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Setting priorities for publicly funded research

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SUMMARY

Decisions about how best to allocate public funds to support research, especially in these times of economic stringency, are complex. They are not a matter of applying a simple matrix or formula. Instead, they require careful judgements about the deployment of limited funds between competing priorities so that the pursuit of knowledge and its translation into practical applications meet the needs of society as effectively and efficiently as possible. They involve a web of interacting funding mechanisms that include the research councils, higher education funding councils and Government departments.

At the centre of the debate about research funding priorities are the tensions between the differing objectives of research. For example, the research councils provide funding for the main areas of current scientific inquiry on the basis of the best scientific proposals made to them, whilst Government departments, such as health and defence, fund the research necessary for them to meet their departmental objectives. Meanwhile, there is an additional pull on resources as a result of major regional, national and international societal needs, including the aptly named "grand challenges" of climate and demographic change, and security of food, energy and water resources.

We welcome the fact that public expenditure on scientific research over the past decade has increased significantly (albeit from a lower baseline than that of comparable countries). Given the current economic context, however, it seemed particularly timely and appropriate for the Committee to focus on how the Government should set priorities for publicly funded research. We see the starting point as identifying the objectives of research. The objective of much research, particularly what is described as "curiosity driven research", is to understand more fully the world in which we live. More specifically, research can deliver a range of direct and indirect benefits. These include the creation, attraction and maintenance of scientific and technological skills; economic and social benefits; and providing evidence to underpin Government policy.

In this report, we make a number of recommendations intended to ensure that the Government are best placed to make research funding decisions. Our first recommendation is fundamental: that the Government should make a clear and unambiguous statement setting out their current research funding commitments. The remaining recommendations fall into two main categories: the need for an explicit Government overview of public expenditure on research (at both cross-departmental and departmental levels), and the need to develop improved mechanisms for setting priorities. They include requiring the Government Chief Scientific Adviser to publish annually figures on all public spending to support research, including specific aggregations; the establishment of mechanisms to identify major cross-cutting policy challenges and to co-ordinate and fund appropriate responses to such challenges; and a review of the contribution made by the Council for Science and Technology. Finally, we draw the attention of the House to a number of important issues which we have not been able to explore fully in the time available. These include: the balance between "responsive-mode" and "targeted" research; supporting private-sector research and innovation; concentration of research resources; and the role of "impact" as a criterion for allocating research funding. We anticipate that these are matters to which this Committee may wish to return in due course.

Setting priorities for publicly funded research

CHAPTER 1: INTRODUCTION

Background

1. Decisions about how best to allocate public funds to support research, especially in these times of economic stringency, are complex. They require careful judgements about the deployment of limited funds between competing priorities so that the pursuit of knowledge and its translation into practical applications meet the needs of society as effectively and efficiently as possible. Decisions about the use of public funds to support research are more complicated than the classical division between "basic" and "applied" research implies. They involve a web of interacting funding mechanisms, which include the research councils, higher education funding councils and Government departments (see Appendix 5).

2. If the institutional arrangements for funding research are complex, so too is the diversity of demands on those funds. Central to the debate about research funding priorities are the differing tensions resulting from those demands. For example, research councils provide funding for the main areas of current scientific inquiry on the basis of the best scientific proposals made to them, as well as maintaining a strategic overview of developments within science and technology and their potential applications for the benefit of society. In contrast, Government departments such as health and defence fund research necessary to achieve their departmental objectives and discharge their departmental responsibilities. An additional pull on resources results from the major needs of society identified regionally, nationally and internationally—including the aptly named "grand challenges" of climate change, energy security, demographic change and security of food and water resources. Such "grand challenges" require funding bodies to work together if they are to be tackled successfully.

3. Public funding for research has increased in cash terms over the last decade, and this has helped to make the United Kingdom's research base a world leader in many respects. This is welcome. But it does not obviate the need to ensure that funds are being spent well, in terms of value for money and in a way that best reflects societal needs. The current economic climate makes this all the more important.

4. In this short report, we consider whether current mechanisms to support research are sufficiently robust to ensure that decisions about research funding are, as far as possible, based on the best available advice.

Structure of the report

5. We begin with a description of the context in which public funding decisions are made, referring in particular to the economic climate (Chapter 2). We go on to consider the substantive issues of this report relating to improving mechanisms for setting priorities for publicly funded research (Chapter 3).

We then flag up a number of issues that we have not had an opportunity to explore fully but that would warrant further investigation in the future (Chapter 4). Finally, we list our recommendations (Chapter 5).

Terminology

6. The terminology used to distinguish between different types of research is the subject of much debate,[1] including among our witnesses (see pp 5, 419, 449, 505; QQ 2, 5, 42, 285, 286, 288, 289, 456). Identifying tidy categories for research is difficult, but necessary for the purposes of analysis. In this report, we use the term that is most appropriate in the particular context in which it appears. In particular, we use "responsive-mode" research to mean research whose topic has been determined primarily by the researcher, and "targeted" research to mean research whose objective has been determined primarily by the funding agency. We also use the terms "basic" or "curiosity driven" research to mean research intended primarily to enhance understanding, and "applied" research to mean research intended to develop existing understanding for application. We emphasise, however, that such necessary distinctions are not clear cut, and that there is much overlap within and between these categories.

Acknowledgements

7. The membership and interests of the Committee are set out in Appendix 1, and those who submitted written and oral evidence are listed in Appendix 2. The call for evidence with which we launched our inquiry is reprinted in Appendix 3. On 14 October 2009, we held a seminar to which academics, representatives from the Department for Business, Innovation and Skills (BIS) and others contributed. A list of those who gave presentations is set out in Appendix 4. We thank all those who assisted us in our work.

8. Finally, we are grateful to our Specialist Adviser, Professor Ben Martin of the Science Policy Research Unit (SPRU) at the University of Sussex for his expertise and guidance during this inquiry. We stress, however, that the conclusions we draw and the recommendations we make are ours alone.

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1 For example, see *A Vision for UK Research*, Council for Science and Technology, March 2010, p 10.

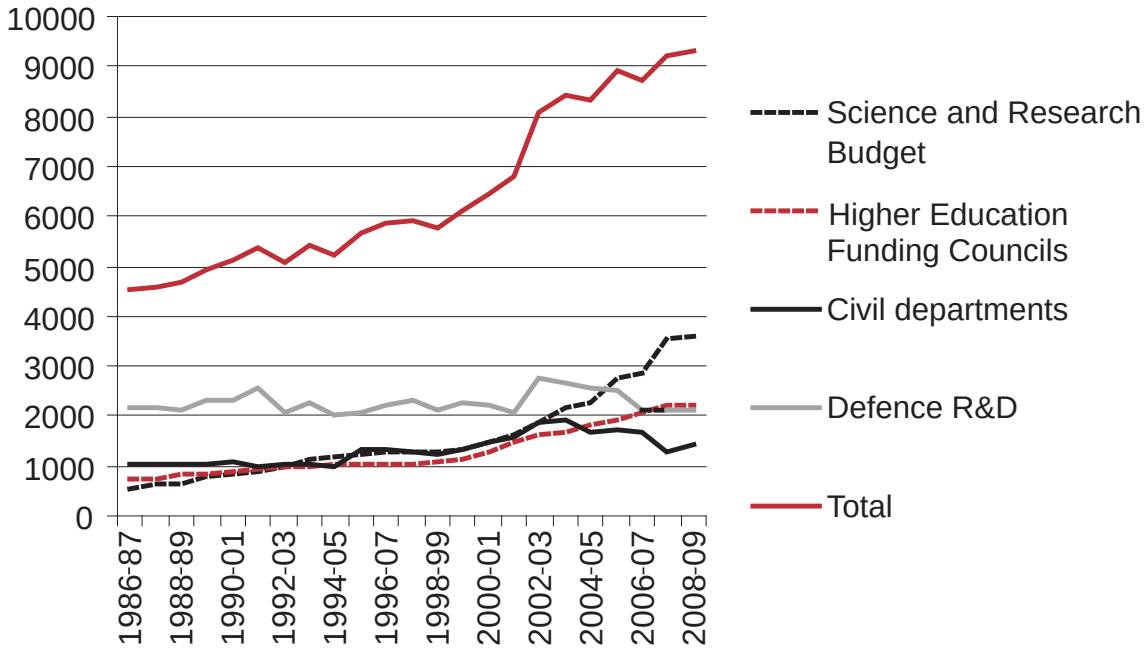
CHAPTER 2: UNITED KINGDOM RESEARCH BASE AND THE ECONOMIC CONTEXT

International comparisons

9. The UK research base ranks highly on many international performance indicators[2] even though the UK allocates a relatively small proportion of resources to research. Over the past 10 years, public research funding in the UK has experienced sustained and significant growth in cash terms (see Figure below), although in international terms it remains relatively small as a percentage of Gross Domestic Product (GDP).[3]

FIGURE

UK Government spending (in cash terms: £ million) on research and development



Note: Figures for 2008–09 are from the 2007 comprehensive spending review plan and are not final.

Source: BIS SET Statistics: Science, Engineering and Technology Indicators (2009)

10. In recent years the UK's position has been increasingly challenged, by two developments in particular. First, other nations, especially in Asia, are catching up rapidly as a result of large investment in research. Secondly, other governments are increasingly prioritising research as part of their policies to support the development of the "knowledge-based economy" in enhancing productivity and growth. In recognition of the importance of such policies, under its 2000 Lisbon Strategy, the European Union has set a target of 3 per cent of GDP—including both private and public investment—to be spent, as an average across all Member States, on research and development by 2010.[4]

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2 *The Scientific Century: Securing our Future Prosperity*, Royal Society, March 2010, pp 9–10; *International comparative performance of the UK research base*, Evidence, September 2009.

3 *OECD Science, Technology and Policy Scoreboard* (2009).

4 *OECD Science, Technology and Industry Outlook* (2008).

11. In 2007, the UK's public and private investment in research and development totalled approximately 1.8 per cent of GDP (pp 452, 460). Public expenditure to support research and development accounted for 0.61 per cent of UK 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 (in 2006) and 0.42 per cent in China (p 8). A further element comes from business and other sources such as the charitable sector. Private-sector investment in research in the UK is low compared with that in many countries (pp 272, 459). In 2006, such investment in the UK totalled 1.1 per cent of GDP—below the Organisation for Economic Cooperation and Development average.[5] Studies have shown that there is a broad correlation between levels of public and private investment in research in a particular country: a low level of government funding is commonly associated with a comparatively low level of private investment, and public spending on research encourages private investment (p 457, Q 272).[6] This correlation has significant implications for public research funding decisions.

Global economic downturn

12. The prospect of exceptional financial stringency in public spending over the coming years has added urgency to the debate about how the UK sets priorities for publicly funded research: as the Wellcome Trust said, "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" (p 505). Lord Drayson, Minister for Science and Innovation, told us that the UK needs to make some "very important decisions about its future and the prioritisation and allocation of resources to deliver that future" (Q 581).

Stimulus packages abroad

13. In response to the economic downturn, several countries have announced "very significant" financial stimulus packages for research and development (pp 148, 195, QQ 482, 458). The federal stimulus package for research and development in the United States, for example, is approximately $21.5 billion; Germany is allocating more than £15 billion of new money for research institutes over the next 10 years; and Japan recently announced a £9 billion stimulus package for science and technology for 2009–10. The research and development budget in India increased by 17 per cent, and in China by 25 per cent, in 2009 (p 148). According to the UK Deans of Science, the justification for such increased investment in research and development is clear: "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" (p 499).

Government response and investment in science

14. Although the UK has not responded to the economic downturn with a stimulus package explicitly intended to support research,[7] the Government

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5 Ibid.

6 *Forward Together: Complementarity of public and charitable research with respect to private research spending*, Alzheimer's Research Trust and the Office of Health Economics, September 2009, p 4.

