has so far raised over $170 million through investments and sale of stock.

- In addition, **Plastic Logic Ltd** was formed, and currently employs a staff of 90. So far over $150 million from venture capital funding in Europe, Asia and the US has been raised.

- **Transitive Corporation**—University of Manchester: Transitive Corporation was founded in 2000, to commercialise the outputs of basic computer science research at the University of Manchester. Technology which has been developed allows for software applications to be easily translated across different computing systems. Transitive has developed relationships with Apple and IBM, and have over 15 million customers worldwide. The company has secured external investment to the value of US$30 million.

- **Bioluminescence**—Cardiff University: Over 20 years of research into the way in which living creatures can generate their own natural lights or “bio-luminescence” enabled the development of important new tools for medical and health research, now routinely used, and the formation of Molecular Light Technology Ltd. In 2003, the company was acquired by Gen Probe Inc for $7.2 million.

It is essential that any consideration of targeting further investment to strategic research priorities involves close dialogue with the research community as well as potential users. Such dialogue needs to be part of the ongoing debate about the responsiveness of the research base to new opportunities and user-driven research needs. A balance needs to be struck in ensuring the research base is responsive to the needs of today, while ensuring it is sufficiently strategically placed to meet the longer-term requirements of tomorrow.

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136 Forthcoming Russell Group publication
4. How is publicly-funded science and technology research aligned and coordinated with non-publicly funded research (for example, industrial and charitable research collaborations)? How can industry be encouraged to participate in research efforts seeking to answer social needs?

It is excellent research which has the greatest impact over time. Evidence shows that there is a positive relationship between the quality of university research and collaboration with industry, and that those departments and institutions with more research income tend to engage more frequently with industry. Research has also shown that institutions with a high critical mass of research activity, such as Russell Group universities, tend to attract the high levels of external research sponsorship.

Universities and businesses collaboration takes many forms, including partnerships which are focused on long-term fundamental research, as well as more problem solving and near market research activities. We believe that one of the most effective ways to encourage and align public sector investments in research with business and charitable funding is by creating an environment which enables and incentivises a variety of research partnerships and the exploitation of research findings. For example, the Higher Education Innovation Fund (HEIF) is important in enabling Russell Group universities to build and maintain linkages with business and the community to more effectively exploit public investments in research.

We consider there is room to develop policies to address the substantial investment gap between identifying promising research results and the successful commercialisation of research ideas. The difficulty of predicting impact at the outset of a research programme means that seeking to enhance research impact through directed funding may be problematic; yet ensuring that universities have the necessary capacity to exploit the opportunities that emerge from their research has resulted, and will continue to result, in significant returns.

For example, proof of concept funding is an essential stage in the development of many emergent technologies from initial prototype to the stage where they are able to attract investment from venture capital firms or other commercial interest. Proof of concept funding can therefore play an important role in bridging the gap between the initial invention or research idea and demonstrating commercial viability. Our case study research showed that 57 per cent of projects had received proof of concept or seed funding during their early development.

The Technology Strategy Board’s Collaborative R&D programme specifically seeks to align public sector and private investments in specific priority areas. Whilst Russell Group universities are involved in a substantial number of these programmes, TSB funding for collaborative research is still too often focused on a small number of sectors, rather than exploiting the opportunities for research involving the social sciences, arts and humanities.

The Government’s Foresight programme and the Horizon Scanning Centre, which investigates the challenges and opportunities arising from emerging areas of science and technology, also provides a useful platform for bringing together universities, business, charities and funding agencies to explore complex multidisciplinary issues of both social and economic importance.

5. To what extent should publicly funded science and technology research be focused on areas of potential economic importance? How should these areas be identified?

Evidence suggests that the highest quality research, particularly basic research is likely to have the greatest economic and social impact over time. It is the breadth and depth of subject coverage across the UK’s research base which is one of its great strengths, and ensures that UK universities are well placed to deliver knowledge and skills to meet the needs of the economy and society, and especially to capitalise upon to new breakthroughs and respond rapidly to unexpected challenges. As Lord Drayson has observed:

"we need to maintain a broad base in science, because we don’t know where the challenges are going to come from...and because the synergies from a broad based excellence in science promote world class leadership and interdisciplinary breakthroughs. Only with a diverse range of skills and deep reservoirs of knowledge will we have the flexibility to provide the expertise required in different fields."

Studies such the Council for Industry and Higher Education’s report on “International Competitiveness: Businesses Working with UK Universities” make it clear that multinational companies are looking to the Government to continue to invest in basic research since “maintaining the flow of ideas and their conversion through innovation is at the heart of our future competitiveness.” Therefore, we believe that public funding should continue to be available to support excellence research across all academic disciplines, including targeted support to maintain capacity in strategically and vulnerable important subjects, in order to support...

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139 Lord Drayson, “To what extent should UK funding for science and innovation be focussed?”, Foundation for Science and Technology lecture, Royal Society, 4 February 2009.
not just the areas of inquiry which might be identified today as having "economic potential" today, but to seize the unpredictable opportunities which lie in the future.

As the scale and complexity of the global challenges we face increase, maintaining the breadth of the UK's research base is increasingly important to enable universities to participate in national and international interdisciplinary collaborations. For example the Human Genome project is an example of a long-term, large-scale interdisciplinary project in which new fields and ways of working emerged and new research careers were developed. A recent report from The Lancet and UCL Commission on Climate Change which identified climate change as "the biggest global health threat of the 21st century" noted the importance of interdisciplinary research to identify approaches to tackle the problems presented by climate change—engineers, political scientists, lawyers, geographers, anthropologists, economics and philosophers were involved in identifying the critical challenges presented by climate change and setting out ways to address these. Therefore we support a strong multidisciplinary focus for funding in order to best advance knowledge and to maintain the UK's long-term research capacity. Harnessing the expertise of researchers from diverse disciplines to provide multi-faceted solutions to the complex and unprecedented challenges we face is a crucial priority for the UK—and indeed for countries across the world.

6. How does the UK's science and technology research funding strategy and spend compare with that in other countries and what lessons can be learned? In this regard, how does England compare with the devolved administrations?

For the UK's world-class universities to remain world-class, and hold their own against our major competitors, they need stable, sustained funding streams which allow them to invest in research for the future and enables continued excellence.

UK universities are relatively under-funded compared to major international competitors. Many nations are currently making unprecedented investments in higher education with a view to producing the new knowledge and developed the skilled people which help their businesses innovate in response to the economic downturn. Compared to the UK's investment of 1.3 per cent of GDP in higher education and research:

- the US invests 2.9 per cent of GDP; Canada 2.6 and South Korea 2.4;
- the European Union has a target of spending 3 per cent of GDP by 2010;
- China is now the second highest investor in R&D in the world after the US, and aims to spend 2 per cent of GDP by 2010 and 2.5 per cent by 2020.

Specific investments include:

- The US’s recent fiscal stimulus package included over $17 billion for research. With a massive injection of new federal funds into research, it will be even more difficult for the UK to keep pace with the US. The US also announced nearly $16 billion in student grants and $200 million to help working college students, demonstrating its commitment to get even more people into university and to continue to expand student growth.

- The 2009 EU budget included €60 billion for research, innovation, employment and regional development programmes (45 per cent of the total budget). Of this, €12 billion has been allocated to increase the EU’s competitiveness—this includes funds for research which see an 11 per cent increase. Funding for innovation has also increased by 22 per cent.

- Universities Australia is seeking a $1.2 billion budgetary increase, arguing that this will help to pump-prime the economy, to be spend on teaching, research, and increasing the participation of indigenous, rural or poor students. They are also seeking fast-tracked off-budget funding of $1 billion from the new $8.5 billion Educational Investment Fund to address a backlog in infrastructure spending.

- Brazil is seeing record levels of investment in R&D and has become one of the fastest-growing countries in the world in terms of scientific publications.

- The Swedish Government’s committed in October 2008 to increase R&D funding by 20 per cent over the next four years.

140 http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/2007_11_23/science_opms_0700032
142 The UK spends more than only seven comparator countries in the OECD: Belgium, the Czech Republic, Germany, Hungary, Iceland, Ireland and Spain; it spends the same as five countries: Austria, France, the Netherlands, Norway and Mexico.
144 Ibid.
146 Currently around 1 per cent of GDP, to be increased to 1.5 per cent by 2010, with a commitment to then maintain spending at double 2006 levels.
It is notable that many countries, such as the US, Australia, China, India and Germany, are also increasingly choosing to concentrate resources for research in order to develop or sustain their leading universities. Examples include:

— The French Government, as well as recently granting autonomy to 20 universities, has established Operation Campus. This will direct funding to alliances of leading universities forming “super-campuses”, in an effort to make France’s universities more internationally competitive.

