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HOUSE OF COMMONS SESSION 1990–91

EDUCATION, SCIENCE AND ARTS COMMITTEE

First Report

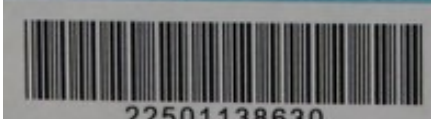
SCIENCE POLICY AND THE EUROPEAN DIMENSION

Together with the Proceedings of the Committee, Minutes of Evidence and Appendices

Ordered by The House of Commons *to be printed*
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The Education, Science and Arts Committee is appointed under SO No 130 to examine the expenditure, administration and policy of the Department of Education and Science and associated public bodies, and similar matters within the responsibilities of the Secretary of State for Northern Ireland.

The Committee consists of a maximum of eleven members, of whom the quorum is three.

The Committee has power:

(a) to send for persons, papers and records, to sit notwithstanding any adjournment of the House, to adjourn from place to place, and to report from time to time;

(b) to appoint specialist advisers either to supply information which is not readily available or to elucidate matters of complexity within the Committee's order of reference;

(c) to communicate to any other such committee its evidence and any other documents relating to matters of common interest; and

(d) to meet concurrently with any other such committee for the purposes of deliberating, taking evidence, or considering draft reports.

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(discharged 18.1.89)

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FIRST REPORT

SCIENCE POLICY AND THE EUROPEAN DIMENSION

The Education, Science and Arts Committee has agreed to the following Report:

1. In March 1990 we began a short inquiry into the development of United Kingdom science policy in Europe.[1] We took oral evidence at seven meetings and received a number of written submissions; the oral and written evidence is published with this Report. We are grateful to all our witnesses (in particular Professor Paolo Fasella, Director-General of the European Commission's DGXII (Science, Research and Development), who flew from Brussels to give evidence before us) and to our specialist advisers—Professor John Ziman FRS, Director of the Science Policy Support Group, and Dr David Thomas, Pro-Rector (Research Contracts) at Imperial College—for their help with our inquiry.

2. At an early stage in our inquiry we visited several of the principal collaborative research establishments in Europe: the European Molecular Biology Laboratory (EMBL) at Heidelberg, the Institut Laue-Langevin (ILL) and the European Synchrotron Radiation[2] Facility (ESRF) (which is still being constructed) at Grenoble, and the European Organisation for Particle Physics (CERN) at Geneva. We are grateful to the Directors and staff of these establishments for their hospitality and for their valiant attempts to make their work intelligible to us.

3. This Report is the outcome of a relatively limited examination of this area of policy, which we are glad to see is attracting growing interest in Parliament and elsewhere: for example, in November 1989 the Parliamentary and Scientific Committee, the Royal Society and the Fellowship of Engineering held a one-day meeting on Science, Technology and 1992; the Select Committee of the House of Lords on the European Communities reported on "A Community Framework for R&D" in June 1990[3] and the Lords Select Committee on Science and Technology has recently begun an inquiry into international scientific programmes. In this Report we first outline the nature, extent and significance of the "European dimension". Then we consider three issues which, in the light of the evidence we received, appeared to us to be of particular importance:

- the role of the European Community in the organisational framework of European science;
- the difficulties faced by the universities in participating in European Commission science programmes;
- governmental machinery for the consideration of science policy in relation to Europe.

We conclude by emphasising the importance of maintaining the United Kingdom's science base.

The European dimension of British science

4. Although still relatively small, the European dimension of British science is increasing in both size and importance. The indicative United Kingdom contribution to the Community budget in respect of research and development is estimated at £171 million for 1989-90[4] (about 7 per cent of Government expenditure on civil R&D). Subscriptions to a variety of multilateral and bilateral organisations outside the EC amount to a further £150 million.[5] A quarter of the budget of the Science and Engineering Research Council (SERC) is now allocated to international facilities and organisations,[6] and between 1981-82 and 1987-88 Research Council expenditure on international

---

[1] Unless the context otherwise requires, "Europe" in this Report means the continent as a whole, not just the European Community.

[2] Synchrotron radiation: "electromagnetic radiation emitted in narrow beams tangential to the orbit of very high energy charged particles, such as electrons, spiralling along the lines of force in a strong magnetic field" (Collins Dictionary of the English Language).

[3] 17th Report, HL Paper 66 (1989-90).

[4] Annual Review of Government Funded R&D 1990, Table 1.1.

[5] Ev p. 9 (DES).

[6] Ev p. 67.

science generally increased by some 40 per cent.[1] (These figures of course take no account of science which is funded nationally but is influenced as to its methods or objectives by formal or informal international contacts.[2])

5. The European Commission is now the biggest and richest of the organisations through which the United Kingdom undertakes international collaboration in science and technology. The objectives of EC research and development programmes include—

> the strengthening of the scientific and technological basis of European industry and making it more competitive;
>
> the strengthening of the economic and social cohesion of the Community;
>
> the completion of the Common Market;
>
> the unification of the European scientific and technical area; and
>
> the establishment of uniform rules and standards where these are needed.[3]

The Community's activities are to be guided by the principle of "subsidiarity", which is that things should not be done at Community level if they could be done better at national level. Community action is intended to be complementary to national, and other international, activities.[4]

6. Most of the Community's activities in this area are now included in the Framework Programme. A new Framework Programme, which places greater emphasis than its predecessors did on basic research, has been agreed to by the Council and the separate programmes within the Framework are at present receiving detailed consideration.[5] It will run from 1990 to 1994 and will have a total budget of 5,700 million ECU. Most of this money will be allocated to collaborative projects involving industrial enterprises and universities and other higher educational institutions (HEIs) in two or more member States in the fields of information and communication technologies; industrial and materials technologies; the environment; life sciences and technologies; and energy. In addition the "Human capital and mobility" programme (the successor to the SCIENCE[6] programme) will be concerned with the training and mobility of research staff and the establishment of links among laboratories and research teams.[7]

7. Outside the structure of the Community, the United Kingdom is involved in a variety of multilateral scientific collaborations,[8] principally but not exclusively with other Community countries and with members of EFTA. Some are devoted to the provision of large-scale research facilities, such as:

- CERN, with 14 member countries, for high energy particle physics;
- ILL, a neutron scattering facility which is run jointly with France and the Federal Republic of Germany, with three other countries in associate membership;
- ESRF, with 11 member countries, for research using synchrotron radiation.

Other major organisations which promote collaboration within their field of specialisation include the European Space Agency and the European Molecular Biology Organisation (EMBO); 14 of the 17 member countries of the EMBO fund the EMBL in Heidelberg.

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[1] Ev p. 3 (DES).

[2] e.g., participation in the Scientific Programmes of the European Science Foundation (see Ev p. 44).

[3] Appendix 24, preamble.