7 We note, however, that in 2009, the Government announced the introduction of the Strategic Investment Fund; the UK Innovation Investment Fund; additional funding for the Technology Strategy Board; and funding to encourage the development of low-carbon technologies.

have made a commitment to maintain investment in science. In February 2009, the Prime Minister said that "the downturn is no time to slow down our investment in science ... we will not allow science to become a victim of the recession—but rather focus on developing it as a key element of our path to recovery".[8] Similarly, in March 2010, the Secretary of State for Business, Innovation and Skills, Lord Mandelson, reiterated that the Government had "no plans to cut science spending".[9] Lord Drayson has made the same commitment.[10] However, in the light of other countries' significantly increased investment, merely maintaining UK public investment may not be sufficient to protect the UK's international pre-eminence in research: there is, we were told, a risk that other countries may become more attractive to researchers than the UK (p 148, QQ 482–3). As Professor John Beddington, Government Chief Scientific Adviser (GCSA), acknowledged, a differential in the level of public funding between the UK and other countries presents a significant risk to the UK's retention of a skilled work force (Q 491).

15. Despite the Government's stated commitment to maintain public investment in research, in both the 2009 Budget and December's Pre-Budget report, they announced reductions that will affect research—although the full extent of the effect is not yet clear. The Treasury was, for example, unable to tell us how the £600 million of savings announced in the Pre-Budget report would be made (p 412). Although the Government described some of the reallocations within the "science and research budget" (see Appendix 5), announced in the 2009 Budget, as "efficiency savings", [11] some of those savings "will be met through reprioritisation" (p 173).[12] We were also told that the increased cost of international subscriptions as a result of changes in currency exchange rates (QQ 295, 505–7), along with a reduction of £573 million in the funding available to higher education institutions in 2010–11, will have a significant impact on research. Research infrastructure is especially vulnerable in challenging economic circumstances (pp 473, 505–7).[13] We were pleased therefore to hear that Lord Drayson is working with the Science and Technology Facilities Council to increase predictability and stability and help reduce the uncertainty it faces.[14]

Conclusion

16. We welcome the Government's commitment to maintain the "science and research budget". However, we invite the Government to explain how that commitment can be reconciled with the reductions recently announced to the funding available for research councils and for higher education.

17. There is uncertainty about the Government's long-term intentions for public funding to support research. In our view, such funding should be protected:

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8 Romanes Lecture, Oxford University, February 2009.

9 *Financial Times*, 13 March 2010, p 4.

10 Lord Drayson in evidence to the House of Commons Science and Technology Committee, 24 February 2010 (Q 247).

11 Prime Minister in evidence to the House of Commons Liaison Committee, 2 February 2010 (Q 26).

12 For a discussion of the difficulty in establishing the relationship between the research councils and Government in setting priorities, see House of Commons Innovation, Universities, Science and Skills Committee, 8th Report (2008–09): *Putting Science and Engineering at the Heart of Government Policy* (HC Paper 168), pp 45–6.

13 *The Scientific Century*, Royal Society, March 2010, pp 45–6.

14 Statement by the Science and Technology Facilities Council, 4 March 2010.

the Government should recommit to the spending plans outlined in their 2004–2014 science investment framework.[15] They need to establish clearly understood, evidence-based policies and procedures for decisions about public research funding. This is especially important given the relationship between public research funding and private-sector investment in research (see paragraph 11).

18. **We recommend that the Government should make a clear and unambiguous statement setting out**

- **their current research funding commitments; and**
- **the periods of time over which those commitments will apply.**

[15] *Science and innovation investment framework 2004–2014*, HM Treasury, July 2004.

CHAPTER 3: IMPROVING THE MECHANISMS FOR SETTING RESEARCH PRIORITIES

19. Given the current economic context, our focus is on how the Government should set priorities for publicly funded research, ensuring that it represents value for money and is of the highest calibre. This will involve, first, recognising and agreeing the objectives of research and, secondly, setting budgets in the light of identified objectives.

Research objectives

20. The objective of much research, particularly what is described as "curiosity driven research", is to understand more fully the nature and processes of the world in which we live—from atomic substructure to galactic change—and to measure, and where necessary to change, the impact of these processes on the individual and on society (p 1).

21. More specifically, research can bring about a series of direct and indirect benefits, which include:

- the creation, attraction and maintenance of scientific and technological skills (pp 1, 399, 359, 475, QQ 465, 456);
- economic benefit (through harnessing technology, promoting business development and attracting investment into the UK) (p 1);
- social benefit (such as improving health and wellbeing) (pp 1, 359, 475, 506); and
- providing evidence to inform and direct Government policy (pp 1, 43, 70, 371, 383, 446).

22. The Government employ several mechanisms to enable the research base to meet research objectives (see Appendix 5). Although they are interdependent, each has different aims and purposes (p 2). Each may use a different primary criterion: for example, excellence is the primary criterion used by the research councils, to ensure that the highest quality research is funded, whereas Government departments' policy objectives determine their priorities in meeting specific policy needs. The plurality and diversity that this system provides is considered to be valuable as it allows multiple opportunities for the best research to be funded (p 204, QQ 333, 336, 464).

Reaping the benefits of research through Government policy

23. The Government need to make informed policy decisions on the basis of the best available advice, which requires the best possible structures to ensure that advice to Ministers is independent and of the highest calibre.

24. Understanding how this need can be better met is the purpose of this report. We make a number of specific recommendations. They fall into two main categories:

- the need for an explicit Government overview of public expenditure on research—at both cross-departmental and departmental levels;
- the need to develop improved mechanisms for setting priorities.

We consider each in turn.

Overview of Government expenditure on research and development

25. All Government departments' research and development spending should be driven by the need to support policy objectives. It is likely that, in a number of departments, that expenditure, like those objectives, will vary from year to year (Q 100). Only the Department of Health's research and development spending is ring fenced (p 23).

26. There is often a tension between the short-term focus of a Government, and especially of a particular Minister, and the long-term nature of much research. That tension is increased when budgets are under pressure, and can make departmental research and development budgets particularly vulnerable at a time of reductions in expenditure (QQ 278, 282, 79, 563, 327, 102, 103, 104).

27. According to the evidence we received, within the Government there is no overview of total public spending on research and development across key policy sectors, or discussion of national research priorities. Nick Dusic, Director of the Campaign for Science and Engineering, for example, told us that although the Treasury decided research allocations to the various funding mechanisms, it had no overview of all public spending to support research—that is, not only Government departments but the research councils and other mechanisms (Q 327). Lord Drayson said that "no individual" is "the locus for an overview of all of the lines of [research] investment" (Q 560). Professor Beddington confirmed that data were collected at departmental level and that they did not include the calculation of figures for specific subject areas across all Government spending (p 314).

28. Professor Andrew Stirling, Research Director at SPRU, University of Sussex, also made the point that in the UK, in contrast to the United States, for example, "aggregated information" on how much is spent on particular aspects of research and development within key sectors was not readily available; as a result, it was difficult to identify the reasons why resources were distributed as they were (QQ 441, 442, 443). He suggested that the Government Office for Science, which provides administrative support to the GCSA, should publish on a regular basis detailed figures aggregated across all public research investment in key sectors of the economy such as energy, food, transport, security and public health (p 287). We agree. Such aggregation would require Government departments and the other organisations involved to agree definitions for the categories to be reported. Aggregated information on public research spending is important not only for reasons of accountability. Much research in key policy sectors is essential to maintain national capacity. If that capacity is lost or jeopardised because a particular aspect is not given sufficient priority, and is therefore subject to a reduction in funding, Government policy may suffer.

29. **We recommend that the Government Chief Scientific Adviser should**

- **publish annually figures on all public spending to support research, including aggregated figures for categories the definitions of which have been agreed among Government departments and with relevant organisations; and**
- **make appropriate recommendations to the Prime Minister.**

We further recommend that the Government Office for Science should have the appropriate resources to support that task.

Advice and consultation

30. The Government have access to several sources of science advice, both within the Government (internally) and from independent advisers (externally). Internal science advice is provided to Ministers by, among others, the GCSA and departmental CSAs.[16] Most Government departments—with the exception of the Treasury—have a CSA to provide advice on and challenge to departmental spending, strategies and priorities. All departmental CSAs attend regular meetings of the Committee of CSAs (CSAC), chaired by the GSCA. The GCSA also attends the Cabinet Sub-Committee on Science and Innovation, ED(SI). ED(SI) is chaired by the Minister for Science and Innovation and includes Ministers from the Treasury and "all departments in which science plays a key role in the formation and delivery of policy" (pp 299–301).

31. The GCSA reports quarterly to ED(SI) on departmental research and development spending (Q 516). ED(SI) has "agreed" that departments "should consult" the GCSA and the Treasury "in advance of any potential cuts to research budgets or expenditure".[17] It is not clear, however, how that will work in practice: for example, Home Office research and development spend is not calculated in advance (Q 18 in Appendix 7).

32. Lord Sainsbury told us that ring fencing departmental research and development budgets would make them less vulnerable in the event of pressure on the department's overall budget (Q 51). However, Miles Parker, Deputy CSA and Director for Evidence at the Department for Environment, Food Rural Affairs (Defra), disagreed (QQ 100, 101). Rather, he and other representatives of Government departments emphasised the need to increase understanding of the role of evidence in formulating informed policy and of the consequences for policy objectives of reductions in research and development spending (QQ 104, 31, 79, 101). To do that, science advisers need to be present at meetings at which departmental policy objectives and the research to support them are discussed.

33. Professor Beddington has proposed that each department's board should include its CSA or another senior analyst (p 298),[18] but some departmental boards meet without a CSA or senior analyst even present (p 427, Q 498).

34. **We recommend that, as part of his oversight role, the Government Chief Scientific Adviser should be present at meetings with the Treasury at which departmental budgets are considered.**

35. **We further recommend that all departmental Chief Scientific Advisers should provide Ministers with timely information in advance of departmental budget negotiations.**

Improved mechanisms for setting priorities

36. We have identified two broad areas in which the mechanisms for setting priorities can be improved. We acknowledge that there are others. The two areas are:

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16 For full details of the roles and responsibilities of these (and other) science advisers, see *Science and Engineering in Government: An Overview of the Government's Approach*, Government Office for Science, October 2009, pp 14–23.

17 Ibid., p 4.

18 Ibid., p 25, para 3.8.

- developing formal mechanisms for identifying major cross-cutting challenges, including the "grand challenges", and, where appropriate, putting in place cross-departmental budgets;
- strengthening the role of independent external advice to Government, including a review of the role of the Council for Science and Technology.

Improving mechanisms for responding to major cross-cutting policy challenges

37. Responding to major cross-cutting policy challenges, such as energy security, food security and climate change, requires collaboration—across research institutions, disciplines, funding organisations, Government departments and international boundaries. As Professor Robert Watson, CSA at Defra, told us, we have to break through the "stove pipes" among and within institutions that fund research (Q 96). The Government have a role to play in facilitating co-ordination and collaboration among researchers in different disciplines and across different funding streams in order to respond quickly and effectively to such "grand challenges" (p 120, QQ 374, 432, 433).

38. Yet, according to our witnesses, research is often not translated into policy solutions. In part, this is because of "the lack of incentive for collaborations within our research system" as a result of "highly competitive" funding systems and the complex structure of the research councils, which do not reward or facilitate interdisciplinary or ground-breaking research (QQ 472, 473, 450, 248, 21, 500; pp 470, 199, 495, 120).

39. More significantly, we received evidence that co-ordination across Government and between departments was weak and inconsistent, and that departmental priorities outweighed cross-Government priorities (p 120). Professor Beddington thought that departmental "silos" presented particular difficulties in tackling both cross-cutting policy areas (Q 500) and "orphan issues", for which no one department has responsibility (Q 13 in Appendix 7). Professor Sir John Bell, Chair of the Office for Strategic Coordination of Health Research, recognised that "current structures" presented a "really serious problem" that "affects science probably more than it affects anything else" (Q 425). Across Whitehall, projects can suffer from the lack of a single budget or budget holder and having, instead, "a committee of sub-budget holders" with different and even competing interests, because the budgets reside within different Government departments under individual accounting officers (QQ 429, 433, 24). Lord Drayson admitted that departmental "sovereignty" did not facilitate cross-departmental research activity (Q 561), and suggested that "additional structures" were required (Q 562).