— Germany’s Excellence Initiative concentrates funding at clusters of excellence to support leading research and strengthen the higher education institutions.\footnote{The Excellence Initiative was established as part of Germany’s Innovation Campaign for publicly-funded science to ensure that Germany remains a world leader in research. The DFG’s (which runs the Initiative jointly with the Germany Science Council) website states: “The aim of the Excellence Initiative is to make Germany a more attractive research location, making it more internationally competitive and focussing attention on the outstanding achievements of German universities and the German scientific community.” The Initiative has three funding lines: clusters of excellence between institutions, to promote leading research; institutional strategies to promote top-level university research; and graduate schools to train doctoral students. (http://www.dfg.de/en/research_funding/coordinated_programmes/excellence_initiative/general_information.html)}

— In 1998, China announced its goal of building world-class universities. Its strategy is to concentrate resources on a small number of institutions to enable them to become internationally excellent. Following high levels of central government investment, China’s ten historic universities have been climbing rapidly in the top 500 international league table rankings for universities, whilst UK universities have remained steady.

— South Korea’s World-Class University project provides 830 billion won (around £4 billion\footnote{http://www.xe.com/ucc/convert.cgi}) in funding for 18 universities, to support their international competitiveness.

— In recent years, Taiwan has significantly increased funding for its Academia Sinica Institution—around 12 per cent of the annual R&D budget in 2009. This is a concerted effort to foster a world-class research institution which can carry out leading research and attract the best staff and students from around the world.

The significant investment in research by emerging and established competitor countries means the UK is facing unprecedented competition. In a time of expected fiscal constraint it is therefore important that research funding strategies and policies are focus on, and foster excellence across both sides of the dual support system.

Nationally, the higher education funding bodies of Scotland, Wales and Northern Ireland choose to allocate funding to research in a different way to HEFCE and to each in order to address the aims and priorities of each Devolved Administration. A Universities UK Report published in December 2008 provides a comparative analysis which is reproduced below.

### Table 6.7

<table>
<thead>
<tr>
<th>Total allocation to higher education institutions</th>
<th>QR research allocation</th>
<th>Percentage variation from GB average</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEFCE</td>
<td>5,564,049</td>
<td>23.7</td>
</tr>
<tr>
<td>HEFCW</td>
<td>344,083</td>
<td>17.7</td>
</tr>
<tr>
<td>SFC</td>
<td>917,087</td>
<td>19.2</td>
</tr>
<tr>
<td>GB total</td>
<td>6,685,219</td>
<td>23.3</td>
</tr>
<tr>
<td>DELNI</td>
<td>43,657</td>
<td></td>
</tr>
<tr>
<td>UK Total</td>
<td>1,621,131</td>
<td></td>
</tr>
</tbody>
</table>

All figures in £000s.

Source: UUK, “Devolution and higher education”.

Whilst differences in approach are necessary to reflect the different needs of each country, it is important that funding mechanisms in each country are sufficiently convergent in their approach and messages to researchers to ensure consistency and alignment of incentives to underpinning research excellence.

\textit{September 2009}
Memorandum by the Sustainable Development Group of the Institute of Materials, Minerals and Mining

1. SUMMARY

The response attempts to address the focus of how decisions for research priorities to meet societal needs are made in the some of the areas of professional interest to the members of The Institute of Materials, Minerals and Mining (IOM3).

Currently, open consultations to determine research priorities address technical needs and each Executive Agency focuses on its own technical or scientific area. The problem is that many of the current important societal issues require the interaction between several interest groups and there are few mechanisms for ensuring cooperation and dialogue between the different research funding agencies and different government departments.

IOM3 welcomes these open consultation processes and is improving its internal processes and resources to be able to respond to these consultations on behalf of the materials engineering profession. However, in our opinion, there is a need for an inter-disciplinary and cross sector approach to the current strategic challenges in order to achieve sustainable development and to provide more robust and longer lasting solutions.

2. REVIEW OF CONSULTATION PROCESSES

The Government supports several admirable consultation actions to try to gain consensus on research priorities and publishes the results in publicly available reports. These results are then used to establish priorities for actions and funding by Executive Agencies such as: EPSRC, NPL, the National Measurement Office and the Technology Strategy Board. IOM3 has contributed to many of these consultations in the recent past and some examples of the outcomes are discussed in the sections below, particularly where these outcomes relate to currently important problems of sustainability, energy utilisation and carbon emissions.

2.1 Foresight Programme

The contributions of IOM3 to the Foresight Programme are summarised at http://www.iom3.org/foresight. The most recent contributions were made in 2003. The titles of the topics that were investigated then appear to be focused on the needs for the developments of specific sections of materials science but there were no subject titles that relate to important issues for society that currently have repercussions for the materials engineering industry; eg sustainability of resources, substitutions for scarce or regulated elements, reducing environmental degradation, energy production and utilisation. These issues cross several scientific and engineering subject boundaries and the Foresight Programme did not seem to be set up in a manner to allow this cross fertilisation and consider these admittedly complex problems. These reviews also did not address the issue of ensuring a supply of engineers and scientist qualified to degree level to deal with these issues.

2.2 EPSRC


Page 19 of this Plan outlines the priorities for Engineering for Science and Sustainability and the list of topics covers every important aspect of sustainability and environmental impacts. However the main programme of funding for research is called Living with Environmental Change (http://www.epsrc.ac.uk/ResearchFunding/Programmes/EnvironmentalChange.htm) and is concentrated on the built and urban environment and transport. How much of the issues of sustainability and environmental impact identified in the Plan are built into other funding programmes is not clear. Each submission for support for funding in the European Commission Framework programmes has to show how the research will have an impact on societal issues such as the environment.

2.3 The National Measurement Office

The National Measurement Office (NMO) recently issued a strategy consultation document (http://www.nmo.bis.gov.uk/) and IOM3 responded with a written submission. The proposals from the NMO included new research into measurements related to climate change and carbon emissions as well as the measurement of more fundamental scientific property values such as the “second” and fundamental atomic parameters. A series of “road maps” have also been published in 2009 by NPL, on behalf of DIUS, for a series of measurement schemes for several areas of science, including materials. IOM3 broadly welcomed and supported the proposals in the consultation document.
2.4 The Technology Strategy Board

The Technology Strategy Board (TSB) holds several workshops to gain consensus on the topics for new competitions for funding and IOM3 has hosted several of these events as part of its support for Materials UK. A recent TSB workshop on proposals for standards to support the sustainable use of materials was very successful: it attracted participants from a wide range of industry sectors and was oversubscribed. One result has been a firm commitment from BSI to develop a new British Standard to support this topic. There is also a need to address the development of methodologies and support tools to enable sustainable decision making; particularly ones which adopt a whole life cycle approach to social, economic and environmental assessments. The TSB, supported by Materials UK and the RDAs, has commissioned a review of the UK’s capabilities in Nuclear Engineering as part of the on-going support for the new build programme.

2.5 Chief Scientific Advisors

IOM3 recently provided a statement to a meeting between the professional engineering institutions and the Departmental Chief Scientific Advisors on the successful actions that the Divisions and Committees of IOM3 are taking to deal with the challenges of climate change, sustainability and other environmental issues.

3. Discussion

These consultations have addressed technical needs and each Executive Agency focuses on its own technical or scientific area. The problem is that many of the current important issues require the interaction between several interest groups and there are few mechanisms for ensuring cooperation and dialogue between the different research funding agencies and different government departments. However, in our opinion, there is a need for an inter-disciplinary and cross sector approach to the current strategic challenges in order to achieve sustainable development and to provide more robust and longer lasting solutions.

IOM3 has created three multidisciplinary groups for energy materials, construction materials and sustainable development that are now able to respond to the new societal challenges facing materials engineers. These groups are well placed to be able to respond to the consultation exercises from the Government and its Executive Agencies. Many of these agencies have provided opportunities for public consultation of new research proposals of relevance to IOM3 recently. IOM3 has been able to respond positively to these consultations and has seen its efforts acknowledged.

4. Conclusions

IOM3 welcomes these open consultation processes and is improving its internal process and resources to be able to respond to these processes on behalf of the materials engineering profession. However attention should be given by the Government and its Executive Agencies to how to achieve a cross-disciplinary, cross-cultural and cross-departmental approach to the setting of research funding priorities in order to meet current societal needs.

September 2009

Memorandum by Syngenta

1. Introduction

Syngenta is a world-leading agribusiness committed to sustainable agriculture through innovative research and technology. The company is a leader in crop protection, and ranks third in the high-value commercial seeds market.