[4] Q 6; Appendix 24, Annex III.

[5] Ev p. 1 (DES), para 5.

[6] See Ev p. 5 (DES).

[7] Appendix 24, Annex I.

[8] Ev pp. 9-10 (DES).

8. On a smaller scale there are bilateral collaborations, for example, the Anglo-Dutch observatories on La Palma;[1] and international participation in national facilities, such as the SERC's spallation[2] neutron source at the Rutherford Appleton Laboratory, for which nearly a quarter of the funding comes from agreements with a number of overseas partners.[3]

9. Among non-governmental organisations special mention should be made of the European Science Foundation (ESF), the members of which are the research councils and academies of 19 countries, including Yugoslavia and Turkey. The ESF is neither a funding body nor a collaborative laboratory but a catalyst: on an annual budget of £5 million it promotes informal co-operation by bringing people together in its Scientific Networks and Scientific Programmes, which are funded by its member organisations.[4] Another vehicle for informal co-operation is the Royal Society's European Science Exchange Programme for post-doctoral research workers; the Hungarian Academy of Sciences has recently become its first Eastern European participant.[5]

The need for a European dimension

10. Whilst it is and will continue to be appropriate for the greater part of the United Kingdom's scientific research to be organised and funded at national level, **the evidence we received recognised the increasingly international character of scientific endeavour and strongly supported the United Kingdom's continuing to develop and strengthen her international links in order to retain her place in world science.** The argument was put most pithily in the evidence of the Secretary General of the ESF:

> "Some people believe, in terms of those rear window car stickers which were popular a year or two ago, that "doing science with foreigners takes longer and costs more" than doing it at home. But there is much science that can be done only across frontiers, and much which can be done more effectively that way. Large scale installations are one example; the pooling of ideas and manpower at the fast moving edges of science is another; the use of data from a number of different sites is a third".[6]

11. The prime example of science which can be done only across frontiers is the research into high energy particle physics undertaken at CERN. In this field, which is by no means unique in this respect,[7] the cost of scientific equipment is now so high that only by sharing facilities among a number of nations can basic research be undertaken at all. Medical and environmental problems do not respect national boundaries and research into them can be done more effectively across frontiers through improved co-ordination and the avoidance of wasteful duplication of effort. The setting of agreed standards, whether for telecommunications equipment or acceptable levels of pollution, increasingly requires an international approach.

12. More generally, "big science"[8] and "small science" alike are enriched by the free movement of ideas and information, by bringing together scientists from different countries who are working in the same field, and by enabling scientists to carry out research in laboratories abroad. The Royal Society said in its evidence that

> "science is international by nature. The health and strength of an individual scientific community depend to a large extent on its ability to interact with other communities worldwide to exchange ideas, to compare results, to discuss and challenge their own and others' theories and to expose their science to the scrutiny of the best of the world's scientists".[9]

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[1] Ev p. 9 (DES).

[2] Spallation: "a type of nuclear reaction in which a photon or particle hits a nucleus and causes it to emit other particles or photons" (Collins Dictionary of the English Language).

[3] Ev p. 67; Q 246 (SERC).

[4] Ev pp. 43-4.

[5] Ev p. 22.

[6] Ev p. 43.

[7] Ev p.67 (SERC).

[8] The present Chairman of the SERC pointed out to us that much so-called "big science" is big facilities used by large numbers of people working in "small science" (Q 355).

[9] Ev p. 22.

The Science Policy Research Unit (SPRU) at the University of Sussex pointed out that "the UK contributes only some 5 per cent of the world's output of science and technology . . . closer involvement in and understanding of [the other] 95 per cent must be of advantage to the UK."[1]

13. The DES told us that Government policy favoured European collaboration in scientific research "where added value from collaboration will exceed the unavoidable extra costs involved."[2] A balance has to be struck between on the one hand the evident disadvantages—not only administration and travelling but also the loss of exclusive national control over resources —and on the other the less evident advantages of collaboration: as a DES witness admitted, the added value cannot be quantified and any estimate of it can only be subjective.[3] **In our view the collaboration itself creates an "added value" through the intangible benefits which flow from the cross-fertilisation of scientific ideas, technological developments and research techniques, and their diffusion throughout the scientific community in Europe and the wider world, with which it is essential for British science to keep in touch if it is to advance and develop.**

14. In emphasising the value of the European dimension of science policy we are not arguing for the creation of a "fortress Europe"[4] in the field of science. Within Europe we welcome co-operation not just with the United Kingdom's Community partners but also with the members of EFTA, and we look forward to the closer involvement of the states of Central and Eastern Europe in scientific collaboration and exchanges. Looking further afield Europe must not cut itself off from scientific developments elsewhere, such as North America or the Pacific, since fields such as electronics and information technology are dominated by Japan and the United States.

15. Professor Fasella said in his evidence to us that in many fields the European or continental level acted as an intermediate size between the national level and the global level.[5] For many of the trans-border problems to which we referred above[6] the argument for international collaboration is really an argument for collaboration on a world-wide rather than merely European scale. The ambitious project to decipher man's genetic material (the human genome) is a case in point: research programmes in various European countries, the European Community, the United States and elsewhere are being brought together through the Human Genome Organisation (HUGO), which has members in 23 countries.[7] The development of a European dimension of science policy should be seen as part of a steady trend towards a wider "international dimension".

The role of the European Community in the organisational framework of European science

16. In considering the organisational framework of European science policy, the central question is the proper role of the European Community and the Commission. To what extent should scientific co-operation be organised through the Commission, and to what extent through other modes of collaboration?

17. The Commission's involvement in science and technology through the promotion of European R&D was generally welcomed by those who gave evidence to us,[8] as was the inclusion of more basic research in the new Framework Programme. The CBI thought the Framework Programme needed to be significantly larger in order to "support a critical mass of EC research".[9] Nonetheless, there was also substantial criticism of the Commission in the evidence we received.

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[1] Appendix 3.

[2] Ev p. 1.

[3] Q 12.

[4] Ev p. 22 and Qs 49-53 (Royal Society); Appendix 3 (SPRU).

[5] Q 291.

[6] Para 11.

[7] See, for example, Briefing Note 15, "Understanding the Human Genome", Parliamentary Office of Science and Technology, June 1990.

[8] eg, Ev p. 51 (CVCP); Appendix 8 (Institute of Physics).

[9] Ev p. 35.

Criticisms of the Commission

18. The Commission was depicted by several witnesses[1] as unduly influenced by "political" considerations, and paying too little regard to national priorities or scientific excellence in selecting programmes for support. The Medical Research Council (MRC) told us that the Community's cancer research programme was a response to a political rather than a scientific imperative: cancer research was well funded at national level and needs for international collaboration were already largely met through other organisations.[2] In our view **there is a clear need for a "forward" policy on the part of the British scientific community:** they must establish closer working links with the Commission in order to influence policy at an early stage and to give the Commission access to the highest quality scientific advice from the UK.