40. In our view, formal mechanisms should be put in place to remedy this deficiency. **We recommend that the Government should establish appropriate mechanisms for:**

- **identifying major cross-cutting policy challenges; and**
- **funding and co-ordinating appropriate responses to such policy challenges.**

We further recommend that:

- **separate budgets should be made available for research programmes to respond to major cross-cutting policy challenges;**

- **each research programme to respond to such policy challenges should have one, readily identifiable, budget-holder who would be ultimately responsible for delivering the programme; and**
- **management and delivery of research programmes to respond to such policy challenges should feature prominently in budget holders' performance appraisals.**

Strengthening the role of independent external expert advice

41. In addition to internal sources, Ministers receive science advice from external independent advisory organisations, such as the Council for Science and Technology (CST).[19] According to Jeremy Clayton, Deputy Head of the Government Office for Science: "All the committees and advisory bodies you could want are in the system"; but, as he says, "what we need to do is make sure that the ones we do have are effective" (Q 28). We propose three specific areas where improvements should be made to strengthen the contribution of external advice.

Consultation and transparency

42. During each Comprehensive Spending Review (CSR), BIS allocates funding to individual research councils and national academies on the basis of prospective and retrospective performance assessment, according to the Haldane Principle.[20] In recent years, this process of allocation has been criticised for a lack of transparency (pp 193, 360).[21] The Government are committed to improving transparency and the allocation process by "consulting more extensively" before the next CSR (p 2). The consultation will include the Royal Society, the Royal Academy of Engineering, the British Academy, the CST, the CSAC and the Confederation of British Industry, and will be made public (Q 518). **We welcome the Government's commitment.**

Departmental commissioning of research

43. Government departments conduct or commission research in order to provide evidence to inform policy interventions (pp 1, 379, 412, 446; Q 101). The evidence we received included concerns that some departments were not acting as intelligent customers in commissioning research. Departmental commissioning processes were described as "ad hoc and inefficient" (p 200). This, along with other shortcomings such as a lack of the necessary technical understanding resulting in "over-reliance on consultancies", could affect the quality of the commissioned research (pp 146, 200, 470, 476). These problems persist despite retrospective reviews by the Government Office for Science and the Cabinet Office of individual departments' approaches to research prioritisation and use of evidence (pp 24–5).

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[19] In February 2010, we wrote to Lord Drayson on the provision of independent scientific advice to Government (see Appendix 6).

[20] See footnote 30 below. For a full discussion of the principle, including its history, see House of Commons Innovation, Universities, Science and Skills Committee, 8th Report (2008–09): *Putting Science and Engineering at the Heart of Government Policy*, (HC Paper 168), pp 40–4.

[21] For a full discussion of the lack of transparency in the allocation process, in particular in the role of Government in setting research council priorities, see House of Commons Innovation, Universities, Science and Skills Committee, 8th Report (2008–09): *Putting Science and Engineering at the Heart of Government Policy* (HC Paper 168), pp 45–6.

44. One departmental CSA assured us that departments would not fund research that was not of high quality (Q 113). However, Professor Beddington was "absolutely sure" that departmental commissioning of research for policy formulation did not always involve the necessary "virtuous circle" of posing "researchable" questions, with expert external peer review; nor, in his view, was there always the necessary "expertise to know who to ask and who to ask what to ask" (Q 503). In our view, this aspect—knowing who to ask and what to ask—is fundamental.

45. Departmental CSAs are responsible for the adequacy of the evidence base and the allocation of funding for research within their department (p 384). However, some of the evidence we received suggested that the influence of CSAs over the research agenda varied among departments (pp 420, 252).

46. In our view, the support provided by a departmental CSA is critical to a department's commissioning of research. **We recommend that the departmental Chief Scientific Adviser should be consulted as an integral part of the commissioning process, in particular in helping to identify the nature of the advice sought and the relevant expertise.**

Council for Science and Technology

47. The CST is the Government's highest level independent science advisory group and reports directly to the Prime Minister. We had some difficulty in establishing the precise role of the CST in the process of priority setting for research funding and in relation to oversight of publicly funded research and development spending. The Institute of Physics described the CST as an "underexploited resource" with limited impact (pp 427, 195).

48. **We recommend that the Government commission an independent, external review of the role, responsibilities, objectives and reporting arrangements of the Council for Science and Technology and the use made of its advice.**

CHAPTER 4: FLAGGING UP FURTHER ISSUES

Introduction

49. We received evidence on a range of other issues relating to the prioritisation of publicly funded research. They included the balance between "responsive-mode" and "targeted" research; supporting private-sector research and "innovation"; increasing concentration of research resources; and the use of "impact" as a criterion in funding decisions. We recognise the importance and complexity of these issues. Although we have not, at this stage, explored them fully, we draw them to the attention of the House as matters to which, we anticipate, this Committee will wish to return in due course.

"Responsive-mode" and "targeted" research

50. In February 2009, Lord Drayson posed the question whether "the balance of investment in science and innovation" should "favour those areas in which the UK has clear competitive advantage".[22] In evidence to us in February 2010, he suggested that the approach of targeting funding on competitive areas presented "part of the answer to the problem" that economic pressure presents (QQ 581–2).

51. We recognise that some targeting of research is needed—for example, to meet departmental policy objectives (p 1); to achieve the necessary scale of activity within an area of science in which major infrastructure and skills are required (pp 505–6; Q 289); to encourage the development or application of research in areas of identified academic excellence or economic strength (p 231, QQ 371, 343); and to respond to identified major cross-cutting policy challenges (pp 147, 396, 447; QQ 290, 340, 422, 473, 484).

52. However, some witnesses expressed anxiety about the possibility of responsive-mode research being targeted. It was suggested that targeted research funding might, in some circumstances, result in a conflict with the principle of excellence: whereas funding for responsive-mode research is "highly competitive" and "can raise standards" (p 194), a targeted approach risked funding "poorer quality" or even "mediocre" research (pp 353, 357). Much of the evidence we received emphasised the importance of "basic" research, in particular in generating the most important breakthroughs (pp 353, 496) and as a necessary precursor to much applied research (p 427). Furthermore, a low level of public funding for responsive-mode research had a disproportionate effect on some disciplines, such as mathematics and chemistry, because of a lack of alternative sources of funding (p 367, Q 474). Recent assessments of the future of research have recommended increasing the funding available for individual researchers, as opposed to particular research projects, in order to protect the excellence associated with "responsive-mode" research.[23]

53. Some witnesses argued that, in order to find necessary solutions to societal challenges in a time of financial constraint, the "delicate balance" between targeted and responsive-mode research needed "to swing towards targeted

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22 Speech to the Foundation for Science and Technology, 4 February 2009.

23 *A Vision for UK Research*, Council for Science and Technology, March 2010, p 25; *The Scientific Century*, Royal Society, March 2010, p 48.

research in the short to medium-term" (pp 98, 100). In contrast, others argued that the balance had already "swung too far" towards targeted research (pp 417, 496, 501). Figures on research council funding for responsive-mode and applied research show that the amount of funding allocated to responsive-mode research has remained fairly constant—or, indeed, in the case of some research councils, that funding for responsive-mode research has increased (pp 174–9).[24] Some witnesses said that the balance between responsive-mode and targeted research should be "dynamic" rather than "static" (pp 100, 194); and that there was "no magic formula" (p 360): it was a "judgement call" (Q 291), the success of which could be evaluated only retrospectively (QQ 292, 376).

54. It goes without saying that an appropriate balance needs to be maintained between the different types of research. We were told that, in the light of its inherent unpredictability, responsive-mode research is likely to fare less well in challenging economic circumstances than targeted research (pp 417, 467). With this in mind, **we urge research councils, in determining the appropriate balance, to give due consideration to the role and importance of responsive-mode research in meeting the broader objectives of research.**

Supporting private-sector research and innovation

55. The UK's ability to translate research into applications remains poor in comparison with the volume of high-quality research carried out in the UK (pp 254–5, 356, 420, 422–3, 426, 469, QQ 292, 414, 574). Maximising the benefits of research would therefore require a significant increase in the effort devoted to the translation of research findings into successful applications. In the light of the importance of the contribution of private-sector investment in fulfilling that objective, the Government have a role in supporting such investment both directly and indirectly (QQ 362, 456).[25]

56. The translation of research into new products, services or processes is part of the process of "innovation", which the Government have made a national priority.[26] Public funding mechanisms to support "innovation" include the Technology Strategy Board (TSB), R&D Tax Credits, the UK Innovation Investment Fund and the Small Business Research Initiative (SBRI) (see Appendix 5). Regulatory interventions, standards, regional development agencies, and departmental institutions and agencies also play an important role (p 22, QQ 397, 393–6).

57. In order to attract private-sector research investment and thereby encourage innovation in the UK, witnesses argued that relevant policies had to be clear and consistent over the long term (QQ 394, 460, 375, 394, 456). Some witnesses told us that UK innovation policy lacked coherence and a strategic approach; and that the clarity and stability provided by a strategic approach were vital in encouraging private-sector decisions to invest in research

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24 *The Scientific Century*, Royal Society, March 2010, p 15.

25 The Government provide direct funding to support private-sector research investment through the UK Innovation Investment Fund and the Small Business Research Initiative. Tax credits are available for private-sector research investment. In the December 2009 Pre-Budget report, the Government announced the introduction in April 2013 of the Patent Box initiative, under which companies that develop a patented technology in the UK will be eligible for a reduced rate of corporation tax (see Appendix 5).

26 *Innovation Nation*, Department of Business, Innovation and Skills, March 2008.

(QQ 362, 375, 394, 456, 460, 472). The CST report *A Vision for UK Research*, published in March 2010, stated that the Government need to develop consistent, focused long-term industrial strategies, backing novel key technologies with global market potential to provide a framework for research investment by the private sector, research councils and the TSB.[27]

58. A number of witnesses made suggestions to help achieve this, including expanding the role and increasing the resources of the TSB, and developing a system of large research centres (pp 194, 200, 441, QQ 362, 407, 460, 471). We await with interest the publication of Herman Hauser's review of how the UK might maximise its research potential, and the Government's response to both that review and the CST's recent report.

Increasing concentration of research resources

59. We recognise that for some research activity, such as that based on large experimental facilities, or for more applied research projects responding to major policy challenges, concentrating relevant skills and financial resources in particular locations may be necessary in order to achieve the necessary scale of effort and facilitate knowledge transfer. However, the implications of concentrating research resources within particular institutions are poorly understood, and it was suggested to us that the evidence base to support further concentration remains weak (Q 448). Again, we await with interest the publication of Herman Hauser's review, which we anticipate will cover the role of concentration of research resources in realising the full potential of UK research.

Impact

60. In recent years "impact" has been increasingly used as a criterion both retrospectively, in research council delivery plans and evaluations, and prospectively, in individual grant applications to research councils. It is a concept that encompasses more than economic impact. Professor Alan Thorpe, Chair of the Research Councils UK Executive Group and Chief Executive of the Natural Environment Research Council, for example, said that "we do not regard impact as narrowly as ... economic benefit ... it is a very broad concept" (Q 271).

61. Professor Dame Janet Finch, co-Chair of the Council for Science and Technology, observed that "any assessment of impact needs to take into account that breadth" (Q 477). Measuring "impact" presents difficulties. Professor Leszek Borysiewicz, Chief Executive of the Medical Research Council (MRC), for example, admitted that the MRC was "struggling" to measure societal impact (Q 272). Professor Sir Martin Taylor, Chair of the Royal Society's Fruits of Curiosity project, said that scientists were often very poor judges of the likely impact of their research (Q 478). Witnesses also expressed anxiety about the timescale involved in measuring research impact (pp 345, 360, 497, 506, Q 478). As Professor Beddington, said, "almost by definition, the impact of research comes after some variable time-lag, depending on the research ... whether one could have actually had that degree of foresight to say that some particular development would actually prove to be enormously important some decades later ... is difficult" (Q 509).

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[27] *A Vision for UK Research*, Council for Science and Technology, March 2010, p 30.

62. Professor Dame Janet Finch clearly stated that the CST's view of prospective assessment of impact was that "there should not be any principle other than excellence in the identification of [basic] research projects to be funded" (Q 477). Professor Beddington believed that it was 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" (Q 509).

63. Nevertheless, other witnesses told us that including consideration of impact in prospective assessments might result in opportunities for collaboration in and development of research that would not otherwise arise (QQ 274, 275, 277) and that this had brought about an important culture change (Q 451). Professor Adrian Smith, BIS's Director General, Science and Research, described prospective assessment of impact as an attempt to encourage "a culture, an awareness and a behaviour change" to identify and support opportunities for exploitation (Q 552).