Whilst we are headquartered in Switzerland, we have a strong UK heritage having operated here for nearly 100 years. We contribute over $1 billion to UK exports and are one of the country’s 25 biggest investors in R&D. We spend more than $200 million on the research and development of agricultural technologies in the UK, which represents more than 20 per cent of Syngenta’s global spend on R&D. Our UK R&D activities are concentrated at Jealott’s Hill International Research Centre in Berkshire. We employ over 500 scientists at this site including many world leading chemists and biologists. In July 2008, we also announced a major increase in our capital investment in both our UK manufacturing and research and development operations amounting to more than $200 million.

Given our role in UK and world agricultural, biotechnological and chemical R&D, we welcome the opportunity to respond to the Select Committee’s call for evidence on setting science and technology research funding priorities.
2. Syngenta’s response to the Select Committee’s call for evidence:

What is the overall objective of publicly-funded science and technology research?

We fully support the Lisbon Agenda to make the EU the most dynamic and competitive knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion, and respect for the environment. This should continue to set the tone of investment in the UK and Europe. It is essential for developed countries to be able to compete by being “smarter”. We also fully support the recommendations made in the review of science and innovation by Lord Sainsbury of Turville. We see these as critical to securing the future growth prospects and the global competitiveness of the UK and we mustn’t overlook the importance and high cost of “demonstration” in turning technology into innovative products and services—the UK has consistently produced high quality research but needs to be more successful in its ability to convert this research into commercial profits.

How are public funds for science and technology research allocated? Who is involved at each level and what principles apply? Where appropriate, is the Haldane Principle being upheld?

We believe that the research funded by the Research Councils should be primarily targeted towards defined objectives, which will benefit the majority of citizens, with some scope to pursue serendipitous discoveries made within that targeted research through “responsive mode” funding. It is not clear to us how this should be divided, but 75 per cent targeted and 25 per cent non-targeted feels about right. In addition, some funds should be allocated to create centres of excellence—both resource and expertise, eg a powerful computer cluster, which would enable industry to access first class facilities to improve the quality of their own research. There are also significant financial and scientific advantages in the UK collaborating in big international science projects rather than “going it alone”. The TSB should fund applied research to enable discoveries to be translated across technology families and to enable the development of the output of this basic and applied research work into robust working models. RDAs should primarily encourage SMEs in their regions to help them to convert their proven ideas into working prototypes, which could then be used to secure investment to enable the commercialisation of their products. Government departments should be able to fund research in support of their policy objectives and their development.

It is not clear to us, whether Government actively manages its full portfolio of projects, as we do, to ensure that the portfolio is carefully balance between projects at the different stages of research, development and deployment and the balance across the different target areas (areas of interest). In addition, in our experience of working with the research councils, we know that extensive peer review takes place to approve the funding of a project, but in our opinion, the review at the end of the project, apart from giving the project a score, does not adequately capture and disseminate the learning gained from the project amongst those who could benefit.

Many in industry, including Syngenta, find the bureaucracy involved in the European Framework deters them from taking part in these projects. It makes us ask the question, “Do we get the full benefit from our investment in Europe?” If not, should some of the investment be diverted into greater direct support for UK R&D?

Are existing objectives and mechanisms for the allocation of public funds for research appropriate? If not, what changes are necessary?

We are not in a position to comment.

What governs the allocation of funding for Government policy-directed research through Government departmental and agency initiatives? Are existing mechanisms appropriate? What is the role of Departmental Chief Scientific Advisers?

We support the existence of the Chief Scientific Adviser network, as we know that networks are effective mechanisms for knowledge transfer, but we have had no interaction with this network.

We are impressed by the energy and focus Professor Beddington has brought to the role of Chief Scientific Advisor, but we are concerned by the overlapping remits of the different government departments. Eg around the strategy for food security.

We believe that the appointment of Chief Scientific Advisers to all Government departments to encourage the use of science-based policy making and to create an inclusive network which can work together, to define and support the overall science strategy, which should be in support of and in alignment with the overall Government strategy.
The funding mechanisms to support, research, development and deployment are overly complicated. A significant simplification would be for Government to have three funds:

1. The Research Councils to fund all the early stage work (Technology Readiness Levels (TRLs), 1–3).
2. The TSB to fund the middle stage (TRLs 4–6/7).
3. A crisis fund (eg for tackling a flu pandemic).

In our experience the peer review process is generally effective but there is an issue with cross-cutting and new areas of multidisciplinary research—these need to be nurtured. It is very important that the Research Councils act in concert to ensure that multidisciplinary and cross-disciplinary needs are met. The Research and Technology Clubs are a good idea, but, for example, with IBTI it took a long while for the EPSRC to join the BBSRC in the club, even though it was already funding work in this area.

The KTNs (Knowledge Transfer Networks) set up by the TSB work well.

How are science and technology research priorities co-ordinated across Government, and between Government and the relevant funding organisations? Who is responsible for ensuring that research gaps to meet policy needs are filled?

The Research Councils have clear overarching strategies and the mechanisms for determining priorities by consultation with their strategy panels are well-defined.

However, their funding of projects is not really coordinated!! If it was simpler, then the current boundary issues between the different RCs could be better managed. We see examples of good practice within the BBSRC that we think could be usefully emulated in the other RCs.

We think that it would help if some specific cross-discipline panels were set up to help with areas which cross boundaries—both for peer review and funding.

The Clubs, such as IBTI, set up by the BBSRC work well to bring industry and academia together.

HEFCE also provides significant funding to universities—there have been some shortcomings with the RAE, but the new framework looks to be addressing these by defining a range of outputs and impacts.

Pooling of resources to provide significant funds for large scale projects can work well and is a good model, eg Defra, BBSRC, NERC, SO and Wellcome Trust announced a jointly funded research project on bees.

Is the balance of Government funding for targeted versus response-mode research appropriate? What mechanisms are required to ensure that an appropriate and flexible balance is achieved? Should the funding of science and technology research be protected within the Research Councils or Government departments? How will the current economic climate change the way that funds are allocated in the future?

As stated earlier, it is not clear to us how funding should be divided, but 75 per cent targeted and 25 per cent non-targeted feels about right. In addition, some funds should (continue) to be allocated to create centres of excellence—both resource and expertise to benefit the research and industrial community, eg Government needs to fund fundamental work on climate change which would help to provide good background data for other projects and industry.

We believe that the system should be simplified such that the RCs and the TSB and not Government departments control the research funding (apart from a small amount for policy development).

We strongly believe that R&D is a significant engine for growth. The long term benefits of investment in R&D should not be compromised to meet short term goals.

How is publicly-funded science and technology research aligned and co-ordinated with non-publicly funded research (for example, industrial and charitable research collaborations)? How can industry be encouraged to participate in research efforts seeking to answer societal needs?

IPAs (Industrial Partnership Awards) are a good example of how to provide the benefit of industrial relevance to early stage research and the Research Clubs like IBTI (Industrial Biorefining Technology Initiative) work well, as they require a cash commitment from industry and yet the industry gets good gearing on their investment in such early stage (very high risk) research. For later projects, which apply the learning to an industrially relevant setting, the current TSB mechanism works well (although it needs more funds).

The UK (and Europe) need to have the correct societal and regulatory climate to encourage the development of new technologies, which can be globally competitive eg The UK has lost its world leading position in plant biotechnology because of the opposition to GM (Genetically Modified crops)
To what extent should publicly-funded science and technology research be focused on areas of potential economic importance? How should these areas be identified?

See our earlier comments

How does the UK’s science and technology research funding strategy and spend compare with that in other countries and what lessons can be learned? In this regard, how does England compare with the devolved administrations?

In spite of a significant increase in support for science and technology since 1997, we still don’t invest enough to be internationally competitive with our main rivals.

We are not in a position to comment to compare England to the devolved administration.

September 2009

Memorandum by the UK Computing Research Committee

1. What is the overall objective of publicly-funded science and technology research?

Publicly-funded science and technology research enables wide-ranging industrial and social developments. It supports the competitiveness and international reputation of UK Universities and their ability to attract additional EU and international research funding and overseas students.

Centred on computer science and electrical and electronic engineering, ICT research cooperates very broadly with, and nurtures, most areas of science and technology, including pure mathematics (algebra, number theory, logic and recursive function theory, probability, functional analysis), applied mathematics (graph theory, operational research, statistics and decision sciences, numerical analysis), physics and chemistry (optics, solid state electronics and material science, quantum mechanics), and increasingly biology and medicine (medical diagnostics, neuroscience, cognitive science and psychology, gene regulatory networks, bioinformatics). Computer aided design plays a key role in all areas of technology, from microelectronics, to aerospace, automotive, energy, finance, epidemiology or drug design.

Thus Software and Computer Networks are now the primary medium for technology transfer from science theory to technology practice, and to further science development.

2. How are public funds allocated? Who is involved at each level of the decision making process? Where appropriate, is the Haldane Principle applied?