19. A number of witnesses complained to us about the difficulties they faced in dealing with the "Brussels bureaucracy". The Committee of Vice-Chancellors and Principals (CVCP) spoke of "widespread concern about the EC's cumbersome procedures".[3] The Institution of Professionals, Managers and Specialists (IPMS), which represents scientific staff, said that "The 'red tape' of the [Commission] has now passed into folklore . . . The formal procedures associated with funding applications are daunting."[4] On the other hand, Sir David Phillips, the Chairman of the Advisory Board for the Research Councils (ABRC), suggested that EC procedures appeared more complex and difficult because university scientists and administrators were less familiar with them than with their British equivalents.[5] (He also pointed out that the Brussels machinery involved not only the Commission but also the committees of national representatives involved in decision-making.) Sir Mark Richmond, who is now Chairman of the SERC, told us that although many people in universities saw Europe as an enormous bureaucracy, those who had taken the trouble to learn the Brussels system found it a rewarding place in which to look for support. In our view the main problem is not that Brussels *is* bureaucratic, but that the scientific community *thinks* that it is bureaucratic. The growth of the basic science element of the Framework Programme makes it increasingly important that British scientists should understand and become familiar with the way decisions are taken in Brussels, and we urge them to persevere.

20. The Research Councils' office in Brussels has an important role to play in facilitating more frequent contacts between British scientists and administrators and the Commission and in giving the Research Councils and British HEIs detailed expert advice on the Community's policies and procedures. We welcome the increasing use which is being made of the services it offers.[6]

"*Attribution*"

21. A problem of a different kind arises out of British government accounting and expenditure control practices. (The Lords European Communities Committee, in the course of its inquiry into the Framework Programme, has examined these practices more closely than we have attempted to do and we have been considerably assisted by its report.) The Treasury operates a system of "attribution" whereby funds received through the EC R&D programmes are attributed to individual spending departments. Those departments' budgets are adjusted in the following annual public expenditure round to take account of these extra receipts. In the opaque words of the DES's memorandum,

> "responsibility for Community expenditure on R&D is shared by a number of Departments. Provision for such expenditure has been allocated to each of them. If expenditure exceeds, or is expected to exceed, planned levels, Departments' domestic public expenditure baselines are correspondingly reduced at the beginning of each year's Survey. Departments can bid for reinstatement of some or all of these reductions and such bids are considered alongside all other claims for increased spending in the annual public expenditure round."[7]

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[1] eg Q 86 (Royal Society); Appendix 16, para 5.2 (University of London).

[2] Ev pp. 83-4. See also Q 250.

[3] Ev p. 51.

[4] Appendix 4, paras 20 and 22.

[5] Ev p. 101. Evidence in defence of the Commission was also submitted by the Pro-Vice-Chancellor for European Affairs of the University of London (Appendix 25).

[6] Ev pp. 52 (CVCP), 69 (SERC), 72 (NERC) and 101 (Chairman of ABRC).

[7] Ev p. 2 (DES). See also Qs 22 (Treasury) and 278 (SERC and MRC).

(We are not alone in finding these mechanisms difficult to understand: it was put to us by Sir David Phillips that "if the Committee were able to persuade HM Treasury to produce a 'plain man's guide' to how the system works and to its likely impact on domestic programmes, you would do a signal service to us all."[1])

22. If it is the case that research funding by Departments is cut back by the amount of funds received by them from the EC, there is a danger that research priorities in this country will be distorted, as EC funds for EC priority projects replace UK funds for UK priority projects. Furthermore, this practice undermines the principle of "additionality" which is enshrined in Community law. This principle, as applied to Community funds, means that any funds received through a Community programme should be *additional* to a nation's public expenditure and not used to subsidise underfunding by that nation of a particular area of expenditure.

23. We agree with the Lords European Communities Committee, which, in its report on the Framework Programme, concluded that:

> "Treasury handling of Community funds under the system of attribution is not satisfactory because:
>
> (i) It cannot be independently monitored by Parliament or any other external body.
>
> (ii) It can lead to applicants who successfully bid for Community funds having their central government grant cut.
>
> (iii) It has not been clearly explained to interested parties.
>
> (iv) The system could accordingly lead to a distortion in the priorities of the scientific community; and,
>
> (v) Universities are being treated as being within the private sector."[2]

24. We are concerned at the distorting effect that the practice of "attribution" may have on UK research priorities and that it may contribute to the cumulative underfunding of research in the UK. **We call upon the Departments concerned to demonstrate that the principle of additionality, enshrined in Community law, is not being breached and that funds obtained by UK research institutions from EC R&D programmes are genuinely "new money" and are not clawed back by the Treasury from spending departments.**

The Community and other modes of collaboration

25. Professor Fasella told us that although he would like to see a larger budget for EC science,[3] he did not think that the whole of European science should be organised through the Commission.[4] The Commission's role was to propose only such actions as could best be done specifically at Community level rather than national level; and if something could be done at reasonable cost by individuals or companies or single universities it was much better that they should do it.[5] We agree with this view. Furthermore, we would apply the same principle to anything that could be done at reasonable cost by a national R&D system, or by a transnational collaboration acting independently of the Community. **We think that the principle of subsidiarity should be firmly upheld, and that it would be inappropriate for the Community to seek to extend its competence in science and technology beyond its present objectives,** which we have summarised in paragraph 5 above.

26. We reject the idea that the European Commission should play a predominant role in determining the priorities for, and funding, scientific research in Europe. Clearly it will have a significant role, but it should only be one player among many. The SERC expressed the general view of the Research Councils when it told us that it saw "great strength and flexibility in a

[1] Ev p. 100.

[2] HC Paper 66 (1989-90), para 118.

[3] Q 308.

[4] Q 320.

[5] Q 291.

plurality of approaches to European collaboration, in which no single mode predominates".[1] Whilst Community support is to be welcomed in those fields for which it is suited (such as information technology), it is not a substitute for the other forms of collaboration which we have previously described: the specialised collaborative laboratories, the informal networks of scientific research teams, the direct co-operation of research agencies in different countries, and the decentralised co-ordination of national research activities. **We recommend that scientific collaboration should continue to be promoted in a wide variety of ways and through a wide variety of different organisations.** Bodies like the ESF, the Academia Europaea and the International Council of Scientific Unions (ICSU) are well placed to co-ordinate international scientific collaboration, and to stimulate new forms of collaboration, and we would welcome an increase in the resources available to them for these purposes.

The European Community and the Universities

27. We received many representations—from the Vice-Chancellors' Committee,[2] the Royal Society,[3] and from individual universities[4] —about the inadequate level of funding for overhead costs on EC research contracts.