64. The term "impact" is not clearly understood and is ambiguous, not least because it is multi-dimensional in nature. However, it is often used as if it were well defined and could, indeed, be quantified. In our view, the methods of assessing and quantifying "impact" have not been sufficiently developed and justified. We therefore have reservations about the use of "impact" as a criterion in prospective assessments of individual applications for funding to research councils. **We therefore propose that, when the relevant funding organisation considers "impact" to be a material factor in funding research, it should make an explicit statement of the nature and quantifiability of the expected impact of the research in question.**

65. The new retrospective assessment proposed by the Higher Education Funding Council for England (HEFCE), called the Research Excellence Framework (REF), "will for the first time explicitly take account of the impact research makes on the economy and society" (p 3). HEFCE proposes a weighting for impact in the REF of 25 per cent. HEFCE does not propose "any trade-off between impact and excellence" but will assess only "impact that arises from excellent research", whether "curiosity driven" or "applied" (Q 219). Many respondents to HEFCE's recent consultation on the REF expressed concern about the inclusion of research "impact" as a criterion, arguing that the assessment of "impact" would be subjective. **We understand HEFCE's wish to take account of the wider impact of research, but are yet to be convinced that a practicable and fair way of doing so has been found. We therefore recommend that, in HEFCE's proposed new retrospective assessment, the weighting given to impact should be significantly less than the 25 per cent proposed.**

CHAPTER 5: RECOMMENDATIONS

United Kingdom research base and the economic context

66. We recommend that the Government should make a clear and unambiguous statement setting out

- their current research funding commitments; and
- the periods of time over which those commitments will apply (paragraph 18). (Recommendation 1)

Overview of Government expenditure on research and development

67. We recommend that the Government Chief Scientific Adviser should

- publish annually figures on all public spending to support research, including aggregated figures for categories the definitions of which have been agreed among Government departments and with relevant organisations; and
- make appropriate recommendations to the Prime Minister (paragraph 29). (Recommendation 2)

We further recommend that the Government Office for Science should have the appropriate resources to support that task (paragraph 29). (Recommendation 3)

Advice and consultation

68. We recommend that, as part of his oversight role, the Government Chief Scientific Adviser should be present at meetings with the Treasury at which departmental budgets are considered (paragraph 34). (Recommendation 4)

69. We further recommend that all departmental Chief Scientific Advisers should provide Ministers with timely information in advance of departmental budget negotiations. (paragraph 35). (Recommendation 5)

Improving mechanisms for responding to major cross-cutting policy challenges

70. We recommend that the Government should establish appropriate mechanisms for:

- identifying major cross-cutting policy challenges; and
- funding and co-ordinating appropriate responses to such policy challenges (paragraph 40). (Recommendation 6)

71. We further recommend that:

- separate budgets should be made available for research programmes to respond to major cross-cutting policy challenges;
- each research programme to respond to such policy challenges should have one, readily identifiable, budget-holder who would be ultimately responsible for delivering the programme; and
- management and delivery of research programmes to respond to such policy challenges should feature prominently in budget-holders' performance appraisals (paragraph 40). (Recommendation 7)

Strengthening the role of independent external expert advice

Consultation and transparency

72. We welcome the Government's commitment to improving transparency and the process of allocating the science and research budget by consulting 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 of British Industry before the next comprehensive spending review (paragraph 42).

Departmental commissioning of research

73. We recommend that the departmental CSA should be consulted as an integral part of the department's commissioning process, in particular in helping to identify the nature of the advice sought and the relevant expertise (paragraph 46). (Recommendation 8)

Council for Science and Technology

74. We recommend that the Government commission an independent, external review of the role, responsibilities, objectives and reporting arrangements of the CST and the use made of its advice (paragraph 48). (Recommendation 9)

"Responsive-mode" and "targeted" research

75. We urge research councils, in determining the appropriate balance between the different types of research, to give due consideration to the role and importance of responsive-mode research in meeting the broader objectives of research (paragraph 54). (Recommendation 10)

Impact

76. We propose that, when the relevant funding organisation considers "impact" to be a material factor in funding research, it should make an explicit statement of the nature and quantifiability of the expected impact of the research in question (paragraph 64). (Recommendation 11)

77. We understand the wish of the Higher Education Funding Council for England (HEFCE) to take account of the wider impact of research, but are yet to be convinced that a practicable and fair way of doing so has been found. We therefore recommend that, in HEFCE's proposed new retrospective assessment, the weighting given to impact should be significantly less than the 25 per cent proposed (paragraph 65). (Recommendation 12)

APPENDIX 1: MEMBERS AND DECLARATIONS OF INTEREST

Members:

Lord Broers
Lord Colwyn
Lord Crickhowell
Lord Cunningham of Felling
Lord Haskel
Lord Krebs
Lord May of Oxford
Lord Methuen
Baroness Neuberger
Earl of Northesk
Lord O'Neill of Clackmannan
† Lord Oxburgh
Baroness Perry of Southwark
Lord Sutherland of Houndwood (Chairman)
Lord Warner

† Co-opted member

Specialist Adviser:

Professor Ben Martin, Professor of Science and Technology Policy Studies, University of Sussex

Declared Interests:

Lord Broers
Fellow, Royal Society
Fellow and Past President, Royal Academy of Engineering
Chairman, Diamond Light Source Ltd
Past Vice-chancellor University of Cambridge

Lord Colwyn
None

Lord Crickhowell
None

Lord Cunningham of Felling
None

Lord Haskel
Honorary President, Materials UK
Honorary President, Technitex (an association of firms in the technical textiles industry)
Honorary President, Environment Industry Commission

Lord Krebs
Principal, Jesus College Oxford
Fellow, Royal Society
Chairman, Science Policy Advisory Group, Royal Society
Chairman, Oxford Risk
Chair, Adaptation Sub-Committee of the Committee on Climate Change
Member, Climate Change Committee

Trustee, Nuffield Foundation
Former Chairman, Food Standards Agency (2000–05)
Former Chief Executive, Natural Environment Research Council (1994–99)

Lord May of Oxford
Non-Executive Director, Defence Science and Technology Laboratory (DSTL)
Professor, Oxford University
Visiting Professor, Imperial College
President, British Science Association (2009–2010)
Member, Climate Change Committee
Trustee, UK Stem Cell Foundation
President, Royal Society (2000–2005)
Chief Scientific Adviser to the UK Government and Head of the UK Office of Science and Technology (1995–2000)

Lord Methuen
None

Baroness Neuberger
Former member, Medical Research Council (1995–2000)
Former CEO, King's Fund (1997–2004)
Hon Fellowship, Royal College of General Practitioners
Hon Fellowship, Royal College of Physicians
Hon Fellowship, Royal College of Psychiatrists
Former member, Unilever's Central Ethical Compliance Group (2003–2008)
Former Chair, Camden and Islington Community NHS Trust (1993–1997) with a large research component

Earl of Northesk
None

Lord O'Neill of Clackmannan
None

Lord Oxburgh
*Member, (A*STAR) Advisory Committee on Science Technology and Research for Singapore*
Fellow, Royal Society
Hon Fellow, Royal Academy of Engineering
Deputy Chairman, Singapore Science and Engineering Research Council
Foreign member, US Academy of Science
Foreign member, Australian Academy of Science

Baroness Perry of Southwark
Chair, Addenbrookes NHS Trust/ Cambridge University Clinical School Research Governance Committee
Patron, Alzheimer's Research Trust

Lord Sutherland of Houndwood (Chairman)
None

Lord Warner
None

A full list of Members' interests can be found in the Register of Lords Interests: http://www.publications.parliament.uk/pa/ld/ldreg/reg01.htm

Professor Ben Martin, Specialist Adviser
Member, Royal Society 'Fruits of Curiosity' Group, 2009–10

APPENDIX 2: LIST OF WITNESSES

The following witnesses gave evidence; those marked with * gave oral evidence

Academy of Medical Sciences

Advisory Committee on the Safety of Blood Tissues and Organs

Alzheimer's Society

Aporia

Association of Medical Research Charities

* Mr Simon Denegri

Biosciences Federation and Institute of Biology (now the Society of Biology)

Professor Donald Braben

Breast Cancer Campaign

British Academy

* Professor Roger Kain

British Computer Society (The Chartered Institute for IT)

British Council for Ageing

British Heart Foundation

British Psychological Society

British Society for Developmental Biology

* Professor Sir Richard Brook, Leverhulme Trust

Cabinet Office

Campaign for Science and Engineering (CaSE)

* Mr Nick Dusic

Cancer Research UK

Centre for Process Innovation

* Dr Graham Hillier

Chief Government Social Scientist, Professor Paul Wiles

Committee on Radioactive Waste Management

Council for Science and Technology

* Professor Dame Janet Finch

Council for the Mathematical Sciences

Department for Business Innovation and Skills

* Rt Hon Lord Drayson

* Professor Adrian Smith

* Mr Jeremy Clayton, Government Office for Science

* Dr Graeme Reid

* Professor Sandy Thomas, Foresight

Department for Children, Schools and Families

Department for Environment, Food and Rural Affairs (Defra)

* Professor Robert Watson

* Dr Miles Parker

DEFRA Science Advisory Council

* Professor Chris Gaskell

Department for International Development

* Dr Andrew Steer

* Dr Gail Marzetti

Department for Transport

Department for Work and Pensions

Department of Communities and Local Government

Department of Energy and Climate Change

Department of Health

* Professor Dame Sally Davies

* Professor Tom Walley

Dr Martin Dominik

Energy Research Partnership

* Dr Graeme Sweeney, Shell

* Professor John Loughhead, UK Energy Research Centre

Energy Technologies Institute

* Dr David Clarke

Engineering and Technology Board (now Engineering UK)

Engineering Council UK

Engineering and Physical Sciences Research Council

* Professor David Delpy

Environment Agency

* Ms Miranda Kavanagh

Food Standards Agency

* Dr Andrew Wadge

Foreign and Commonwealth Office

Forensic Science Service Ltd

GeneWatch UK

Professor Luke Georghiou, University of Manchester

* Ms Anne Glover, Amadeus Capital Partners

Government Chemist, Derek Craston

* Government Chief Scientific Adviser, Professor John Beddington
Mr Chris Harries
Health and Safety Executive
Higher Education Funding Council for England
* Mr David Sweeney
HM Revenue and Customs
HM Treasury
Home Office
Imperial College London
Institute of Physics
Institution of Chemical Engineers
Institution of Civil Engineers
Institution of Engineering and Technology
James Lind Alliance
John Innes Centre
Joint Nature Conservation Committee
* Dr Andrew Stott
Professor Michael Kelly
Linnean Society of London
Medical Research Council
* Sir Leszek Borysiewicz
Met Office
* Mr Derrick Ryall
Ministry of Defence
* Professor Mark Welland
* Mr Paul Stein
Ministry of Justice
National Physical Laboratory
* Dr Brian Bowsher
Natural Environment Research Council and RCUK
* Professor Alan Thorpe
* Dr Paul Nightingale, Science Policy Research Unit, University of Sussex
Office for Strategic Co-ordination of Health Research
* Professor Sir John Bell
Office of the Vice Provost for Research, University College London
Dr James Ren
Research Councils UK

* Dr Steven Hill

Resource Efficiency Knowledge Transfer Network

Roche

Rolls Royce

* Mr Colin Smith

Roslin Institute

Royal Academy of Engineering

Royal Astronomical Society

Royal College of Paediatrics and Child Health

Royal College of Physicians

Royal National Institute for Deaf People

Royal Society

* Professor Sir Martin Taylor

* Dr James Wilsdon

Royal Society of Chemistry

Royal Society of Edinburgh

* Professor Geoffrey Boulton

Russell Group of Universities

* Lord Sainsbury of Turville

* Professor Andrew Stirling, Science Policy Research Unit, University of Sussex

Sustainable Development Group of the Institute of Materials Minerals and Mining

Syngenta

Technology Strategy Board

* Mr Iain Gray

UK Computing Research Committee

UK Deans of Science

UK Government's Spongiform Encephalopathy Advisory Committees

University College London

Professor Christos Vassilicos

Veterinary Laboratories Agency

* Professor Chris Thorns

* Professor Andrew Watkinson, Living with Environmental Change

Wellcome Trust

APPENDIX 3: CALL FOR EVIDENCE

Cuts in overall public spending due to the current economic climate will lead to some difficult decisions about how to allocate public funds for science and technology research. Effective mechanisms for allocating funds are vital if the UK's science base is to remain healthy both now and in the future and is to continue to contribute to meeting societal needs.