3. Is the balance of Government funding between targeted and curiosity-driven, response-mode research appropriate? How will the current economic climate change the way funds are allocated in the future?

The recent shift of attention towards targeted research, together with the substantial increase in emphasis on societal and economic impact required in all new research council proposals, shifting more funding from responsive mode to “managed programs” and “signposting” within EPSRC, can have detrimental effects. It can displace and curiosity driven research programs which already contribute to the UK’s digital economy.

It encourages universities to choose “winners in advance”, based on the best marketing pitch that targets a “signpost” rather than on the best science and technology. Many revolutionary and lasting inventions and developments in ICT where UK scientists have played a leading role, such as Virtual Memory in the 1960’s, the Internet and Programming Methods in the 1980’s, and the Web in the 1990’s, are unexpected consequences of academic research. Other areas, that where in their time signposted by industrial organisations and funding agencies, such as asynchronous transfer mode networks, have become dead ends, and even industrial leaders were unable to foresee the impact of the Personal Computer and SMS messaging when initially developed.

The EPSRC has a broad range of funding programmes including PhD studentships, individual fellowships, platform grants, large Interdisciplinary Research Centres as well as normal research grants, which have been the envy of academics in other countries. In the past the responsive mode funding has been in the order of 60–70 per cent of the EPSRC budget, but this appears to have substantially reduced. Even PhD funding is moving towards more specifically focused Doctoral Training Centres. EPSRC consult widely with industry, local and central government, and have non-academic representatives in all councils and panels with adequate mechanisms exist for identifying topics for managed programmes.

When considering EU, TSB, MoD and the shift in EPSRC emphasis, our view is that there is now too much focus on research related to economic and societal needs and not enough focus on fundamental “blue-sky” research from which many major breakthroughs of economic and societal benefit have emerged.
4. **How is publicly-funded research aligned and co-ordinated with research that is not publicly funded? How can industry be encouraged to participate in research seeking to answer societal needs?**

EU funded research, to which the UK government contributes, is mostly industrially led collaborative research, focused on short to medium term results rather than the longer term research focus in EPSRC funding. There are a number of Defence related and MoD funded collaborations between industry and universities. Many EPSRC projects do involve industrial collaboration although rightly there may be no funding of industry participation.

The Technology Strategy Board programs, to which EPSRC contributes, tend to address focused short or medium term research led by industry with academic collaboration. In such programmes, a 50 per cent public funding model for industry (up from the current 25–30 per cent), similar to the one practised by the EU, as well as less administrative oversight of the industry partner on the part of government, can make this type of research more attractive to SMEs and industry.

5. **To what extent should publicly-funded science and technology research be focused on areas of economic importance? How should these areas be identified?**

Historical data concerning the industrial and commercial relevance of research areas is certainly useful to allocate science and technology spending between broad subject areas. However, research proposals and projects should be evaluated based on their likely contribution to the accumulation of scientific knowledge and the advancement of technology.

Industry, government and other public bodies have a natural role in identifying areas of economic importance, but the stress placed on different areas will often change in two to five year cycles that are generally much shorter than the time it takes to establish and launch quality research programs, and then achieve the transfer to industry and society. For instance, the development cycle of the Internet, from the first technical concepts to its significant presence in society, has exceeded a period of 20 years and its economic consequences (which have been vast) were not at all identified in its early stages of development.

Thus, although it is of great importance to identify areas for research which are of economic importance, the ability of committees and organisations to accurately predict which future technologies will be of major economic value has been seen to be limited.

6. **How does the UK science and technology research funding strategy compare with that of other countries? How does England compare with the devolved administrations?**

The UK benefits from a very healthy and flexible research base, grounded in some of the world’s best universities which attract some of the world’s best minds, with a proven ability to play a leadership role in most areas of science and technology and move rapidly into emerging and innovative subject areas. Increasingly, university excellence attracts external industry investment and generates new economic development. Over the last decade UK universities have constantly attracted talented academics, researchers and capable students from abroad.

Everything should therefore be done to maintain the UK universities’ exceptional standing. This is the main challenge we perceive in the current economic climate.

**BACKGROUND INFORMATION**

*Lords Science Committee to Investigate Science Research Funding Priorities*

The House of Lords Science and Technology Committee has announced a new inquiry into setting funding priorities for scientific and technological research.

The Committee will investigate how Government and other public bodies responsible for the allocation of funding for science and technology research set priorities in the context of likely overall cuts in public spending. The inquiry will cover all aspects of science and technology, including the medical and engineering sciences.

The Committee will focus on how decisions are made to fund research to meet societal needs, the balance of funding between targeted and curiosity-driven research, and how research is commissioned in Government departments.
The Committee invites written evidence from any interested parties. The deadline for submission of written evidence is Friday 25 September 2009. Lord Sutherland of Houndwood, Chairman of the House of Lords Science and Technology Committee, said:

“In the difficult economic times ahead, there will be increasing competition for resources to fund new scientific and technological research. In such an environment, it is vital there is a robust and effective system in place to allocate public funds.

“Our inquiry will seek to identify how funds are currently distributed, whether that system is appropriate and where improvements could be made.

“We would encourage anyone with an interest in this area to send us written evidence over the coming summer, enabling us to start to take oral evidence when Parliament returns from recess in October.”

Questions:

1. What is the overall objective of publicly-funded science and technology research?
2. How are public funds allocated? Who is involved at each level of the decision making process? Where appropriate, is the Haldane Principle applied?
3. How are science and technology research priorities co-ordinated across Government?
4. Is the balance of Government funding between targeted and curiosity-driven, response-mode research appropriate? How will the current economic climate change the way funds are allocated in the future?
5. How is publicly-funded research aligned and co-ordinated with research that is not publicly funded? How can industry be encouraged to participate in research seeking to answer societal needs?
6. To what extent should publicly-funded science and technology research be focused on areas of economic importance? How should these areas be identified?
7. How does the UK science and technology research funding strategy compare with that of other countries? How does England compare with the devolved administrations?

September 2009

Memorandum by the UK Deans of Science

Summary

— The Government’s recognition of the importance of science and its commitment to the science base has led to an improved infrastructure that underpins the UK’s research capacity. It is essential that these gains are not lost by random reductions in revenue or capital spending. (Please see paragraphs 3, 4, and 10).

— Scientific research knows no national boundaries and its outcomes must be shared. The overall objective of publicly funded research should therefore be primarily to support the UK research base and the extension of fundamental scientific knowledge and understanding. (Paragraphs 5 and 6).

— With the exception of research contracted by the Government to deliver highly specific solutions, the original concepts enshrined in what has become known as the Haldane Principle should continue to dictate how funding is allocated. (Paragraphs 7, 8 and 9).

— The objectives and mechanisms for allocation of research funds that have been applied in recent years have been broadly appropriate (paragraphs 10 and 14). However, the balance between targeted and response mode is now beginning to tip too far in favour of targeted research. Any requirement for more targeted research should be met by new money or by savings that do not impinge on the current breadth of the research base (Paragraphs 16 and 17).

— The processes for considering policy-directed research, defining research priorities, coordinating funding and identifying research gaps have been strengthened by the increase in the number of Departmental Scientific Advisory Councils and Departmental Chief Scientific Advisers. However, a rationalisation of the many Science Advisory Councils might lead to enhanced recognition of common problems, research gaps and potential synergies. (Paragraphs 11 to 15).

— There is a need for a strategic approach to regional development. (Paragraphs 15 and 23).

— The current extent of alignment between public, industrial and charitable funding of research does not achieve maximum social benefit. (Paragraphs 18 to 20).
— The concept of what is of economic importance needs careful consideration. (Paragraphs 22 and 23).
— The Government should not attempt to direct research “pick winners”, though it is appropriate for it to define, using independent advice from the scientific community, within very broad parameters, the main societal challenges that need an input from science and technology. (Paragraphs 21 to 23).
— While a simplistic comparison may be misleading, more attention needs to be given to ensuring that the UK’s investment in scientific research and development is at least comparable with those of our main international competitors. (Paragraph 24).

BACKGROUND
1. The UK Deans of Science welcome this very timely inquiry by the House of Lords Science and Technology Committee and wish to make some brief comments on some of the issues it raises.
2. The UK Deans of Science (UKDS) is an independent group with members from around 70 of the UK’s higher education institutions that have significant science portfolios. Our primary aim is to ensure the health of the science base of the UK through the promotion and support of science and scientists and of science research and science teaching in the UK’s HEIs.
3. Our comments are given at a point when the science community can look back on a decade when the Government has recognised the importance of science and technology to the future of the UK economy. This has been manifested in a significant increase in public funding and a much greater attention to science within the machinery of Government. Amongst the positive developments have been the increasing numbers of Departmental Chief Scientific Advisers and Departmental Scientific Advisory Committees and a much higher and positive profile for science in the speeches and actions of Ministers, culminating in the recent decision that the Minister for Science and Innovation should attend the Cabinet. We are extremely grateful for all of these actions.