28. Each partner in an EC project gets a grant which covers one half of the total cost of its participation. A special arrangement caters for organisations, such as universities, which do not have sufficiently detailed information on their overhead rates to satisfy EC auditing requirements. The arrangement is tailored to produce, on average, the same size of grant. It does however highlight the extremely small contribution being made to university overheads. This contribution was described as "ridiculous and ludicrous" by the Vice-Chancellor of Loughborough University, who told us that the typical overheads on employing a graduate in a laboratory were 100 per cent or 150 per cent of salary costs.[5] Universities awarded EC contracts have themselves to finance the other half of their costs, mainly overhead costs, and this they are finding increasingly difficult.

29. The terms of Research Council grants are distinctly more attractive then those of EC contracts. The former are supplemented by the UFC's block grant to a university through the DR element which is allocated on the basis of the research grant income of the university in the previous year from Research Councils and major charities. When the DR supplementation, nominally a 40 per cent "top up", is taken into account, a university is left to find between one-third and one-quarter of its total costs, depending on the type of project involved.

30. In November 1990 the Government announced that from August 1992 Research Council grants would cover the full direct costs of projects except those related to the salary costs of permanent academic staff and general premises costs, and would include a contribution to the indirect costs of the institution through a standard percentage addition to direct costs. The CVCP, in consultation with the DES and the Research Councils, has been invited to undertake further work on research costs and in particular on the percentage addition which is to be used.[6]

31. The outcome of the discrepancy between the treatment of Research Council and EC grants is that universities are required to find more supplementary funding for EC funded projects than they are for those funded by the Research Councils.

32. Since there is not enough Research Council money to fund even all the alpha-rated projects which are submitted to them,[7] universities continue to apply for EC contracts, even though they are financially disadvantageous, in order to maintain their research base: the research rating of universities and university departments is a significant element in their UFC funding.[8] The Rector of Imperial College told us that "the researchers . . . want to get on with their research

[1] Ev p. 67. See also Qs 17 and 279.

[2] Ev pp. 51-52, Q 219.

[3] Ev p. 23, Q 79.

[4] Apps 12 (Bristol), 13 (Birmingham), 16 (London), 19 (Strathclyde) and 20 (Surrey).

[5] Q 234.

[6] HC Deb (1990-91), vol 180, cc *27-28*.

[7] Q 168.

[8] Ev p. 64 (CVCP).

and that is, after all, what we are there for; so we actively carry on bidding for these grants and getting them as fast as possible, but somebody suggested that this might be a little bit like drinking sea-water when you are dying of thirst in an open boat."[1]

33. The CVCP told us that universities had coped with these difficulties by restricting EC contracts to a relatively small proportion of total research income, by cross-subsidising EC projects where this was possible, and by accepting EC contracts for which the necessary supporting infrastructure was already in place. But this could not continue much longer: "The availability of block grant from the UFC has been the crucial factor in universities' ability to respond in these ways. As funds are transferred from the block grant to other funding agencies . . . and as the UFC contribution to research falls as a proportion of universities' research income, the scope for universities to continue to accept marginal contracts will decline . . . In the absence of steps to provide support for overheads [many universities] expect severely to curtail their acceptance of EC contracts".[2]

34. At a time when the amount of basic science in the Framework Programme is increasing we might hope and expect that the universities would further develop their European Community links and attract more Community funding, but they are being given no financial incentive to do so. It cannot make sense to put money into the Framework Programme through our EC contributions and then find that we cannot afford to take it back in the form of research contracts.

35. We considered whether a solution to this problem should be sought at Community level or at national level. We see no reasonable prospect of persuading the Commission or our Community partners to agree to improved contract terms while universities in France, Germany and other member States are able by virtue of different national funding arrangements to accept contracts on the present basis.[3] We need therefore to look for a domestic solution.

36. The DES told us that individual institutions received a block grant from the UFC, which they were free to apply to whatever research projects they chose.[4] The UFC said in its evidence to us that grants from the Research Councils are provided on exactly the same terms as those from the EC, that is, they cover the marginal costs of the research, but do not include any contribution to the cost of academic staff time or of premises.[5] In addition, the EC gives 20 per cent on top of the marginal cost of the research it is supporting. So the UFC maintains that, in fact, a university receives a *higher* proportion of the full cost of a project from the EC than it does from a Research Council.[6] However, this fails to take account of the supplementing of Research Council grants by the DR element.

37. We received ample evidence from the CVCP[7] that UK HEIs are not able to take full advantage of EC funding because the costs of the research are not adequately covered. In order to ensure that British HEIs can continue to play an effective role in scientific collaboration within the Community, and that the taxpayer sees an appropriate return in this country on his investment in the Framework Programme, a European equivalent of the DR element in the universities' block grant is needed. This should be administered by the Research Councils, in line with the Government's decision on the DR element itself, but as there are no criteria for allocating it among individual Research Councils it should be administered collectively. This would be exactly analogous to the way proposed for administering the DR element on research grants from charities. Accordingly, **we recommend that a fund be established, under the control of the Advisory Board for the Research Councils, from which any HEI winning an EC research contract could claim a contribution towards overheads to bring it up to a financial par with a Research Council grant. To achieve this, the contribution would need to be between 20 per cent and 30 per cent of the value of the EC contract.**

38. It is essential that this fund should be new money and not simply a redirection of funds within the science budget: we wish to achieve a real improvement, not merely a redistribution of

[1] Q 80.

[2] Ev p. 64.

[3] Qs 79 and 84 (Royal Society); Q 219 and Ev p. 64 (CVCP).

[4] Q 40.

[5] Appendix 23 (UFC).

[6] *Ibid.*

[7] Ev pp. 64-5 (CVCP).

the deficit. Up to £10 million per annum would be needed at the universities' present rate of involvement in EC science,[1] but this would need to be increased if (as we hope) the universities were successful in winning more EC research contracts.

Science policy and the machinery of government

39. The complexity of modern scientific and technological endeavour means that responsibility for science—even quite basic research—is spread across a number of Government departments and non-departmental public bodies. These include the DES, the DTI, the Treasury, the ABRC and the Research Councils. This multiplicity of agencies is co-ordinated through the Science and Technology Secretariat of the Cabinet Office, headed by the Chief Scientific Adviser. The Advisory Committee on Science and Technology (ACOST), which is based in the Cabinet Office, has responsibilities which include advising the Government on the nature and extent of United Kingdom participation in international collaboration in science and technology.

40. As far as relationships and negotiations with the European Commission are concerned, the lead department, representing the interests of British science in Brussels, is the DTI. This is because, historically, the emphasis of EC research programmes has been on applied research designed to benefit EC industrial and commercial interests.