The House of Lords Science and Technology Committee, chaired by Lord Sutherland of Houndwood, is undertaking an inquiry into the setting of research funding priorities within Government and other bodies responsible for the allocation of public funds for science and technology research—that is, all aspects of science and technology, including, for example, the medical and engineering sciences.

The Committee intends to focus on:

- how decisions are made to fund research to meet societal needs;
- the balance of funding for targeted[28] versus unsolicited response-mode, curiosity-driven research;[29] and
- how research is commissioned in Government departments and agencies.

The inquiry will cover the research councils, Higher Education Funding Councils (HEFCs) and Government departmental research and development. It will not cover funding for European Union research activities.

The Committee invites evidence on the questions below.

- 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[30] 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

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28 "Targeted research" refers to research directed towards a specific strategic outcome and includes, for example, Government departmental research and the research councils' 'themed' research programmes.

29 The Natural Environment Research Council (NERC), for example, uses the following definition of responsive-mode research: "the funding stream that supports excellent research in response to unsolicited ideas from research groups, consortia or individuals, in any area relevant to NERC's remit. NERC promotes unrestricted and innovative thinking; proposed research can be pure, applied or policy-driven, and must seek to address—or provide the means to address—clearly defined science questions."

30 After the First World War, Lord Haldane undertook a review of the function of Government. The 'Haldane Principle' stems from a distinction made in that review between 'research work of general use' and 'research work supervised by administrative departments', advising that the former should be undertaken independently of administrative supervision as 'science ignores departmental as well as geographical boundaries'. The 'Haldane Principle' has evolved over time, and there is currently no accepted definition of the principle.

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?

APPENDIX 4: SEMINAR HELD AT THE HOUSE OF LORDS

14 October 2009

The Committee heard presentations from:

- Jeremy Clayton (Deputy Head of the Government Office for Science, Department for Business, Innovation and Skills) and Dr Graeme Reid (Deputy Director, Economic Impact, Science and Research Group, Department for Business, Innovation and Skills): Introduction to the allocation of science and technology research funding within Government.
- Dr Phil Sooben (Director of Policy, Economic and Social Research Council) and Dr Wendy Ewart (Strategy Director, Medical Research Council): Research Council allocations of science and technology funding.
- Dame Ann Dowling (member of advisory committee to Royal Society's Fruits of Curiosity project) and Nick Dusic (Director, Campaign for Science and Engineering): The scientific community's perspective on the allocation of science and technology funding.
- Mike Carr (former Chief Science Officer, British Telecom and independent council member of the Engineering and Physical Sciences Research Council): Alignment of public and private research funding priorities—industry's perspective.
- David Lynn (Head of Strategic Planning and Policy, Wellcome Trust): Alignment of public and private research funding priorities—the charitable sector's perspective.

APPENDIX 5: PUBLIC FUNDING MECHANISMS TO SUPPORT RESEARCH AND DEVELOPMENT

Public funding for research is channelled through a diverse range of different mechanisms to support the pursuit of knowledge and its translation into practical applications for the benefit of society (see Table).

TABLE

Summary of the public funding mechanisms to support research and development in the UK

Mechanism	Budget* (Millions)	Notes
"Science and research budget"	£3,970* (09/10)	Ring-fenced funding allocated (by BIS) to • research councils; and • national academies on the basis of prospective and retrospective performance assessments; and • to cover large facilities' capital costs. Research councils and national academies themselves determine allocations to projects and individuals using the primary criterion of excellence as assessed through peer review.
Higher Education Funding Councils	England £1,785* (10/11) Wales £79.5 ** (10/11) Scotland £240.4 *** (09/10) Northern Ireland £51.9† (09/10)	Funding allocated to four HEFCs (for England, Wales, Scotland and Northern Ireland, by either BIS or the relevant devolved administration). Allocated (by the relevant HEFC) to higher education institutions as block grants to support research and capital costs, through periodic retrospective assessments of higher education institutions' research activity, using the primary criterion of excellence. (The assessment was formerly known as the Research Assessment Exercise; its proposed replacement, the Research Excellence Framework, was recently subject to consultation.)

Government departments	Civil departments £1,294* (07/08) Defence £2,139* (07/08)	Part of each department's annual budget/expenditure. Only Health's is ring-fenced and therefore discrete. Allocated to support research that underpins the department's policy objectives, using the primary criterion of policy need.
Technology Strategy Board	£289* (10–11)	Funding is allocated to the TSB to catalyse business innovation in the areas identified as offering the greatest scope for boosting UK growth and productivity.
Regional development agencies	>£300‡ (08/09)	Allocated to RDAs for research to support regional development strategies.
R&D Tax Credit	£820* (08–09 forecast)	Tax incentives to support private-sector investment in research and development, through either payable credits or tax relief.
UK Innovation Investment Fund	£325* (available 2010)	Funding available (as part of Strategic Investment Fund) to invest in companies in strategically important UK sectors through specialised, private-sector technology funds, in order to stimulate investment in high-growth businesses and create high-skill jobs. Allocated through open competition by contracted fund managers.
Small Business Research Initiative	£12* through TSB (2010)	Funding available through Government contracts for small businesses with ideas and new technologies to meet specified needs within Government departments. Administered through open competition by the TSB.
Patent Box	Available from 2013	Tax incentive offering a reduced (10 per cent) rate of corporation tax for companies that develop patents registered in the UK into innovations within the UK.

* *all figures for latest available year (pp 22–4)*

** *Higher Education Funding Council for Wales: Circular W10/10HE—Recurrent Grant 2010/11*

*** *Scottish Funding Council: Circular SFC/14a/2009*

† *Department for Education and Learning in Northern Ireland: Quality-related Research (QR) Funding, Table 1: www.delni.gov.uk*

‡ *Annual Innovation Report (2009), BIS, February 2010*

APPENDIX 6: LETTER TO LORD DRAYSON, MINISTER FOR SCIENCE AND INNOVATION, FROM THE CHAIRMAN

Dear Lord Drayson

On 2 February 2010, the Science and Technology Committee in the House of Lords held a seminar on issues relating to the provision of independent advice by scientific advisory committees to Government. A range of views were contributed by both members of the Committee and invited participants, including those of senior scientists and former Ministers. The purpose of the seminar was not to consider the dismissal of Professor David Nutt although, inevitably, our discussion touched upon it.

During the seminar, in addition to the principles proposed by Sense about Science, the Committee considered your proposed principles of scientific advice to Government, published on 15 December 2009, on which you are consulting as part of the Government Chief Scientific Adviser's consultation on the guidelines on scientific analysis in policy making. We are aware also of the exchange of correspondence which you have had with the Phil Willis MP, Chairman of the House of Commons Science and Technology Committee, about the principles. We share the concerns expressed in Mr Willis' letter of 13 January and welcome your commitment to respond positively to those concerns.

Whilst we do not propose to make further specific suggestions about the wording of either the principles or the guidelines, I hope that you will find of assistance the following, more general points which emerged during the seminar.

First, subject to the concerns raised by the Commons Science and Technology Committee (in particular, the points raised about the principles listed under "trust and respect" and also the importance of enshrining academic freedom), we see advantage in the formulation of high level principles. The present Code of Practice for Scientific Advisory Committees and the Guidelines on the Use of Scientific Advice in Policy Making are lengthy and, to a large extent, practical documents. The proposed principles provide an opportunity to set out in short, clear terms the fundamental elements of the relationship between Government and independent scientific advisory committees. We look forward to seeing the revised principles in due course, once the consultation has been concluded.

In addition, and following on from recommendation 13 (d) of the Commons Science and Technology Committee report (3rd report, Session 2009–10, HC 158), the Committee took the view that the most effective way in which to ensure that Ministers develop an understanding of the nature of the relationship between independent scientific advisory committees and Government would be to introduce a short provision into the Ministerial Code, cross-referencing the principles, the guidelines and the code, setting out the fundamental elements of that relationship.

Whilst not an exhaustive list, we suggest that the elements set out in the new provision should include:

- that it is the responsibility of Ministers to decide on policy and of scientific advisers to advise
- that policy-making should be evidence-based and informed by the best available scientific evidence and advice
- that Ministers should ensure that they are informed by a range of scientific advice and, to that end, Ministers should, where appropriate, seek out dissenting opinion

- that Ministers should ensure that the advice sought from independent scientific advisory committees should include an exploration of the inherent uncertainties associated with such advice
- that Ministers should recognise the independence of independent scientific advisory committees and also of the individual members of such committees, and ensure that explicit conventions be agreed on the their right to express themselves publicly, whether orally or in writing
- that Ministers should allow for proper consideration of scientific advice and, save in exceptional circumstances, should not make a policy decision in advance of receiving advice commissioned in respect of that policy decision
- that, subject to exceptions (such as national security), scientific advice to Government should be published
- that Ministers should explain their reasons for policy decisions and, in particular, where a policy decision is contrary to scientific advice Ministers should explain their reasons for not accepting that advice
- where there are concerns about the conduct of a scientific adviser, a Minister should consult the departmental Chief Scientific Adviser and, where appropriate, the Government Chief Scientific Adviser.

We look forward to hearing your views.

In view of the nature of our recommendation, I am sending a copy of this letter to Sir Gus O'Donnell, Cabinet Secretary, and also to Professor John Beddington, the Government Chief Scientific Adviser.

Yours sincerely

Lord Sutherland of Houndwood

10 February 2010

APPENDIX 7: ORAL EVIDENCE OF PROFESSOR JOHN BEDDINGTON, GOVERNMENT CHIEF SCIENTIFIC ADVISER

TUESDAY 2 JUNE 2009

Present

Colwyn, L

Crickhowell, L

Finlay of Llandaff, B

Haskel, L

Jenkin of Roding, L

Krebs, L

Methuen, L

Neuberger, B

Selborne, E

Sutherland of Houndwood, L (Chairman)

Warner, L

Witness: **Professor John Beddington,** Government Chief Scientific Adviser, examined.

Q1 Chairman: Welcome, and thank you very much for scheduling this. You have, doubtless, as busy a diary as the rest of those around the table. It is much appreciated. I think we have given you some indication of some of the areas we would like to talk about. We see this, not as a sort of "when did you last see your father?" type of interrogation, but rather an opportunity for a discussion between you—and the very important position you hold—and the Committee, as we think through our own future interests and areas of inquiry and discussion. Do you want to say anything at the outset?

Professor Beddington: No, I am very happy to move to question and answer. I think you have seen enough of me around in various parts for me not to make any formal statement to start.

Q2 Chairman: Never enough, never enough! Can I just start the ball rolling by asking, you have been in post now for a time, you are still almost new but not quite: what are the issues which are beginning to emerge in your own interaction with government and with the departments and which will be the focus of what you want to do? What are the key issues you see?

Professor Beddington: If I could go through from, as it were, walking through the door and perceptions then, and then indicate how things have moved on, I think that on walking in the door two things immediately struck me. The first was that the penetration of scientific advice in departments was extremely patchy; and

that given you have a job which is, shall we say, immodest to say the least, in the sense that you are responsible for science across government, then it seemed to me essential that I should try to get penetration into the departments of key scientific advisers, not necessarily as it were physical scientists and engineers but also social scientists and, where appropriate, other areas. That was the first thing that struck me when I came in the door. To an extent, David King had got some way forward in achieving this but only some way, and there were still a number of key departments that did not have scientific advisers. That was the first thing that struck me, and I will describe a little bit about how progress has been made on that. The second area, which I took rather seriously, was that I am head of profession for science and engineering in government, and walking in the door I was saying: "Okay, who are these and how can I find out more about them; what departments they are in and the distribution between engineers and scientists and so on?" It was very clear that there was no information base on this at all, so these were two things that I thought I had really got to grip. If I may, Chairman, I will take you through the Chief Scientists first and then go on to the other heads of profession!

Q3 Chairman: Yes, do.