THE CONTEXT
4. We are concerned about the interpretation that may be given to the inquiry’s contextual statement that introduces this call for evidence. The expectation of overall cuts in public spending must not be a trigger for any reduction in the budget available for research in science and technology. This statement may be seen as the special pleading of the community that would suffer most if any reduction in funding were to occur. However, this is not the case. The countries that bite the bullet and decide to invest in scientific research during a period of economic downturn will prosper most in the inevitable economic upturn.

THE OVERALL OBJECTIVE OF PUBLICLY FUNDED SCIENCE AND TECHNOLOGY RESEARCH
5. Science and technology, by their very nature and practice, know no national boundaries. Except where national security or commercial sensitivity demand a different approach, the outcomes of all scientific research must be shared through readily accessible, peer-reviewed publication. Any other approach will prevent the essential progress that can be made by “standing on the shoulders of giants”. Thus the overarching objective of publicly funded research must be that it will contribute to the sum total of the world’s knowledge and understanding of science and its actual and potential applications. However, within such an intent it is accepted that support for science and technology by Government will be made through channels in universities, government research establishments, departmental research expenditure, etc, that will and should support curiosity-driven work, research that has broad and defined outcomes and applied work intended to solve very precise problems.

6. Within overall government supported research the objectives to support applied work must be built on the recognition of the need to develop fundamental scientific knowledge and understanding. Only with such knowledge can we be sure that we have the tools necessary to find solutions to society’s needs. Within this the funding must make it possible for discover and address challenges that are yet to be recognised and to generate science whose application is as yet unknown.

THE HALDANE PRINCIPLE
7. In our approach to a definition of the Haldane Principle it is first necessary to distinguish between publicly funded research paid for by government departments (which occasionally requires direct answers to specific problems) and other research funded by the research councils and the university funding councils. Much of the former will fall outside a principle that government should never define or direct what research should be done. Thus we would argue that the Haldane Principle means that, outside very specific areas of defined need for applied research to answer specific and often immediate issues (eg swine flu), the Government must not
expect to define and direct the research that it funds. This is a position that we would defend in the strongest possible terms. Again this is not a case of a special pleading from a special interest lobbying group that wishes to maintain a privileged position even when society is under extreme financial stress. We argue this case because we know of no evidence that medium to long term success is likely to follow such decisions made by governments. Notwithstanding this, those in receipt of public funding should be expected to account for its proper use.

8. It will be clear that freedom in research and a definition of a modern Haldane Principle are complex issues. However, it can be summarised in the following terms:

- the Government has a right to specify fairly directly areas of applied research that it may, through its departments, commission from time to time for the solution of very clearly identified problems. In these cases the scientific method that is used should be decided by the scientists who will carry out the work and not the Government.

- in some other cases of public funding of research the Government may wish, using to its fullest extent the advice of independent scientists and others, to indicate in the broadest possible terms the areas within which it, on behalf of the tax payer, wishes to see research carried out. These should be expected to relate to the perceived current and future challenges facing national and international society. But even in this there must be room for new areas outside the broad objectives

- in all other public funding there should be freedom to carry out the research, with funding decisions based on peer review of the quality of the research proposals and of the research team’s ability to deliver.

9. It is only by adherence to the principles in the latter two bullet points, allowing scientists to choose what projects to propose for funding, that the best and most productive research will be done in UK universities and the UK will continue to be a world leader in science and will attract and retain the very best scientists.

**Appropriateness of Existing Objectives and Mechanisms for the Allocation of Public Funds for Research**

10. Here we restrict our response to the funding of university research through the so-called dual funding mechanism, ie support provided by the research councils and the funding councils (through the Research Assessment Exercise (RAE)/Research Excellence Framework (REF)). Together with the significant investment that has been possible in the last 10 years through the generosity of the Wellcome Trust and various Government capital funding initiatives the dual funding mechanism has successfully underpinned research capacity. UK science undoubtedly punches well above its weight, helped by the absolute dedication of the university science community. The success has been hard won. A major perturbation in the dual support mechanism, either in the balance of funding or an increase in the directing of research that should be done would be a major risk to this success and to the ability of the research community to follow up a wide variety of potentially fruitful ideas. This issue is considered further in paragraphs 13, 14 and 16.

**Allocation of Funds for Policy-Directed Research, Role of Departmental Chief Scientific Advisers**

11. As a group that is not in day to day contact with the Whitehall machine we confess to having an unclear “organisational” view of how policy-directed funding decisions are made, and the funding allocated. There is a maze of Science Advisory Councils (SACs) focussed on specific topics, with some departments, but unfortunately not all, having Departmental Scientific Advisory Councils (DSACs). It is also regrettable that not all departments yet have a Departmental Chief Scientific Adviser (DCSA). Nevertheless the existence of this infrastructure is a clear indication of the Government’s commitment to science and its intention to obtain a wide range of independent scientific advice. Although the current need to reduce the overall rate of public spending may lead to some timely rationalisation or reduction in the numbers and complexity of SACs it is essential that, where they currently exist, Departmental Science Advisory Councils and Chief Scientific Advisers remain intact and are extended to the departments that currently lack them. It is also imperative that the advice they give to Government is made public.

**Research Priorities, Coordination of Funding and Identification of Research Gaps**

12. Notwithstanding the need to maintain, through difficult economic times, appropriate independent scientific advice, we have concerns as to how the disparate advice of all the advisory groups and individuals is collated and combined. While a Chief Scientific Advisers Committee exists we wonder whether each member brings to it such a high level summary of the advice of the many SACs (over 70 in total) that much useful detail may be missed—for example, common scientific problems, the need for development of similar fundamental
research, scientific methodologies, etc. It is unclear where such diverse but important issues may be picked up
given the apparently much higher level priorities of the Council for Science and Technology. In short it seems,
from the outside that there is a major silo effect across the Science Advisory Councils and we are unconvinced
that this complex system successfully identifies all research gaps or potential research synergies.

13. In principle there is little wrong with the current process for agreeing priorities and coordinating funding
through the Technology Strategy Board and the Research Councils. However, the very low rate of success of
funding applications and the recent increasingly directional approach being taken by the Research Councils
to the research that will be funded are both of concern. We believe that the balance is now being moved too
far away from responsive mode funding. We also have some concern about the lack of transparency of
Government “advice” to the research councils.

14. The second major Government research funding stream to universities through the university funding
bodies is delivered through a robust and rigorous procedure (RAE/REF) that involves appropriate peer
review, including in the last exercise (RAE 2008), the use of international panel members. In spite of minor
concerns about the results of the last exercise, they were broadly fair, though, as always, there was some
disappointment over the resultant financial allocations. However, on balance the distribution and relative
concentration of RAE funding resulting from the 2008 RAE is generally about right.

15. There is also a question as to whether in this and the coordination of research priorities discussed sufficient
consideration is given to strategies for distribution of research funds to the regions and the effect that this may
have on some of our regional universities. This issue is further addressed in paragraph 23.

**Balance of Funding Between Targeted and Response-Mode Research**

16. As indicated earlier we believe that the balance of funding is now shifting too far in the direction of
targeted research activity. Unfortunately, as a comparison of the funding streams illustrates, there is a similar
issue over the funding available to universities within the EU’s Seventh Framework Programme. Of course,
it is quite reasonable to expect scientific research paid for by Government to show impact, but success in this
regard needs to be evaluated over timescales of up to at least 10 to 15 years.

17. One issue which is paramount in any discussion of Government support for scientific research is the need,
in the coming period of financial constraint, for the sum total of Government research funding to be ring-
fenced. Any additional needs for investment in targeted research should be additional new money.

**Alignment between Public, Industrial and Charitable Funding**

18. In one respect we would take issue with the suggestion which is implicit in the question posed by the
Committee—we believe that the science-based industries in the UK do, very often, take full cognisance of
societal needs when drawing up their strategies and research plans. However, there is always the need for
industry to consider the bottom line so that the highest priority will be given to solutions where there is likely
to be a good, and relatively rapid, rate of return. This might be less of a problem to industry were it not for
the commercial environment in the UK which allows the predatory takeover of a company, often based on
very short term views of its balance sheet.

19. An issue that seems to be increasingly difficult for many universities is trying to pass on the effect of full
economic costs for research. Industry argues that this makes the cost of the research too high, imagining that
they are paying in part “for the Vice-Chancellor’s yacht” while they only want to pay the direct cost of the
research. Charities often take the view that they should pay for the salaries of a project’s researchers, expecting
the infrastructure to be available free of cost to them. There would seem to be a place for Government to
consider this issue further, helping to act as a broker, in recognition of the fact that much very useful
researching into societal needs is carried out in universities with such funding.