41. However, concern has been expressed about whether the *scientific* interests of the United Kingdom can be properly represented by a DTI Minister. The DES will brief DTI officials going to Brussels to negotiate on scientific matters, but the view was expressed by several witnesses that the views of the scientific community are not given enough weight in these negotiations. It is felt that the UK is not sufficiently "pro-active" at the stage when the Framework Programme is being decided upon and has to content itself with responding to decisions made in Brussels without being able sufficiently to influence them.[2] The MRC expressed concern that at higher levels, such as the Council of Ministers, arrangements for briefing the British representative "cannot be guaranteed to convey adequately the scientific messages, which tend to be diluted at each stage in the passage through the Government machine, nor to address the wider issues of national scientific research priorities in the international context".[3]

42. Up to now, the United Kingdom has done well out of EC Framework programme funding, receiving more in grants than we pay in. Professor Fasella expressed the view that, although the British arrangements for negotiating with Brussels appear rather diffuse and incoherent, they do, in fact, work effectively:

> "The more I know about England the less I understand you because you have a strange, mysterious way your wonders to perform. On paper, by Continental standards, there should be chaos among your various ministries. . . . [but] sometimes in the countries which do have a centralised ministry you find less internal coherence than is the case with Great Britain. I do not know what happens in London but by the time you get to Brussels you are pretty well co-ordinated."[4]

This is to the credit of the teams which advise the Minister from the DTI. However, we are concerned that, as a greater proportion of EC funding is allocated to basic research, the interests of UK science will not be sufficiently represented.

43. Our attention has been drawn to the arrangements in France and Germany:[5] each of these countries has a separate ministry dealing with science and technology headed by a cabinet minister. The creation of a single Ministry of Science in the United Kingdom would strengthen this country's position in Brussels by bringing British scientists into the discussions directly and at an early stage, and by giving the British representative full membership of the "club" of Community Research Ministers and science ministries;[6] but these advantages are in our view outweighed by the disadvantages which such a step would bring to the organisation of domestic science policy.

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[1] Ev pp. 65-6 (CVCP).

[2] Ev pp. 69 (SERC), 71 (NERC), 100 (Chairman of ABRC).

[3] Ev p. 84. See also Q 253.

[4] Qs 307 and 312.

[5] Qs 10, 105-106 and 242-4; Ev p. 69.

[6] Q 326 (Chairman of ABRC).

44. The Chairman of the ABRC pointed out that most Government departments need a strong scientific capability and that locating all scientific responsibility in one Ministry of Science would dilute this.[1] On the other hand, if a Minister of Science were appointed with merely a co-ordinating function, and no budget, it is doubtful whether he would have sufficient influence over policy decisions, unless he were a senior member of the Cabinet without onerous departmental responsibilities. Such a person, with spare time and an interest in science, is not always available.

45. The CVCP[2] suggested that the Chairman of the ABRC could represent UK science interests at Brussels, but Sir David Phillips rejected this idea.[3] The ABRC is an independent adviser to the Government and could not act as a part of the executive. Furthermore, the ABRC represents basic science, whereas the EC Framework Programme encompasses applied as well as basic science.

46. The Pro-Vice-Chancellor for European Affairs of the University of London expressed the view that "there is a complete vacuum in policy as to what research should best be funded on an EC basis and what on a national basis. There is no debate on the matter, indeed no mechanism for the debate".[4] He suggested that the ABRC was the appropriate forum for such a debate. We have no doubt that such a debate ought to be taking place with the active participation of the Research Councils, and that the DES, as the Research Councils' sponsor department, should ensure that their views are effectively represented in both inter-departmental discussions in Whitehall and in negotiations in Brussels with the Commission and our Community partners.

47. In our view UK basic science needs its own voice at the Council of Ministers and should no longer rely on indirect representation through the DTI. That voice must be the voice of a Minister. **We therefore recommend that the Parliamentary Under Secretary of State at the DES with responsibility for basic science should accompany the Minister for Industry to meetings of the Community Council of Research Ministers.**

The United Kingdom's science base

48. An inquiry into the European dimension of UK science policy cannot ignore the state of our national science base. The capacity of United Kingdom HEIs to participate in and to gain from European collaboration has been mentioned in evidence on several occasions[5] as an important factor and deserves some consideration.

49. Sir David Phillips warned us that "in some instances the opportunities for UK universities to take advantage of EC support will be constrained by a shortage of nationally funded resources . . . Potential collaborators abroad will not consider UK universities to be attractive partners if they appear relatively under-resourced for prospective joint research programmes".[6] Equally worrying is the prediction that more talented scientists from the UK will be attracted abroad by the prospects of higher salaries and better working conditions.[7]

50. The problem of attracting young people to the study of science has recently become more acute, especially at the postgraduate level. Evidence submitted to the Committee by Save British Science[8] and by the CVCP indicates that universities are finding it difficult to attract high quality graduates to take up Ph.D. studentships. The Provost of University College, London told us that it was very difficult to persuade young people to accept a stipend of £4,500 per year to study for a Ph.D. when they could earn £15,000 if they went into employment.[9]

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[1] Q 326; Ev p. 100.

[2] Q 240.

[3] Q 332.

[4] Appendix 25.

[5] Qs 64-69 (Royal Society); 193, 194 and 198 (CVCP); 338 (Chairman of ABRC).

[6] Ev p. 101.

[7] Q 149 (CBI); Appendix 4 (NATFHE); Appendix 5 (IPMS).

[8] Appendix 22.

[9] Q 198.

51. An academic science career in the UK is not perceived as attractive, because of low salaries and poor prospects. In the past, the route to an academic career was a Ph.D. followed by 3-6 years as a research assistant in a university department. After this, the researcher would expect to obtain a lecturing post. Pressure on university finances in recent years has meant little recruitment to lectureships, lessening the attraction of low-paid research as a stage in an academic career. Furthermore, this type of progression does not provide for those who wish to pursue a career in research, since it assumes that all researchers will ultimately become lecturers.

52. **We believe that it is crucial, not only to our scientific presence in Europe but also to our national prosperity, that we recruit and retain enough high calibre scientists. We recommend:**

(i) **The creation of a proper career structure for those wishing to pursue a research career** by creating more permanent research posts. The present system, which relies heavily on fixed term contracts, does not allow the creation of a cadre of top flight, experienced researchers.

(ii) **More encouragement for able students to work for a Ph.D. in science.** One possible way of providing this, which we believe merits serious consideration, was suggested to us by Save British Science. They proposed the creation of a twin-track route to a Ph.D., with five-year salaried research assistantships (combining research with teaching or demonstrating) for those willing to work their way to a higher degree, and a limited number of three-year studentships on the same rate of pay for the most able postgraduate students.[1]

(iii) **The expansion and continuation beyond 1995 of the programme of "new blood" lectureships** to create a cohort of lecturers to replace those due to retire in the 1990s.