Professor Beddington: What has now been achieved by virtue of reasonable discussion with permanent secretaries is that, with the exception of the Treasury, each main department of state and some agencies have appointed, or are about to appoint a chief scientific adviser, which I believe to be a good thing and absolutely essential. Indeed, we are in discussion with the Treasury about whether it would be appropriate for them to have a chief scientific adviser also. Obviously, the roles of chief scientific advisers in different departments are significantly different, and the Treasury one would be very different. We interviewed about ten days ago for the chief scientific adviser for the Foreign and Commonwealth Office. There are no labs there, and so it is a rather different role; nevertheless, having that scientific advice at the highest level is really important. The other thing I did with the chief scientific advisers was that I energised the way in which they worked together by forming a core group of senior advisers in the main departments. We meet every six weeks. It is a meeting, with minutes taken, over a working dinner, and then a proper afternoon's or morning's meeting in which we deal with things in rather more detail. We have formed two sub-committees of that group of chief scientific advisers, one to deal with food security and climate change, and one to deal with counter-terrorism issues, which also involves representatives from the intelligence agencies. Those are the two we have formed. We had the plan, until the current swine flu epidemic took us over, to start one on infectious diseases, with some prescience, I suppose, but it arrived a little bit late. We have got that operating. I will stop there. I am obviously happy to answer some of the questions in detail. The second area is how we took forward the issue of the involvement of science and engineers in government. We started by circulating by department, saying: "Do you think of yourself as a scientist and engineer?" To an extent, I was concerned about this because I had heard dark tales that if you admitted to being a scientist or an engineer it is guaranteed that you had no chance of promotion, et cetera. I did not find that, and I still have not found that; I think it is a legacy of some previous time. We went round to the community and asked them to volunteer—you know, to admit that they were scientists and engineers -----

Q4 Chairman: A sort of coming-out, was it?

Professor Beddington: It was a coming-out party, yes. We judiciously had the first conference on a site known as The Brewery in the City, which we thought

might encourage. That has worked pretty well: 1,600 people signed up for it. These are very hand-waving figures; I would say they are no more than hand-waving, but there is a little in excess of 10,000 engineers and 8,000 scientists in government as a whole, so we are at around 10 per cent of that. We held the first session in January of this year, and I got Sir Gus O'Donnell and Lord Drayson to speak to it. That was reasonably successful. We plan two more sessions for this community, and we will have an annual conference in January. We are also trying to extend this and we are shooting to double the number of people to elect to be part of government's science and engineering. There was some suggestion that we should call it a Government community of science and engineering, but I vetoed that on the basis of the acronym! Those are the two things that I felt were really important. There are obviously other subject in areas in government, but those are the bureaucratic things I have done. I should add too that I found it was really important that we should link together with the research councils in a regular way. Adrian Smith is the Director General of the Research Council and also the Chief Scientist in DIUS. He is part of the group of chief scientific advisers. We also meet every 12 weeks with the chief executives of the research councils, so in a sense everyone who is funding and is involved with science and government are meeting, at the very least, every 12 weeks. That was trying to get networks and communities to work together, and that was the thing that had struck me most. There were some subject areas, which we will get on to later, that I thought were important to draw to the attention of Government, but those were the first things that I have done, as it were.

Chairman: That is very helpful. Lord Haskel, do you want to pick up any of these points?

Q5 Lord Haskel: It says here the Government has been commended for introducing chief scientific advisers. It was actually the Conservative Government that introduced the role of chief scientific adviser, carrying out a part of the Labour Party's manifesto policy in about 1993, if I remember rightly. Is this an example of science transcending politics?

Professor Beddington: I would hope it always does!

Q6 Lord Haskel: I hope so. The point that I would be interested to know is this: are the chief scientific advisers given the resources, and are they given the ability to carry out their work, or are they just a sort of figure?

Professor Beddington: It is a good question, Lord Haskel. The answer is that it is slightly a curate's egg. Some chief scientific advisers have very good support infrastructure; they sit on the departmental board and have representation; and others have less resources and have less status. I think I have now got it that it is ubiquitous that each of the chief scientific advisers has the right of access to the appropriate secretary of state and permanent secretary, so not necessarily all of them are on the departmental board. In terms of resources, you move from something like the Ministry of Defence with a budget of £2 billion or so and a very substantial infrastructure in support of the chief scientific adviser, to something like, I suppose, the CLG where there is a very limited scope for assistance to the chief scientific adviser; and that has presented problems. What I would say is that the access is essential. If you have a chief scientific adviser—and I would emphasise that it is not just scientists but engineers as well—if you have access to these people, they have to have access to a high level. If they felt that essentially they were reporting just to a line manager civil servant who might not have either an appreciation or a view or an appropriate assessment of science or engineering skills, then that would not be attractive. That is the first thing. Resources vary a lot

between departments—the ones that need substantial resources, with one exception, have got them. The exception is the Department for International Development, and there is work in progress which I believe will be announced next month to significantly change that. Historically, Gordon Conway, who was the Chief Scientific Adviser, had very little support given that he had £200 million a year science budget. I think that is changing now. I had discussions with the Department only yesterday about how that is changing. It has not been announced, so I prefer not to share that with you at the moment. I think that the other aspect of the scientific advice into departments that is really important is essentially the science advisory committees. There, I have not been quite as successful as I had hoped to be, and it is work in progress. For all departments that have significant science and engineering activity, I think there is real advantage in having an overriding science advisory council that is appointed independently, with an independent chairman, who can challenge the department and set their own agenda, but also respond to requests for the department. It is a limited number of departments that have got that and we are about to see that extended. The Ministry of Defence has had one for a long time, Defra has had one for a long time, the Home Office has had one, and the Food Standards Agency. Culture Media and Sport are in the process of appointing a science advisory council, which is really quite important. Quite shortly the Department for International Development will do as well. In a sense, taking a department like the Foreign and Commonwealth Office, there really is not an awful lot of point in having an independent panel to do it because the chief scientific adviser would link in with a group of chief scientific advisers and play a challenge role there. In departments that have significant activity, like Defra, you really need that independent science advisory council. There are lots of individual science and advisory committees, but the overarching council is one that I would really like to see in the main departments with substantial scientific activity.

Q7 Lord Haskel: The Foreign and Commonwealth Office has science attachés all over the world. Is there a way in which their work is inputted into Whitehall?

Professor Beddington: They are enormously valuable, but actually the Foreign and Commonwealth Office is in the process of jettisoning them.

Q8 Lord Haskel: Really!

Professor Beddington: Last year the Science and Innovation Network, as it is called—part of the budget was taken up by DIUS, and the London-based team was moved to DIUS and is operating out of there. The process is lasting two years, and with a run-down of the FCO budget. In the absence of these attachés now, who work within the embassies and high commissions throughout the world—but they are reporting into the Science and Innovation Network in DIUS rather than directly into the FCO—with the appointment of the new FCO chief scientific adviser, the reality is that that will probably change quite significantly, because, as you say, they are an enormous asset. I was in America last week and they organised impeccably the sort of people I needed to meet, and the agenda, and they got you into the right places. They have a very, very good level of intelligence.

Q9 Lord Haskel: But science is an international -----

Professor Beddington: Absolutely.

Q10 Earl of Selborne: I wanted to raise the question about the case for having lead departments. Just to give an example, you may remember we did a follow-up report recently on systematics and taxonomy; and in fact that was the third report we had done over some years. It seemed to be one of these orphan disciplines,

quite critical in areas such as delivering biodiversity and conservation commitments under the treaty. The whole time we came across the fact that there is no one single government department that has responsibility for this; it is diffuse responsibility, for which you could read "no responsibility". We found that DCMS, which is certainly involved, Defra and the Scottish Office— all these have no coordinated approach, and no one department has been designated in this specific area at least. We suggested that DIUS should be designated the lead department, and that recommendation has not been accepted. Is there not a case in areas like this for trying to designate a lead department?

Professor Beddington: Yes, I was aware of the discussions and, as I understand, there is a plan: NERC is doing a study to report on this. First of all, to take the issue, it is an enormously important discipline and it underpins so much of the concerns we have about biodiversity and conservation, and indeed the way in which climate change will operate and the way in which we can exploit ecosystems in a sustainable way. The first point is that I absolutely accept it is of fundamental importance. The second point is that it does present a slight organisational difficulty. As you say, the Natural History Museum is a very substantial base, which is part of Culture Media and Sport, and I do not see quite how easy it would be for DIUS to either take over the Natural History Museum—because it would be outside it—or take over just the scientific part of it. While I sympathise with the idea that there needs to be better coordination of work in there, I think I remain unconvinced, Lord Selborne, that a lead department is the answer because it is, after all, a subject area. I am not convinced that lead departments for every subject area, or indeed some key subject areas, would be essential. I can think of many examples. Let us take the nuclear world: it is enormously important both within the Ministry of Defence and Energy—but do we have a lead department in that? In the weapons field we do, with the MoD; and on the nuclear side for civil energy we have DECC at the moment. I have enormous sympathy with the position that taxonomy needs to be brought up and made certain to work properly, but I am not certain that the solution that this Committee proposed is the one that will work. I am going to wait to see what the NERC committee reports and take it from there. I do wonder whether this is one of the things where the community of research council chief executives and the chief scientific advisers might usefully play a role. One of the things I will see coming out of that report is whether they make any suggestions. The other problem—forgive me, I am going on a little bit—is that departments come and go.

Q11 Chairman: DIUS today and who knows tomorrow!

Professor Beddington: To be orphaned twice is probably a bit unfortunate! This is not any sort of prediction that DIUS will cease to exist as a department, but I do think that tying a particular subject area into a department base, when reorganisations can occur, can be quite problematic; whereas if you had cross-government links, and properly managed the subject area, that might be slightly more robust.

Q12 Earl of Selborne: I might just point out this issue is not just about taxonomy and systematics—there are other orphan disciplines—but we were slightly surprised to find from the Government response that it had clearly not consulted the Scottish Government. It did seem to be that if ever there was a case of having a lead, someone at least would have gone round the houses to make sure that all input was put in. In the second response, that was taken care of.

Professor Beddington: It is the Scottish Government. I should have mentioned that their Chief Scientific Adviser, Anne Glover, is part of the group of chief

scientist advisers who meet regularly, and she sits on the Climate Change and Food Sub-Committee; so I think if we did take some degree of responsibility for coordination in that area you would be bringing in the Scottish Government at the scientific advisory level. The Welsh Government has not yet appointed a chief scientific adviser, though they have an acting one; and when one is appointed they will be invited to attend our meetings.

Q13 Chairman: The issue for us is not necessarily that we would see the need for a department to organise everything under a particular roof, but rather that there are cracks, and things fall between the cracks because no individual agency of Government has the responsibility of saying, "Well, this is our patch; that is their patch; what has not been covered?" I think that is the real issue.

Professor Beddington: I really share that concern because I see it in projects. One of the things I have encountered and which I have raised is what we now call "orphan issues", not subject areas. We are finding quite often areas where nobody is prepared to own particular projects, and therefore find the money, and there are cross-government interests. Very early on in my stay I visited Brazil, where proposals were made to us to launch a satellite to monitor the rainforest. They were going to pay for the launch and the satellite, and wanted a camera from us. It was quite difficult to find a department that felt that this was important enough to do. That was ultimately found, but it had to be taken at a fairly high level, and it was £1 million! It seems to me that monitoring a rainforest is so fundamental to our issues on climate change; and there are other examples of what I would call orphan issues. The Cabinet sub-committee that Lord Drayson chairs, which I attend, is looking specifically at these orphan issues and raising the question. I am scheduled to put together a paper with Treasury about how we might have some form of floating fund that would be able to be used to support orphan issues like that. That is very much work in progress, but it is important, and the subject area—one has similar concerns. There are cracks in the system, and we have got to make certain that important things do not fall through them.

Q14 Lord Methuen: You mentioned some numbers for scientists; I think you said there were about 18,000 scientists and engineers employed by the Government.

Professor Beddington: Yes.

Q15 Lord Methuen: Is that tending to go up? Do you have difficulty recruiting them?

Professor Beddington: I could not tell you about the trend, Lord Methuen, because I think the figures are so shaky and so inaccurate that it would be impossible to say whether the trend was up or down. In terms of recruitment, there are departments that recruit directly through the Ministry of Defence, and then there is recruitment into a fast stream, of which scientists and engineers are a reasonable part. I think there is an issue here that we need to be thinking about: in the Civil Service that we have at present, and the problems they are facing, all science and engineering skills are really important. The DIUS Committee did an inquiry on science and engineering, and we are planning a response in a positive way to say that we see a real need to enhance the recruitment of engineers but also scientists.

Q16 Lord Methuen: You must have a problem perhaps of making it attractive in some departments.