20. We believe that the Technology Strategy Board should take as part of its brief the need to find ways of
ensuring that industry, charities and universities can work more fruitfully together, with consideration of how
tax incentives could be given to companies, perhaps encouraging a commitment from them that a certain small
percentage of their research and development budget might be dedicated to such activity.

**Focussing on and Identifying Areas of Economic Importance**

We do not believe that it is possible to predict the economic future so any attempts to identify and focus on
“winners” is likely to be unsuccessful unless only very predictable, short-term gains are being sought. What is
more important is whether there should be any attempt to do this at all and we believe there should not—it is
not the role of Government.
22. The question is not even a simple one of financial profit or loss. Much of what is of economic importance is not instantly recognised as such—for example the health of the nation can have a positive effect on economic performance, as could such events as England winning the 2010 World Cup.

23. An aspect of economic performance which must not be neglected is the spread of success across the UK. Just giving money to the Regional Development Agencies insufficient. There is a need to ensure that proper and appropriate strategies are in place for regional development in science research and development. This would appear to be a role for the Technology Strategy Board, one which it should be encouraged to take up with some vigour as soon as possible. However, regional issues also need to be in the brief of Departmental Science Advisory Councils, Chief Scientific Advisors and the Council for Science and Technology. In this way we can ensure that the UK uses fully the talents of all its scientists.

24. COMPARISONS WITH OTHER COUNTRIES

It is interesting that the Committee has made this particular issue the last point in its call for evidence because it is quite obviously the most important of all and one which is most worrying to the science community across all public, commercial and not-for-profit sectors. In spite of the very welcome increased investment by the Government over the past 10 years, the percentage of GDP that the UK spent on research and development at only 1.8 per cent lags significantly behind most of our competitors. The current UK target is for a rise to 2.4 per cent by 2014. Even if this is achieved, the UK will still be below most of our international competitors, almost all of whom have plans to increase their investment in the next few years. A few examples, of many that could be quoted, may suffice to sound a serious warning about the UK’s investment: President Obama’s commitment to science and to devote more than 3 per cent of US GDP to research and development, while Germany and France also intend to move to 3 per cent. India intends doubling its research and development expenditure, while China’s research output has rapidly outstripped the UK’s in the past ten years and will soon rival the US.

25. UKDSS would be very pleased to supply further comment if required

September 2009

Memorandum by the UK Government’s Spongiform Encephalopathy Advisory Committees

1. Advisory Committee on Dangerous Pathogens Transmissible Spongiform Encephalopathy Working Group (ACDP TSE WG);
2. CJD Incidents Panel;
3. Engineering and Science Advisory Committee into the decontamination of surgical instruments including Prion Removal (ESAC Pr); and
4. Spongiform Encephalopathy Advisory Committee (SEAC).

1. The handling of transmissible spongiform encephalopathies (TSEs) has important lessons for the work that the House of Lords Science and Technology Committee intends to focus on, specifically:
   — how decisions are made to fund research to meet societal needs;
   — the balance of funding for targeted versus unsolicited response-mode curiosity-driven research; and
   — how research is commissioned in Government departments and agencies.

2. The transmissible spongiform encephalopathies (TSEs), also known as prion diseases, are a group of fatal transmissible neurodegenerative disorders of man and animals, characterized by the “spongy” microscopic appearance of the brain in affected animals and by a link with a ubiquitous protein, the prion protein (PrP), a misfolded form of which is widely believed (though never unequivocally proved) to be the infectious agent of prion. The most widely known examples of these diseases are bovine spongiform encephalopathy (BSE) in cattle, scrapie in sheep and goats and Creutzfeldt-Jakob disease (CJD) in humans. BSE emerged in the UK in the 1980s, has been reported in many other countries and is responsible for the human disease, variant CJD (vCJD).

3. TSEs are thus a group of diseases that, in a short space of time, gave rise to significant health effects in animals and humans and resulted in massive economic loss. In identifying the solutions that were required, science and scientific research, both basic and applied, were critical. The recent history of the diseases and the research into them therefore merits careful consideration by the House of Lords Science and Technology

149 Remarks by the President at the National Academy of Sciences Annual Meeting, Washington, 27 April 2009.
Committee, as many of the specific aspects of that history are relevant to the general principles that the Committee is looking into.

4. SEAC is the government’s overarching committee for advising on the science of TSEs and thereby assessing risk to the public. ACDP TSE WG, CJDIP and ESAC Pr are in their different ways involved in developing practical advice to reduce the spread of TSEs (risk management), most notably spread of CJD/vCJD from person to person via contaminated surgical instruments or via blood transfusion.

What is the overall objective of publicly-funded science and technology research?

5. The overall objective of publicly-funded science and technology research, the public good, has to be considered in a broader and longer term context than that of policy, as the latter is often understood within government. This policy, in practice, is, inevitably, strongly influenced by electoral and media cycles whereas effective scientific policy has to be constructed around a much longer term administrative cycle. This is particularly aptly illustrated by TSEs, in which the slow progression of the diseases can make developing reliable answers to scientific questions, necessarily, a long term undertaking.

6. Publicly funded TSE research in the UK was stimulated by substantial public funding in the late 1980s/early 1990s, initially in response to the threat that the emerging BSE epidemic in cattle posed to animal health and later following the recognition, in 1996, that BSE was linked to vCJD and posed a public health risk. The need to limit the damage to health and wellbeing from BSE gave rise to a number of intensely practical questions such as the nature of the infection and the infectious agent, the distribution of the agent in different animal species and whether barriers to transmission existed between certain species. These questions could not be answered without an investment in basic science. Equally some of the key techniques for characterising the diseases, such as biological and molecular strain typing of the responsible agents had been developed in the 1970s and 1980s to distinguish different isolates of scrapie. This latter work had taken place at a time when the policy community put so little emphasis on TSEs that these developments were seen, at the time, as of little practical application.

How are science and technology research priorities co-ordinated across government and between government and the relevant funding organizations? Who is responsible for ensuring that research gaps are filled?

7. Balancing curiosity driven research with research driven by departmental and policy needs requires that both research councils and the departments themselves are in a position to commission meaningful research and that this research can be effectively co-ordinated.

8. The model by which research funding priorities has been co-ordinated between government departments and the research councils has been the TSE Joint Funders Advisory Group which has been sufficiently successful to be emulated for novel H1N1 influenza A virus (“swine flu”) research. However, the decline of the BSE and vCJD epidemics has led to a recent disinvestment in the field. This is premature. Those of us who are members of the three risk-management committees, particularly, are aware of questions that, if answered, would facilitate disease control, by allowing potentially the relaxation of certain expensive contemporary control measures as well as those answers having implications for other more widespread diseases. There are equally other widespread TSEs such as Chronic Wasting Disease (CWD) of mule deer and elk in the United States and Canada that may yet show the potential to infect man, as well as newly identified TSEs such as bovine amyloid spongiform encephalopathy (BASE), and atypical scrapie, whose potential to be a human health problem is not yet fully understood. In humans there is a recently discovered “new” TSE called protease sensitive prionopathy (PSP), the significance of which is, as yet, unclear.

9. More specific examples of unanswered questions with health implications are:

- Will the eventual elimination of classical scrapie in the EU leave an ecological niche for other TSEs such as BSE or atypical scrapie?
- Is CWD transmissible to humans?
- Can a reliable ante mortem diagnostic blood test for vCJD be developed?
- What is the true prevalence of v CJD infection (as opposed to overt disease) in the UK?
- Are some commoner types of neurodegenerative disease (including Alzheimer’s disease and Parkinson’s disease) also transmissible? Some recent scientific research has suggested this possibility
— Could cases of protease sensitive prionopathy (PSP) be missed by conventional tests which, in all other TSEs, rely on the resistance of the prion protein in the nervous system that accompanies disease to digestion by protease enzymes?
— Can we develop reliable methods for removing and detecting protein on re-usable surgical instruments?

10. These are frequently highly practical questions impacting on very expensive policy options but needing to be informed by scientific work that may more appropriately be described as basic rather than applied. The cost of funding such work could well be trivial compared to the precautionary measures that are currently being put in place to mitigate such possible but unproven risks.

To what extent should publicly-funded science and technology research be focussed on areas of potential economic importance? How should these areas be identified?

11. We would argue that the evaluation of the economic importance of science and technology research needs to be based on a model that is sufficiently sophisticated to acknowledge adequately longer term economic benefit. For example, DEFRA have developed a prioritization tool which ranks animal diseases according to a number of variables—for example impact on public health, animal welfare, international trade and wider society.