53. We have already reported on the problems involved in recruiting sufficient numbers of teachers qualified to teach science in schools.[2] Evidence we have received during this inquiry[3] indicates the seriousness of the problem for the long-term health of the science base and the future of the British economy.

54. Whilst we welcome the Government's attempts to recruit more science teachers by offering bursaries to trainee teachers, we believe that further action needs to be taken as a matter of urgency to redress this particularly worrying shortage. **We reaffirm the view we have already expressed that more financial incentives need to be introduced to make teaching an attractive career for able people with good scientific qualifications.**

55. The inclusion of science in the National Curriculum for all pupils from five to 16 will ensure that all children receive a thorough grounding in science. However, it is crucial that science be taught by enthusiastic and well-qualified teachers. **We therefore recommend that the Government provide funds for an in-service training programme in science for all primary school teachers and for retraining programmes for science teachers in secondary schools whose original qualifications were not in science.**

56. The central issue seems to be a growing perception by British young people that a scientific or an academic career is not attractive. The rewards are not sufficient, either in terms of salary or of status. **Urgent action needs to be taken to raise the profile of science in this country and to make people—especially young people—realise that science is an exciting and worthwhile activity with a vital part to play in the nation's economic and intellectual life.** The Government cannot achieve this on its own simply by political and administrative measures, but it is essential that it use the means at its disposal to demonstrate a firm commitment to these objectives. Scientists themselves have an important role to play in communicating the importance and value of the work they do, and we welcome Sir Mark Richmond's recognition that the scientific community has to be more effective in "selling" science.[4]

57. There has been concern for decades over the "brain drain"—the loss of well-qualified scientists and engineers to other countries, chiefly to the United States but increasingly to

[1] Appendix 22 (Save British Science).

[2] Second Report, Session 1989-90, HC 208 (1989-90).

[3] Qs 153-161 (CBI).

[4] Q 351.

continental European countries as well. Collaboration in international projects allows UK scientists to experience the terms of employment and working conditions offered abroad. If these are markedly superior to conditions in the UK, it is not surprising that many choose to make their careers abroad. We saw this for ourselves during our visit to three European collaborative laboratories earlier this year. This situation is likely to become worse after 1992, with the creation of the Single European Market.[1]

58. **We recommend that an objective study of the extent and causes of the "brain drain" be undertaken and that the findings of this study be taken into account when providing funds for scientific research.**

59. UK science is highly regarded internationally, and the UK has been very successful in obtaining research funding through the EC programmes. However, worries were expressed by some witnesses[2] about the ability of the UK to maintain its high standing because of the relative decline in funding of the science base.

60. The UK has a record of success in obtaining funding from the EC. Under the SCIENCE programme, which is a responsive mode programme, UK HEIs have been involved in 72 "twinning" contracts compared with 69 for France, 47 for Germany 34 for Italy and 24 for Spain.[3] The DES estimates that the UK's share of the available funding is a little over 20 per cent, which is slightly more than our contribution.[4] Professor Fasella put it at between 23 per cent and 26 per cent against a financial contribution of 18 per cent. However, the UK also puts in more applications than any other country, and so also has more rejections.[5] It has been suggested that the reason why UK universities put in so many bids for funding is because of the lack of funds available in this country.[6] This is worrying, since, as we have suggested above, it indicates that national scientific research priorities will be subordinated to Community priorities, even though Community science is supposed to be "subsidiary" to national science.

61. Recent research carried out at the Science Policy Research Unit (SPRU) indicates that the emphasis of scientific publication in the United Kingdom has shifted away from basic towards applied research. This may indicate a shift in research activity in the same direction. The SPRU report suggests that this shift might be due to the fact that HEIs are having to seek more funds from commercial companies, who want applied research, because there is not enough money available for basic research.[7] We were warned by representatives of the CBI[8] that it was absolutely essential for our long-term scientific and commercial success that the UK remain at the forefront of original, basic research. In this context, the trends reported by SPRU merit serious consideration.

62. Government funding of academic and related research increased very little between 1975 and 1980. Between 1980 and 1987 it increased by 16 per cent in real terms, from $2.4 billion to $2.8 billion.[9] Why, then, is there a perception among the country's foremost scientists, such as the Royal Society, the CVCP, the Research Councils and other witnesses, of a shortage of funds for research?

63. One reason might be that the increase in research funded by the Research Councils is greater than that funded directly by universities through the UFC. A significant proportion of Research Councils' funding is already spoken for by subscriptions to major facilities such as CERN and so their deployable funds have not grown as fast. The House of Lords Select

[1] Q 150 (CBI).

[2] Q 102 (Ryal Society); Q 119 (CBI); Q 219 (CVCP).

[3] Q 282 (SERC); Appendix 2 (ESRC).

[4] Ev p. 11 (DES).

[5] Qs 307 and 314.

[6] Q 133 (CBI); Appendix 16, para 2(4 (University of London).

[7] Martin B *et al* (1990). Recent trends in the output and impact of British science. *Science and Public Policy* 17, 1, 14-26.

[8] eg, Qs 119-124. See also Appendix 7 (Chemical Industries Association).

[9] Martin B *et al* (1990). Trends in UK Government spending on academic and related research; a comparison with Germany and France, Japan, The Netherlands and USA. *Science and Public Policy* 17, 1, 3-13.

Committee on Science and Technology[1] has recently pointed out that the extent to which Britain's R&D expenditure appears to have increased depends entirely on which definitions are being employed. If the growth of total spending on research[2] is compared with the growth of Gross Domestic Product (GDP), the UK is the only OECD country where growth in spending on research was less than growth in GDP. When allowance is made for the fact that 49 per cent of government spending is on defence (compared with 32 per cent in France and 12 per cent in Germany)[3] it appears that in the United Kingdom the Government is investing comparatively less in civil R&D than other Western countries.

64. In the context of European science, international comparisons are highly significant. We are competing for research funds with the other countries of the EC. We are also looking for research partners in other EC countries. In this context, the UK is undoubtedly disadvantaged by the amount of funding devoted to scientific research. On the basis of government-funded civil R&D as a percentage of GDP, the UK is not as well funded as Italy, France, Sweden or Germany.[4]

65. **We recommend that Government funding of civil R&D be increased to match that of our major partners in the EC, France and Germany, who currently spend around 0.9 per cent of GDP compared with less than 0.6 per cent spent by the UK.** Against this background, the Secretary of State's announcement that the 1990 public expenditure settlement "maintains the value in real terms of the underlying Science Budget"[5] is wholly unsatisfactory. We were particularly concerned to learn of the SERC's recent announcement that it faced an estimated shortfall of £40 million in 1991-92 and consequently would have to consider its continued commitment to a number of large programmes. The SERC's international commitments are substantial and the costs which result from them are—at least in the short term—beyond the Council's direct control. The present Chairman told us that as a result of fluctuating exchange rates and cost inflation in other countries the SERC would have to find an extra £9-£10 million for its subscription to CERN in 1991, and that this would have to be found by making cuts in domestic programmes.[6] **We recommend that increases in international costs as well as in domestic costs should be taken into account when determining the Research Councils' budgets.**

66. Witnesses also drew attention to another factor which may hinder the UK's efforts to participate fully in international science: the lack of sufficient up-to-date equipment in UK laboratories. Several witnesses[7] referred to a recent ABRC report[8] which showed that £453 million needed to be spent to equip UK laboratories to a satisfactory standard. The survey found that 37 per cent of equipment is over 10 years old, 14 per cent is no longer adequate in terms of technical capability and 17 per cent is in poor working condition or inoperable.