Professor Beddington: I think in some departments you can feel rather lonely, I should imagine, if you are a scientist and engineer, but I want to say that in general

I think there will be big differences. The other issue is that most of the scientists and engineers in Government are not working in labs or in front of computers; they have a background in science and engineering but they work in the policy or administrative areas of their departments. They are equally important because they bring some skill base that is different from, as it were, those that would have done social or humanities degrees.

Q17 Lord Methuen: You need integrated teams.

Professor Beddington: I think so, yes.

Q18 Lord Warner: I have some questions about money. The science budget has clearly grown, and the Government has taken a lot of credit for the rise in the science budget, but departmental R&D looks to being pretty flat, and certainly in the last five or six years it has been slightly dipping down. Do you have a picture of R&D budgets across the departments? Do you have areas of concern, and are you worried about what the impact is likely to be on some of these budgets in an economic downturn and a tough public finances climate?

Professor Beddington: Yes. The first issue is that the sub-committee that Lord Drayson chairs has charged me with doing a survey of scientific spending in R&D budgets in departments. We set about doing that. There is a problem that some do not have budgets to spend, so you are slightly comparing apples and oranges. The Home Office, for example, has no R&D budget, but spends substantial amounts of money on R&D, so looking at their budget alone is difficult and you therefore can only look at their spend post hoc. That is a difficulty. That is one issue. The second is that we have agreed that I will report quarterly to this Cabinet committee on the budget of all the individual departments. The agreement is that if there is going to be a significant cut-back in the R&D budget or spend of a department, this needs to be discussed with the Treasury and myself. That essentially has been agreed. Am I worried? Yes, I am. The biggest worry I have had recently concerns the Ministry of Defence, where there has been a decision to take a very substantial cut. I wrote to John Hutton about this and expressed real reservations—and I can share this with you because it was shared not by myself but the Financial Times. I was particularly concerned about two aspects. One was that potential cut-backs would mean significant redundancies at DSTL, which is an enormous asset not just in terms of straight MoD business but also in terms of counter-terrorism and the way we work closely with the Americans. I felt that the capacity, once lost in DSTL, would be almost impossible to regain over a short period of time. The second area that I wrote about was that I was very concerned about the funding they provided for the Hadley Centre. In the first case there has been change. I attended the research board of the MoD where we discussed this, and albeit they are cuts, they are cuts that do not involve substantial redundancies at DSTL. In terms of the Hadley Centre funding, that has just stopped. It is not a very large amount in the MoD spend, but they did not feel that this was an appropriate use of their funding in difficult financial circumstances. We are exploring with other departments how that shortfall in funding can be made up because the Hadley Centre is a pearl in our crown, as it were. In the current very difficult financial situation, it seems to be essential that we try to monitor it, and that there is at the very least significant discussion about any decisions to cut back. It would be a thing that I would try very hard to oppose—anything where there would be some arbitrary cut, and R&D is the obvious one because you need to cut spending. I think this needs to be up for debate. Ultimately of course it is a ministerial decision on the advisory role, but I would push the point fairly hard. One area where there was some degree of relief was the decision by the Government to ring-fence the

science budget for research councils. That was very satisfactory. The other area that is good is that the R&D expenditure, following the Cooksey report in the Department of Health, is ring-fenced. Those are the only two. I must confess that I would like to see that movement to ring-fence other R&D budgets and departments, but there has been relatively little progress and now is a very difficult time to be trying to achieve that.

Q19 Lord Crickhowell: Taking you back to a reference you made earlier to the appointment of a chief scientific adviser to the Treasury, and with the evidence on the same point that you gave to a Commons committee on 18 May, you said just now that faced with a cutback you would want to discuss it with, among others, the Treasury. I can imagine, particularly at a time like the present, that those conversations with the Treasury were not necessarily very helpful. My experience from the past is that they might be rather difficult. What is the role going to be of the chief scientific adviser for the Treasury? Is he there hopefully to bring in to the Treasury the view of the significance of decisions that are likely to be taken from a scientific point of view, when otherwise they might be looking at them only from a financial point of view? Could you elaborate a little on what the role of the Treasury is going to be?

Professor Beddington: The first thing I should say is I think that is the sort of role I would like to see, but I should emphasise that these are discussions with the Treasury, and that has not been necessarily accepted. Clearly, as you have outlined, Lord Crickhowell, there is the opportunity for having an informed voice in the Treasury with an appreciation of the contribution that science, engineering and technology can make to our economic base. I would not like to suggest that Treasury officials ignore this, but some idea of distinction between particular areas of science in which you have the ability for a rather more detailed appraisal would be attractive, and it seems to me to have genuine attractions. Perhaps in a few months' time, when these discussions have moved on, I would be very happy to come back and explain to this Committee how that has developed. It is very much work in progress at the moment.

Q20 Lord Krebs: Can I take you back to an earlier comment where you said one of your perceptions when you arrived in the job was that the penetration of science across departments was patchy.

Professor Beddington: Yes.

Q21 Lord Krebs: We hear a lot about evidence-based policy, and I wondered to what extent you found that there was an effective mechanism for folding scientific evidence in the broadest sense into policy formulation, perhaps particularly thinking about the social sciences. My own perception is that in some government departments the natural sciences are well integrated into policy decisions; but there are also questions, particularly in relation to the social sciences. If I could illustrate with one example, I heard a presentation recently from a Professor Belsky at Birkbeck College, who informed us that the Government's Sure Start programme, where a significant amount of public money has gone into helping children from the most deprived communities, was launched against the advice of scientific experts, without any evidence base to support the particular interventions that were carried through. In the evaluation afterwards, in the first phase, it was revealed that the Sure Start programme had had, if anything, a negative effect on most children in the most deprived families and communities. I wonder what your perception is, particularly in social sciences, of the strength of evidence-based policy!

Professor Beddington: Well, this is not a cop-out, but we actually do have a head of profession in social sciences in Professor Wiles, who is the Chief Scientific Adviser to the Home Office. I agree. I would say it is fair to say that a number of departments do not have sufficient numbers of social scientists, and social science advice is therefore less mature. In the particular case you mention I cannot comment because I do not know about it. We have done some reviews of the efficacy of advice and penetration of science into departments. The two I recall particularly well are the review of Defra and the review of the Department of Health. Both reviews recommended strongly that you need strength in the social science evidence in those departments. In the case of Defra, which was done some while ago, they have come back to us and indicated that they accepted that recommendation, and they are strengthening social science. I responded to the Permanent Secretary, indicating "well done, but there is quite a lot still to go"—because so much of the Defra agenda is clearly in social science. A number of the chief scientific advisers in departments are in fact social scientists, but it is fair to say that I would not be complacent about that. We have to think hard about the way social science evidence is dealt with. I had a similar question about that when I appeared before the DIUS committee on 18 May, again concerning some social research, this time to do with child reading, where there are real concerns. I will undertake to have a look at some of these examples and consult with Professor Wiles and see if I can come back with a view on it.

Q22 Lord Crickhowell: I come to two related questions. One is the independence of the scientific advice. I noted Lord Drayson's recent comments: "It is vital to stick to the Haldane Principle. Peer-reviewed judgments of the science community and the independence of research councils are all key to our continued success." Fine, but in your evidence on 18 May, to which I have already referred, you told the committee in another place that there are a lot of science advisory committees in government, of the order of 100 or so on particular subjects, and that only a few departments have science advisory councils that span across the individual departments—the Ministry of Defence, the Home Office, Defra and the Food Standards Agency. The obvious question is: do we really need, and is it sensible to have, so many? If you have too many people are we not all going to have nothing but jaw, jaw, and very little action? Would it not be better to consolidate a little and have rather fewer people doing the job?

Professor Beddington: Yes. I would give a slight counter example from discussions I am having with the Department for International Development where there are issues. Let us take their agenda, where they have issues of poverty, clearly, but also health and agriculture. Those are the three areas where an overall advisory committee would not necessarily be appropriate because of the disparity of the scientific areas discussed. Going to Defra, where for a while I chaired the overall science council, that was useful in the sense that we were able to span Defra's agenda, but we were supported by a whole series of smallish committees which dealt with details sometimes at a fairly esoteric level, for example in virology on the virology of the Blue Tongue Disease. You need a great deal of detailed expertise to advise the civil servants and policy people. I think it is a reasonable question. Having given that evidence to this Committee, I should say that if it turns out that it is not hundreds—it is less than 100—it is about 75 according to my officials who monitor these for me—it is always worth asking whether a particular committee has a role that can be useful, and I expect departments to do that. The other question we need to ask is how long they should be sitting. Are they particular issue committees? I have some concern that committees are set up and then they have a life of their own and a bureaucracy of their own, and they

keep going. I think a reasonable question to pose is: "Has this committee served its useful purpose?" I think I would be supportive of—what is the expression—"sun-downing" a number of these committees. In terms of the overall science ones, I would accept, and indeed said a little earlier this afternoon, that there is a need for an all-embracing committee that goes right across a department's subject area, and that is really important because it should provide a challenge function to the permanent secretary and the chief scientific adviser, and they should be able to ask questions about everything else. It is also important that a number of these committees do not set their own agenda; that they are asked questions by the department, sometimes technical and sometimes policy related, and they are asked to respond to those particular questions. I think that that has a very useful function, but I think there is also a need for independent committees in departments that set their own agenda and pose their own questions.

Q23 Lord Crickhowell: I am rather encouraged by parts of the answer you have given there, but I would like to see how you achieve the sun-downing. We might follow that up in due course. Take an area that one of the sub-committees of this Committee is looking at at the moment, nanotechnology. We are finding that although there is some very thorough work going on in certain areas, particularly critical areas, there is practically nothing known and very little research being done, for example, in the gut. It is crucially important. Maybe something is coming out of Europe where there is a lead coming on some of the research. How do we ensure that when key issues are emerging you get this plethora of committees homing in and giving a lead to see that the crucial questions are being examined?

Professor Beddington: I think that is a good example of subjects we need to think about, because nanotechnology obviously spans a number of departments' responsibilities. It is arguably an issue for the Department of Health, for Defra, the Food Standards Agency and the Health Protection Agency and others. It is quite difficult to think about a mechanism whereby you go through a particular subject and say, "This committee has that responsibility." This is the sort of area where having committees of chief scientific advisers is quite helpful. As I know you will be aware, we had the Royal Commission on Environmental Pollution report on technology that came out, and Sir John Lawton came and presented the report of that to the Committee of Chief Scientific Advisers. We have a group of officials looking at how that might be best taken forward in response to that committee. I confess that that was the last two meetings, so about three or four months, and I cannot tell you how the officials have taken that forward; but at least it is a mechanism for thinking about that across government. It may be going rather slowly, but I will check on that.

Q24 Chairman: We are encouraged to note you have cut the number from 100 to 75 in a very, very short period!

Professor Beddington: No pressure on further sun-downing!

Q25 Baroness Neuberger: You have answered part of this but your remit includes reviewing the use of science in departmental policy-making. You said a bit about how Defra has accepted the need to strengthen its social science advice. How effective have such reviews been in the past? What can we do to strengthen that process now?

Professor Beddington: I will answer the process question first and then the results later, if I may. In terms of process, I think that the reviews were far too long and far too detailed. I sat on the review that Sir David King had of Defra, and it

lasted well over a year, by which time things had kind of changed! I made a fairly early commitment to change this. In fact, one of the things I have been very pleased with is that I started a review of the reviews and seeing what was wrong with them, because everybody was saying that this is ridiculous and far too long; and we commissioned a consultant who then produced a report that came to the Heads of Analysis Group, which has the Chief Economist, the Chief Statistician, the Chief Scientist—myself—the Chief Social Scientist; and we looked at this consultant's report and made recommendations about how scientific reviews should occur in future. In summary, first the suggestion was that they have got to be shortened and would need to have much higher level input from external advisers and consultants to look at how they were going, and to make certain that these were essentially mandatory. The "mandatory" was significantly resisted, as you might imagine; but I am glad to say that the Civil Service Board decided about three weeks ago to agree to my proposal that all departments that had not had a review should have a mandatory review. So I now have in place a programme which will review all departments which have not had a review; that is 11 departments we are going to be reviewing, including big ones like the Ministry of Defence. We will finish that programme by March 2011, so we will have done them all. The idea then is that there will be follow-ups and assessments going on. In addition to the departments, we have done reviews of some of the agencies, the Food Standards Agency and the security services. The latter is obviously one that is not public—but all reviews that we are making will be public documents and will be available on our website and published. That is the intention and has been the practice. The latest one we did of an agency was the Food Standards Agency, which was published about three or four weeks ago. That process of transparency is really important. In terms of how effective the reviews are, I would have to say that the early very long and very, very detailed reviews had probably success that was not quite commensurate with the investment and the amount of time it had taken. I felt there was some progress. For example, I alluded earlier to the recommendation to Defra that they should have significantly more social science. I think that some practices were changed on the basis of some of the early reviews. The ones I was aware of and more familiar with were the Defra one, because I was Chair of the Advisory Council of Defra, and then the ones that I have inherited since I took the position. In the Department of Health, we had a very extensive discussion with the Department of Health as we finalised the review. I think a lot of the recommendations we came to were almost accepted at the time. That process will be ongoing, and I am hoping to see where that leads subsequently. I have high hopes for it, and I think they can be important, and we will at least have done all of the departments by 2011. The concern I have is that these reviews were taking well over a year and there are 17 departments, which would kind of outlast me; so I am sufficiently egocentric to decide that I would really like to do a review of all of them before I leave the job!