12. Thus any method for evaluating the economic importance of research should be able to recognize that TSE research in the UK remains a vibrant field in which there are a number of young researchers making real progress with implications for a variety of diseases and disease processes. The TSEs themselves retain the capacity to surprise and although BSE and vCJD appear to be declining, other health questions that give rise to circumstances that lead to human illness, economic loss and political embarrassment, seem likely. Further, we have now also arrived at the point where a research infrastructure (laboratories, animal facilities, cell lines, animal lines, reagents, trained personnel) with strong international links within the European Union and to Japan and North America, has been established in the UK that can allow complicated questions to be answered efficiently. There would be a considerable opportunity cost to losing this resource.

The Secretariat on behalf of:
— Advisory Committee on Dangerous Pathogens Transmissible Spongiform Encephalopathy Working Group (ACDP TSE WG);
— CJD Incidents Panel;
— Engineering and Science Advisory Committee into the decontamination of surgical instruments including Prion Removal (ESAC Pr); and
— Spongiform Encephalopathy Advisory Committee (SEAC).

September 2009

Letter from Professor Christos Vassilicos

From my own direct experience and those of colleagues at Imperial and elsewhere in the UK, it seems that only about five to 10 per cent of responsive-mode proposals which make it to EPSRC panel are funded even though panels typically recommend around 20 per cent of these proposals for funding.

The recommended but not funded proposals cannot be resubmitted as a new rule dating from April 2009 disallows resubmissions of all unsuccessful proposals.

The definition of what constitutes a resubmission rests entirely on the judgement of the relevant EPSRC manager. This is what I was told by EPSRC managers during phone conversations and email exchanges as no clear definition of a resubmission can be found anywhere.

Note that this new no-resubmission rule acts retroactively and note also that the majority of very original and ground-breaking proposals can, most of the time, simply not be successful first time round. My entire career has been based mostly on resubmissions of responsive-mode proposals, and I am not alone in this.

The EPSRC is attempting to move funds towards longer and larger grants, called programme grants. These larger and longer grants are responsive-mode grants of a sort and it is my feeling that one of the reasons why very few normal-size responsive grant applications are successful is because these grants are now given precedence. However there is a very important caveat on the responsive-mode nature of these larger and longer grants: they have to pass an outline stage where a 4-page pre-proposal is examined by an internal EPSRC committee made exclusively of EPSRC administrators and without a single member of the academic community.
The EPSRC maintains that this outline stage exists in order not to waste the time of proposers who will have very little chances of success.

However, there have been EPSRC programme grant panels which have not made a single award to any of the full submissions which were allowed to reach them by the outline stage committee. It is hard to see how this outline stage committee can make strategic science decisions and how they can really judge the relevance, importance and quality of the science proposed as it is made of EPSRC administrators only. Members of the academic community should be part of the outline stage if the entire process is to be at all credible and not appear as a way to chose between responsive-mode applications on the basis of targeted research criteria.

It is my strong feeling that the EPSRC under its new leadership is attempting to squeeze responsive-mode research in indirect ways based on the new no-resubmission rule and the lack of transparency and academic involvement in the outline stage of programme grant applications. When the House of Lords Science and Technology Committee examines the balance of funding between targeted and responsive-mode research it should probably take the points above into account.

September 2009

Memorandum by the Wellcome Trust

1. The Wellcome Trust is the largest charity in the UK. It funds innovative biomedical research, in the UK and internationally, spending over £600 million each year to support the brightest scientists with the best ideas. The Wellcome Trust supports public debate about biomedical research and its impact on health and wellbeing.

2. We welcome the opportunity to respond to this important inquiry on setting science and technology research funding priorities. The current economic climate is likely to require some hard choices, making it particularly important to consider how to develop a long-term strategic approach to priority setting.

3. The main messages of our response are:

— the need for a long-term strategic approach to setting research priorities;
— the need for a new taxonomy to give clarity to the debate, building on Lord Porter’s observation that research is “applied” or “not yet applied”;
— that there is a role for both response-mode and targeted funding, but that researchers must be given the flexibility to ask the right questions and put forward the best ideas;
— the importance of providing funding and support for infrastructure, research resources and underpinning technology on which the research base depends;
— the need for a coordinated approach to priority setting across government;
— the importance of ensuring that the best available evidence informs policy making at an early stage; and
— the key role of the charity sector in funding research, and the need for partnerships between government, charities, universities and private sector.

Setting Long-term Research Priorities

4. A long-term strategic approach to setting research priorities is crucial. We welcome the approach the Government took in developing a ten-year Science and Innovation Investment Framework 2004–2014. This allowed the Government to make long-term commitments, recognising that the timescale of research often falls outside the spending review cycle. By setting out the Government’s main priorities and signalling funding intentions, the approach also allowed other funders, including the Wellcome Trust, to develop partnership activities with government.

5. The recent study “Medical Research: what is it worth”150 commissioned by the Academy of Medical Sciences, the Medical Research Council and Wellcome Trust under the auspices of the UK Evaluation Forum, provided an indication of the time lag of research. The researchers estimated that the time lag between research expenditure and eventual health benefits is around 17 years. The study concluded that, for each pound invested by the taxpayer or charity donor in cardiovascular disease and mental health research, a stream of benefits is produced equivalent to earning 39 pence and 37 pence respectively each year “in perpetuity”.

6. The study also demonstrated the presence of significant “spillover” benefits from basic research. The distinction between pure and applied research is an artificial one: many applied discoveries are underpinned by basic “blue skies” research, while new innovations in applied research often inform future questions for basic research. Support for basic research and translation need not be at the expense of each other. A strong

150 http://www.wellcome.ac.uk/About-us/Publications/Reports/Biomedical-science/WTX052113.htm
and sustainable research base is crucial to translate the best ideas into innovative technologies, new products, devices and approaches.

7. The language describing different types of research is becoming increasingly complex and problematic. On the one hand we have “pure research”, “basic research”, “blue-skies research”, “fundamental science” and “curiosity-driven research”; on the other we have “applied research”, “targeted research”, “mission-driven research”, “directed research”, “research to meet societal needs”. The fact that your Committee, while choosing to use the terms “curiosity-driven research” and “targeted research”, has had to provide footnoted explanations demonstrates the confusion surrounding current terminology.

8. We argue that a new taxonomy is needed to clarify the discussions. “Curiosity-driven research” in particular gives a misleading impression that scientists are simply following their own whim, with no thought to the eventual outcome. This is not what happens in practice. Lord Porter famously commented that “pure research was merely that research which has not yet been applied”. His observation holds true today. We urge the Committee to consider the development of a new taxonomy—one that takes account of Porter’s recognition that science is “applied” or “not yet applied”, and that allows the debate to progress. We would be happy to discuss ideas in more detail.

9. In practice, all research is about asking important questions which, if answered, will give new understanding about the universe in which we live. The answers to those scientific questions will, in a not entirely predictable way, often provide outputs that have an impact on the health and welfare of society. In some cases, the outputs will have enormously valuable economic impact. The focus of the debate should therefore be about who sets the questions. We argue that it should be a range of stakeholders: including individual researchers, the research community, and society or government more widely. What matters most is to ensure flexibility to allow researchers to answer the questions in the most innovative and effective way.

10. The Wellcome Trust therefore considers that there is a role for both response-mode and more targeted funding in the UK science portfolio. Government strategy must recognise the importance of pursuing research for the advantage of expanding knowledge as well as for potential economic and social benefit. Where funding is directed at particular socio-economic outcomes, it will be important to give researchers sufficient flexibility to put forward the best ideas to address an identified problem or opportunity.

11. Funding agencies can also play a role in helping to identify key areas of need and prioritise research questions, but should not be too directive. The Trust has developed funding structures that enable us to respond rapidly to the best ideas from the research community while providing the most appropriate form of support to take these ideas forward. This approach is underpinned by peer review—an essential part of our processes, allowing international experts to comment on the quality of proposals received and ensuring only the best research is funded.

12. The House of Commons Innovation, Universities, Skills and Science Committee usefully discussed the funding of strategic priorities at some length in its report on “Putting science and engineering at the heart of Government policy”, published in July 2009. We support their recommendation that the Government’s approach to science funding should “incorporate the good elements of the Haldane principle in relation to basic science while not hindering a more mission-driven approach to get the full benefits of applied science and engineering”. We also welcome the Committee’s acknowledgement that the responsibility for ensuring “the independence of science” should remain with academics, universities and learned societies.

**Funding for Infrastructure, Research Resources and Underpinning Technologies**

13. Any research strategy will also require appropriate infrastructure, facilities and resources to facilitate research. Government and funding agencies must place more emphasis on funding and support for research resources and for the underlying tools and technologies on which research depends. Investment in large research infrastructure, both national and international must occur in a coordinated and strategic manner to ensure long-term sustainability.