67. A witness from the DES told us that 80 per cent of individual institutions felt that they had "well-found" laboratories.[9] What the ABRC report actually said was that they were well-found by British standards, and that only 22 per cent of institutions felt they were well-found by international standards.[10] This says something about the low expectations of our scientists of support from the Government for their work.

68. The CVCP told us that the amount given to universities under the "dual support" system, which is intended to provide the infrastructure of the universities, has declined by 6 per cent in

[1] Third Report, Session 1989-90, "Definitions of R&D" (HL 44 (1989-90)).

[2] Government funded civil and defence R&D and industry funded R&D.

[3] *Source:* ACOST.

[4] *Source:* OECD.

[5] HC Deb (1990-91), vol 180, cc *29-30*.

[6] Ev p. 102; Q 346.

[7] Qs 62-72 (Royal Society); Ev p. 52 (CVCP).

[8] Survey of Academic Research Equipment in the United Kingdom, University of Manchester, November 1989.

[9] Q 29.

[10] Survey of Academic Research Equipment in the United Kingdom, p. 52.

real terms over the last two years.[1] The Royal Society also referred to the "gradual erosion of the effectiveness of the dual-support system" and offered the opinion that £200 million was needed to make good the shortfall in the scientific equipment of the universities.[2]

69. In our view, it is absolutely essential that British laboratories are equipped to the standard of our European partners. **We therefore recommend that the Government provide the funding required to bring the laboratories of British universities up to internationally accepted standards of the "well-found" laboratory.**

[1] Q 203 (CVCP).

[2] Qs 62 and 69.

PROCEEDINGS OF THE COMMITTEE RELATING TO THE REPORT

WEDNESDAY 12 DECEMBER 1990

Members present:

Mr Malcolm Thornton, in the Chair

Mr David Evennett
Mr Harry Greenway
Mr Gerry Steinberg
Sir Gerard Vaughan

The Committee deliberated.

Draft Report [Science Policy and the European Dimension], proposed by the Chairman, brought up and read.

Ordered, That the draft Report be read a second time, paragraph by paragraph.

Paragraph 1 read, amended, and agreed to.

Paragraphs 2 to 11 read and agreed to.

Paragraph 12 read, amended and agreed to.

Paragraphs 13 to 18 read and agreed to.

Paragraph 19 read, amended and agreed to.

Paragraphs 20 to 45 read and agreed to.

Paragraph 46 read, amended and agreed to.

Paragraphs 47 to 55 read and agreed to.

Paragraph 56 read, amended and agreed to.

Paragraphs 57 to 64 read and agreed to.

Paragraph 65 read, amended and agreed to.

Paragraphs 66 to 69 read and agreed to.

Resolved, That the Report, as amended, be the First Report of the Committee to the House.

Ordered, That the Chairman do make the Report to the House.

Ordered, That the provisions of Standing Order No 116 (Select committees (reports)) be applied to the Report.

Several papers were ordered to be appended to the Minutes of Evidence.

Ordered, That the Minutes of Evidence taken before the Committee this day, together with Appendices, be reported to the House.—*(The Chairman.)*

[Adjourned till Wednesday 16 January 1991 at Four o'clock.

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HOUSE OF COMMONS SESSION 1989–90

EDUCATION, SCIENCE AND ARTS COMMITTEE

SCIENCE POLICY AND THE EUROPEAN DIMENSION

MINUTES OF EVIDENCE

Wednesday 14 March 1990

Department of Education and Science
Mr R Record and Mr M Higson
HM Treasury
Mr M Mercer
Department of Trade and Industry
Mr R Foster
Cabinet Office
Mr P Thomas

Ordered by The House of Commons to be printed
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TAKEN BEFORE THE EDUCATION, SCIENCE AND ARTS COMMITTEE

WEDNESDAY 14 MARCH 1990

Members present:

Mr Malcolm Thornton, in the Chair

Mr Gerald Bowden
Mr Martin Flannery
Mr Gerry Steinberg
Mr Dennis Turner
Sir Gerard Vaughan

Memorandum submitted by Department of Education and Science (ES 28)

INTRODUCTION

1. UK scientists, and scientific institutions, are engaged in many forms of international collaboration within Europe. Besides the science programmes of the European Community, other collaborative activities include those based on usage of large facilities (CERN, ILL, ESRF); other pan-European organisations (ESA, ESF, COST, EMBC, EMBL); and a wide range of smaller scale bilateral and multilateral programmes, directed towards research, training and information exchange.

POLICY BACKGROUND

2. Within the very broad spectrum of science in Government, the Secretary of State for Education and Science has responsibility, through the Research Councils, for support of the UK's basic and strategic science capability.

3. The UK's general policy towards European collaboration in the field of science is to support research which:—

—is not already under way domestically or through other international channels; and where added value from collaboration will exceed the unavoidable extra costs involved;

—is complementary to existing national and international activities;

—improves the quality of European science, including the scientific capabilities of its manpower, and which offers scope for technology transfer;

—is aimed at improving industrial competitiveness or tackling trans-border issues such as health, environmental protection, or economic problems;

—involves large scale investment with sharing of costs and risks.

EUROPEAN COMMUNITY SCIENCE

4. Most EC science and technology activities are now grouped within the Framework Programme 1987 to 1991. The Programme is divided into separate lines, some of which are in turn sub-divided into specific programmes. These, with the budget share apportioned to them, are displayed at Annex A. Some of the specific programmes have been agreed only recently and some are either not yet operating (Predictive Medicine—now to be known as Human Genome Analysis) or have only just begun (e.g. Marine Science and Technology (MAST), Large Facilities).

5. In August 1989 the European Commission proposed a new Framework Programme to last from 1990 to 1994 and subsequently to operate on a "rolling" basis. At the December 1989 meeting of the Research Council, agreement was reached that the budgetary ceiling should be 5.7 billion ecu. The detailed content of the six main programme lines is currently the subject of further discussions involving the Commission and representatives of member states, which will lead to separate decisions later. The UK Government's views on the Commission's original proposal were contained in the Explanatory Memoranda for Parliament of September and November 1989 (No. 8375/89).