Chairman: There are two areas left that we would like to talk about. One is very specific and a matter of significant concern to us, as I think to you as well, on pandemic flu, and there are some specific questions on that. Then there is a broader issue about the tensions between priorities in science and the so-called Haldane Principle and whether these are compatible. I wonder if we could take the pandemic flu questions now and then perhaps go out on a big broad note of the Haldane Principle!

Q26 Lord Jenkin of Roding: I am a co-opted member of the Committee for the purpose of pandemic flu, and I have been listening to you for the last hour with fascination. What strikes me of course is that your style seems to be very different

from that of your predecessor. I am not at all surprised, in that different people work in different ways. On the pandemic flu question—and we are still continuing our inquiry—it has aroused a good many anxieties about which the Department of Health has not always been able to satisfy us, and we are still looking for an opportunity to have a further discussion with ministers there. However, there was one issue that struck me which arose in a footnote from a paper we had from Professor Neil Ferguson, who gave us a long, very interesting paper, on the whole question of different treatments for different stages in a pandemic flu. There was a footnote to Professor Ferguson's paper when he had said: "Another uncertainty was the identity and critically the lethality of the specific strain which might cause the next pandemic." The footnote says: "The matter which has concerned the Government Chief Scientist John Beddington was the Department of Health planning assumption of a two per cent mortality as a reasonable risk scenario, whereas H5N1"—which is not the one we are currently confronted with—"was more like a 60 per cent mortality rate." I wondered whether you would like to enlarge on that a little because it makes a huge difference to recuperation and how you involve all the people who have to look after the dead bodies. It is a major issue.

Professor Beddington: It is a significant issue. In H5N1 the mortality rate that you observe of people who actually catch it by contact with birds in South East Asia is around 60 per cent. I raised that issue with the independent committee that dealt with pandemic influenza, chaired by Sir Gordon Duff, and said: "I am sorry, can somebody explain to me what are the mechanisms where you might have a reason to be concerned that 60 per cent mortality would erode, either due to some form of biological mechanism or co-evolution or something, or that there is some indication in the analysis that perhaps we were looking at a sub sample, that we were only looking at the very worst affected individuals; and so that individuals identified with avian influenza were those which had it the worst and therefore there would be high mortality rates and so on. I am afraid to say that I am still not entirely satisfied. The current department planning is for what they call a "reasonable worst case scenario", which they use as a comparison with the previous pandemics in the twentieth century; and 2.5 per cent mortality is round about there. I am still concerned about H5N1 and whether in fact our planning is appropriate for that; but we are in the midst of the swine H1N1 epidemic at the moment, where mortality rates seem to be well below -----

Q27 Lord Jenkin of Roding: At this stage.

Professor Beddington: At this stage—indeed. It is a crowded agenda at the moment, and I suppose I am looking to appropriate planning for how we deal with the swine flu epidemic in the autumn. It is not impossible that there is some evolution of the H5N1 virus, but that has always been a possibility. I think the key at the moment is to deal with the problem we have. For example, let us take the advice on vaccines. Perhaps, if I may, Chairman, I could say how scientific advice is going into the current pandemic exploration. I chair the Science Advisory Group in Emergencies which reports directly to the ministerial committee. This Committee consists of ----

Q28 Lord Jenkin of Roding: Which ministerial committee?

Professor Beddington: It is the ministerial committee that deals with the epidemics as chaired by the Secretary of State for Health. The jargon is comparable, but it is the CCC.

Q29 Lord Jenkin of Roding: I do not think we had one when I was Secretary of State.

Professor Beddington: Basically, I chair this Science Advisory Group in Emergencies. It consists of independent people who are on the SPI group, the pandemic influenza modelling group. I co-chair it with Sir Gordon Duff, who chaired that, and I also co-opted a number of individuals on to that group to generate further expertise in particular areas. For example, when we had a very detailed discussion on vaccines, I co-opted on to the committee amongst others Roy Anderson, an epidemiologist, with five senior virologists and vaccinologists who were able to comment on it. The recommendation for that committee, of the SAGE committee to the Cabinet committee was entirely that we should go ahead with procurement of the vaccines for the H1N1 on the expectation that there is a real concern that this may come back as we get a second or third wave in the autumn. As I am sure this Committee is aware there is a degree of happenstance, in the sense that it has emerged in the northern hemisphere during our summer, but it is operating in the summer hemisphere now at significant levels of infection. The concern we have is that in the autumn it will return. The decision was very much that we could have at any time some new attack, but we have resources to deal with one which we know may be there; but it was unanimous that we felt this was the one that was important to deal with at the moment.

Q30 Lord Jenkin of Roding: Can I follow this up? You said that it is still a matter of concern.

Professor Beddington: Yes.

Q31 Lord Jenkin of Roding: The fact that you have a matter of concern will be of some concern to this Committee. Everybody has agreed, and all the advice we have had seems to suggest that this will come in waves. We are in the first wave at the moment, and it seems to be a very mild form, but on the basis of previous pandemics it can come back in a much more serious form, with no doubt some mutations, and with a very much more serious impact on those who contract the disease. If it is anything like the H5N1, which you referred to, then one is dealing with a higher rate of mortality. Ought the department to be making provision or taking some action so that they could respond to that, if necessary very quickly?

Professor Beddington: I would respond, Lord Jenkin, that I think there is absolutely no scientific reason whatsoever to believe that the current virus would mutate to something that would have anything like the level of mortality we are observing if it is a direct transmission from an animal to a human. This is transmission human to human. I think it is extremely unlikely we would have to be concerned about very, very high levels. The mortality that was observed in Mexico is somewhere of the order of about 1.2 per cent. I think what we do not know is whether a mutation will make it more or less mild or, for example, that this current version of the virus is susceptible to antivirals. We do not know whether there may be mutation that means it is less susceptible to antiviral treatment. We also have concerns whether any mutation will mean it is more or less susceptible to a vaccination. There has been quite a lot of work done, and even if the efficacy of the vaccination is not as good as one might hope, nevertheless the control of the epidemic would be quite substantially enhanced by having a vaccine that was partially so. The vaccine that has been order involves an adjuvant which enables the efficacy of the vaccine across different viral strains to be somewhat widened. So there is some degree of comfort to be had from that. I cannot see any reason why this particular strain would mutate; it would be completely unprecedented to have some increase of 60-fold mortality, and there may be biological reasons why that

cannot be the case. I think the reasonable worst-case assumption that is being considered by the Department of Health and which has been under discussion at SAGE, is whether the mortality rate assumption of cases should be 1.5 or 2.5—and that is based on the comparison with the pandemics of the previous century.

Q32 Lord Colwyn: I am not quite clear which vaccine has been ordered. Is that the one for H5N1?

Professor Beddington: No, the H1N1—it is the swine flu vaccine. That is the one that is there. That is the one that is currently operating in the southern hemisphere and which we may get along with our normal seasonal flu in the autumn. It seems to be highly infectious. It hits young children and it does not seem to be hitting the elderly population—so there are real issues about how you deal with it.

Q33 Lord Colwyn: Is it thought that infection from the current virus would provide some form of immunity for the virus that may change -----

Professor Beddington: It could possibly be, but it is not a thing one could completely rely on. There may be partial immunity. I certainly would not be recommending that people go out and catch it!

Q34 Lord Crickhowell: You have spoken about the speed with which it came on young people; can you give us more information about that? We have seen that it clearly spreads very fast if it gets into a roomful of young people in a school here—but I hear that in the United States there is real concern, that it is spreading very fast. It is a more significant spread than in Mexico where they acted quite efficiently early on. Have you any information about the world-wide spread?

Professor Beddington: We can provide you with detailed statistics ---

Q35 Lord Crickhowell: It would be quite useful if we could have that.

Professor Beddington: I visited the USA last week and went to visit the Center for Disease Control to discuss the epidemic in the USA. In terms of the overall symptom spectrum, it is very similar to what we are observing here. It is a relatively mild event. The monitoring system the USA has is not a universal one because the monitoring is done by individual states, and therefore the ability to get comprehensive statistics is more limited. There is also the concern that there is a fair amount of relatively mild influenza which never goes as far as reporting to their system; so whereas they have reported somewhere between 8,000–9,000 cases, which they have confirmed, that is, as it were, the tip of an iceberg, and there is a substantial number of unconfirmed cases, which you deduce from the way the epidemic is doing it. It is quite difficult to come out with very firm figures, other than to say that there is a significant under-estimate of the numbers. I would emphasise that these are really uncertain and there might be a factor of 10 or 20—so there might be 100,000 or 200,000 cases in the USA. The first thing to say is that it has spread quite quickly through the USA. It was noted in Mexico when you started to get severe respiratory illness and deaths, but you have not had that. The latest figures—I could not tell you, but when I was there last week they had had ten deaths out of about 8,000–9,000 people who had sufficiently serious symptoms to be noted by doctors and reported by the state authorities.

Q36 Chairman: Can I thank you very much! I know that you have other commitments and we will leave our big topic, which we may well be coming back to ourselves. Perhaps we will invite you to come and talk to us then. It has to do with selectivity and prioritising research things and so on, and the Haldane Principle on the other side. That will remain with us. We thank you very warmly.

It has been very helpful. We will now digest what you have told us, and look forward to one or two pieces of paper coming from you with statistics.

Professor Beddington: Sure. Thank you Chairman, for the discussion. I am happy to return on your big topics.

Chairman: Good. Thank you.

APPENDIX 8: ABBREVIATIONS

BIS	Department for Business, Innovation and Skills
CSA	Chief Scientific Adviser
CSAC	Chief Scientific Advisers Committee
CSR	Comprehensive spending review
CST	Council for Science and Technology
Defra	Department of the Environment, Food and Rural Affairs
ED(SI)	Cabinet Sub-Committee on Science and Innovation
GCSA	Government Chief Scientific Adviser
GDP	Gross Domestic Product
HEFCE	Higher Education Funding Council for England
MRC	Medical Research Council
OECD	Organisation for Economic Cooperation and Development
REF	Research Excellence Framework
SBRI	Small Business Research Initiative
SPRU	Science Policy Research Unit
TSB	Technology Strategy Board

APPENDIX 9: RECENT REPORTS FROM THE HOUSE OF LORDS SCIENCE AND TECHNOLOGY COMMITTEE

Session 2006–07

1st Report Ageing: Scientific Aspects—Second Follow-up
2nd Report Water Management: Follow-up
3rd Report Annual Report for 2006
4th Report Radioactive Waste Management: an Update
5th Report Personal Internet Security
6th Report Allergy
7th Report Science Teaching in Schools: Follow-up
8th Report Science and Heritage: an Update

Session 2007–08

1st Report Air Travel and Health: an Update
2nd Report Radioactive Waste Management Update: Government Response
3rd Report Air Travel and Health Update: Government Response
4th Report Personal Internet Security: Follow-up
5th Report Systematics and Taxonomy: Follow-up
6th Report Waste Reduction
7th Report Waste Reduction: Government Response

Session 2008–09

1st Report Systematics and Taxonomy Follow-up: Government Response
2nd Report Genomic Medicine
3rd Report Pandemic Influenza: Follow-up

Session 2009–10

1st Report Nanotechnologies and Food
2nd Report Radioactive Waste Management: a further update