14. The development of the Large Facilities Road Map has enabled the Government to become more strategic with investment in capital funding, considering competing priorities across all disciplines. But it is not enough just to consider the capital and construction costs; the Government must also ensure that sufficient operational funding is provided as well.

15. Take the example of the Diamond synchrotron. Diamond is the largest scientific facility to be built in the UK for 30 years, through a partnership between the Government (through the Science and Technology Facility Council (STFC)) and the Wellcome Trust. It is a world-class synchrotron light source that serves researchers across all scientific disciplines, from both academia and industry. Diamond has been a real success story for the UK: it was built on time and to budget and specification, and it has already started to deliver significant scientific outputs and attract industrial users.
16. However, Diamond’s operational budget for 2009–10 has been reduced by £4 million, or 12 per cent, as a result of pressures on the STFC budget. Diamond faces even greater uncertainties over future operating budgets. STFC has indicated that it is unlikely to be able to meet the required budget in full for 2010–11 although it is currently not able to provide further information. If STFC provides ‘flat cash’ funding, Diamond will face significant budget cuts, of as much as 30 per cent (£11.6 million). This would lead to significant staff redundancies, beamline closures and potential shut down periods. Diamond would no longer be able to compete at a world-class level.

17. There are additional concerns over the development of Phase III—a planned expansion, intended to provide new beamlines to allow Diamond to continue to expand its user base, and to give the flexibility needed to respond to new scientific advances. The proposals for capital funding are being taken through the Large Facilities Road Map process. We support the development of Phase III, but only if STFC can give long term commitments about operational funding. If STFC is unable to meet the costs of the existing beamlines and those currently under construction (through Phase II), we question whether it is sensible to commit to build further beamlines that cannot be operated. Diamond has been built as a world-class facility—it must have sufficient funding to be operated as one.

18. Another example of a key facility for the UK is the planned UK Centre for Medical Research and Innovation (UKCMRI), which offers a unique opportunity to provide a world leading centre for biomedical research in the UK. The £600 million partnership between the Medical Research Council, Cancer Research UK, the Wellcome Trust and University College London will strengthen interdisciplinary collaborations between the research community, clinicians and industry. It will also provide access to state-of-the-art scientific facilities, infrastructure, resources, services and specialist facilities, and will recruit, train and develop first-class scientists. The scientific planning of the centre to determine the direction of research is being led by Nobel laureate, Sir Paul Nurse. UKCMRI provides the potential for the UK to compete and collaborate with other global hubs of scientific and medical excellence, such as the Allston Initiative at Harvard and the Howard Hughes Medical Janelia Farm Research Complex in the US, and Biopolis in Singapore. Key facilities such as UKCMRI will only succeed if the Government is able to provide long-term commitments and support.

19. The Government must also do more to ensure the long-term sustainability of bioinformatics and data management infrastructure. New, more powerful informatics resources and platforms are crucial to enable researchers to share, analyse and interpret the growing volumes of bioinformatics data. The UK benefits enormously from hosting the European Bioinformatics Institute (EBI)—the most important European data resource for biological research—but EBI faces significant uncertainties about medium- and long-term funding.

20. We therefore welcome the report of your Committee’s inquiry into Genomic Medicine, and particularly the recommendation that:

“We recommend that the Government show leadership on leveraging sustainable funding to the European Bioinformatics Institute (EBI), through the European Research Infrastructure (ESFRI) instrument and through the UK Research Councils. This would reduce the dependence of the EBI on charitable and cyclical funding and allow further growth of the Institute commensurate with the recent growth in genomic databases and the value of the EBI to the UK science base.”

21. The UK Government must work to support the long-term sustainability of key data infrastructures to underpin genomics research, and take a leadership role in securing sustainable European Union funding.

COORDINATION ACROSS GOVERNMENT

22. The Government’s decision to ring-fence the budget for science, and for research within the Department of Health, has been successful in achieving greater profile, awareness and investment in science. However, it will also be important to ensure a joined-up approach across Government to science issues. There is an increasing need for science to be integrated into policy on macro-level issues, such as climate change, obesity and the implications of an ageing population.

23. The Department for Business, Innovation and Skills must work closely with all departments to ensure science is appropriately reflected in government priorities, and that government policy reflects the needs of science. The Chief Scientific Advisers clearly have an important role to play, working together to identify and explore cross-cutting issues from an early stage. There may also be a need for new arrangements to respond to these challenges, such as structural links between government departments, or a thematic approach to Budget development.
24. A recent example has been the establishment of the Office of Life Sciences to encourage better coordination across government departments. It will be important to maintain the momentum since the publication of the “Life Sciences Blueprint”, and also to ensure that all stakeholders are consulted in the development and implementation of the relevant actions.

25. We also welcome the continued development of the Office for Strategic Coordination of Health Research (OSCHR), which provides a useful balance between basic and translational research. OSCHR is beginning to shape—for the first time—a single health research strategy and we look forward to seeing its proposed “National Ambitions for Health Research”. We hope this will provide a useful focus for the next ten years.

26. There has recently been a significant increase in the number of agencies and committees providing advice and strategic direction on science, innovation and education. It will be important to ensure there is not unnecessary duplication, to clarify their remits and to streamline their activities if appropriate.

27. Government policy must be informed by the best available evidence. We therefore urge the Government to make the best possible use of the significant expertise of academia, learned societies, research funders and charities in the UK. The recent report by the Council for Science and Technology, for example, made a number of suggestions of ways to improve engagement between academia and policy-makers.\(^{151}\)

COORDINATION OF PUBLICLY-FUNDED RESEARCH WITH CHARITABLE RESEARCH

28. UK charities have contributed over £4 billion to research in the UK over the past five years; last year alone charities funded 15 per cent of research and development performed in UK universities. The full benefits of charity funding can be best realised through a close partnership with government and universities.

29. Such partnership is possible because of the dual support system—a unique feature of UK university funding, which allows institutions to take strategic decisions about their research activities and provides flexibility to undertake blue skies research and respond to new opportunities. Crucially, it also allows a diversity of funders—including charities, industry, the European Union and overseas funders—to invest in university research, which has significantly contributed to the strength of the UK science base. We welcome the Government’s continued endorsement of the dual support system.

30. A key part is the Charity Research Support Fund (CRSF). The Government must continue to invest in the Charity Research Support Fund in order to maintain the volume of high-quality research in the UK and ensure that charitable funding in universities is sustainable. We welcome the conclusion of the recent Research Councils UK and Universities UK report “Review of the Impact of Full Economic Costing on the UK Higher Education Sector”, which recognised the importance of the fund, and urged the Government to work with the Funding Councils and charities to develop a clearer understanding of the appropriate level of funding for the CRSF.

31. Charities also contribute to the sustainability of the research base through a range of different routes, in addition to direct project funding. Partnerships between government, charities, universities and the private sector provide the opportunity to address key research priorities and to maximise the value of funding.

32. The Trust has established a number of partnerships with the UK Government and Research Councils over the past two years to address a wide range of key research challenges, including:

- Health Innovation Challenge Fund: up to £100 million for a five-year partnership with the Department of Health to stimulate the creation of innovative healthcare products, technologies and interventions, and facilitate their development for the benefit of patients in the NHS and beyond. The first call focuses on advancing genetic discoveries into clinical practice.
- Neurodegenerative diseases: a £30 million initiative to support high-quality collaborative research to advance knowledge of neurodegenerative diseases through interdisciplinary approaches.
- Medical engineering: a £41 million partnership with EPSRC to stimulate the formation and support of four world-class centres of excellence in medical engineering within the UK.
- E-health research: a £10 million partnership with MRC, EPSRC and ESRC to demonstrate the potential of research using patient records to improve healthcare.
- Insect Pollinators: a £10 million partnership with BBSRC, NERC and Defra to support research aimed at understanding the interactions between the biological, social and environmental factors affecting the viability of insect pollinators.
- UKCMRI: £600 million partnership between the Medical Research Council, Cancer Research UK, the Wellcome Trust and University College London to develop a world-leading centre for biomedical research in the UK.

\(^{151}\) How academia and government can work together, Council for Science and Technology, October 2008
33. Science and technology are global enterprises. It will be important for any research funding strategy to take account of the international context, and to ensure an approach that is sufficiently flexible to respond to changes in the international environment. There is also significant potential for the UK to develop partnerships to help build global capacity. For example, the Trust has partnered with the Department for International Development to support a £10 million collaboration to strengthen health research capacity in Kenya and Malawi. Building global partnerships such as these will be increasingly important to tackle new challenges such as emerging pandemics and the health impacts of climate change.

34. We would be happy to discuss any of these issues in more detail.  

*September 2009*