6. Of the EC programmes of some relevance to science outside the Framework Programme, the most important are SPRINT, STRIDE, COMETT and ERASMUS (brief details at Annex B).

ARRANGEMENTS FOR EC SCIENCE WITHIN GOVERNMENT

7. The EC's Framework Programme covers areas within the responsibility of a wide range of Government Departments. The Secretary of State for Trade and Industry has the lead for the UK, and the Minister for Industry and Enterprise attends the Community's Research Council. Support for him in this capacity, and a co-ordinating role at official level within Government generally, is exercised by the Science and Technology Secretariat of the Cabinet Office, under the oversight of the

The cost of printing and publishing this Report is estimated by HMSO at £3,191.

Chief Scientific Adviser. S & T Secretariat officials attend meetings of the Scientific and Technical Research Committe (CREST) in Brussels. Separate Committees within Government bring together Ministers and officials to review issues concerning European science on a regular basis.

8. Individual Departments within Government take a leading policy responsibility under the Framework Programme for separate Programme lines. This may be either by themselves or in conjunction with other Departments, depending on the content of the Programme. The lead Department will be responsible for preparations within the UK for, and attendance at, relevant official level meetings in Brussels; and for publicity within the UK for EC programme opportunities. In the case of the DES, these responsibilities are discharged in close consultation with relevant Research Councils. Programmes where the DES has the lead responsibility are listed at Annex C.

9. The UK's contribution to R & D expenditure which is financed through the Community budget comes from the same pool of resources, and represents the same burden on domestic taxpayers, as does direct funding of R & D by Government Departments. Much the same public expenditure controls are therefore applied.

10. Responsibility for Community expenditure on R & D is shared by a number of Departments. Provision for such expenditure has been allocated to each of them. If expenditure exceeds, or is expected to exceed, planned levels, Departments' domestic public expenditure baselines are correspondingly reduced at the beginning of each year's Survey. Departments can bid for reinstatement of some or all of these reductions and such bids are considered alongside all other claims for increased spending in the annual public expenditure round.

11. This approach is designed to secure:

(i) that Departments adopt the same rigorous approach to value for money in terms of Community expenditure as they do for domestic expenditure;

(ii) that inevitably finite resources are allocated in line with relative priorities; and

(iii) that expenditure from the Community budget is treated on the same footing as any other form of public spending.

European Science Collaboration Outside the EC

12. The UK is an active participant in many collaborations outside the European Community. Different financial, membership and other terms of participation apply to each. In general the Government welcomes and seeks to foster a diversity of scientific organisations within Europe, including those—for example the European Science Foundation—which seek to draw together national research agencies for the promotion of mutually beneficial scientific exchange and development. Annex D lists the largest international collaborations involving the UK determined by size of budgetary input. Further information about these will be supplied if the Committee wishes.

Relationship Between EC Scientific Programmes and National Science Programmes

13. As the Explanatory Memorandum to Parliament indicates, the UK believes that there should be integration and complementarity between science conducted domestically and that through international collaboration. It is however difficult to generalise about the appropriateness of EC involvement across the wide range of scientific areas in which the UK Research Councils are active. The extent to which any particular scientific area will benefit from collaborative EC activity—as opposed to other international forms of collaboration—is likely to depend upon its characteristics, its previous history of international collaboration, and the extent to which the criteria described in para 2 above are felt to be satisfied.

14. The Government believes that, at least for the programmes where DES is the lead Department, the scope for such involvement should normally emerge in the first instance from contact between scientists at working level. Hence it supports EC involvement in initiating discussions in appropriate areas between national experts and believes these can usefully define both the nature and the scope of subsequent Community action. The involvement of non-EC countries (eg EFTA countries) in this process concerning more fundamental science and areas of public health and quality of life, is supported, not least as a recognition of the international nature of science (and provided that appropriate financial and other arrangements for subsequent participation in programmes can be identified).

15. It is also difficult to generalise about the desirable scale of EC scientific activity—either overall or in relation to particular areas of science. In circumstances where both national and international scientific activity is funded from the same pool of resources (see para 9 above), much depends on scientific judgements by individual Councils concerning the relative share of resources each is prepared to devote to the pursuit of scientific objectives through international action. In practice, the pattern of decisions taken by Research Councils in recent years has shown an overall increase in

the amount of available resources being devoted to international science. Over the period 1981/82 to 1987/88 Research Council expenditure on international science generally has increased by some 60% (from £57.7m to £93.3m at 1987/88 price levels[1]).

EFFECTS OF EC RESEARCH PROGRAMMES ON UK HIGHER EDUCATION INSTITUTIONS AND RESEARCH COUNCILS

16. Available information about grants and awards under the programmes to UK institutions shows that they are relatively successful in obtaining EC support. Although this may in some cases reflect a relatively higher number of applications, the outcome is nevertheless a satisfactory one. Naturally UK institutions will welcome EC programmes as an additional source of potential financial support. Hence it is possible that in some areas of science this may mean an adjustment of research priorities to coincide with those of particular EC programmes. However since, as noted earlier, the programmes where DES leads have in general been developed in close consultation with appropriate scientific interests in the UK, any distortion of research priorities is likely to have been small. In the case of the newly established programmes for support of Large Facilities and Marine Science and Technology, for example, UK researchers and research facilities have been significant beneficiaries.

Department of Education and Science
January 1990

ANNEX A

FRAMEWORK PROGRAMME OF COMMUNITY ACTIVITIES IN THE FIELD OF RESEARCH AND TECHNOLOGICAL DEVELOPMENT (1987 to 1991)

Breakdown of the amount deemed necessary between the various activities envisaged

		(million ECU)	
1.	Quality of Life		375
1.1.	Health	80	
1.2.	Radiation protection	34	
1.3.	Environment	261	
2.	Towards a large market and an information and communications society		2,275
2.1.	Information technologies	1,600	
2.2.	Telecommunications	550	
2.3.	New services of common interest (including transport)	125	
3.	Modernisation of industrial sectors		845
3.1.	Science and technology for manufacturing industry	400	
3.2.	Science and technology of advanced materials	220	
3.3.	Raw materials and recycling	45	
3.4.	Technical standards measurements methods and reference materials	180	
4.	Exploitation and optimum use of biological resources		280
4.1.	Biotechnology	120	
4.2.	Agro-industrial technologies	105	
4.3.	Competitiveness of agriculture and management of agricultural resources	55	
5.	Energy		1,173
5.1.	Fission: nuclear safety	440	
5.2.	Controlled thermonuclear fusion	611	
5.3.	Non-nuclear energies and rational use of energy	122	
6.	Science and technology for development	80	80
7.	Exploitation of the sea bed and use of marine resources		80
7.1.	Marine science and technology	50	
7.2.	Fisheries	30	
8.	Improvement of European S/T co-operation		288
8.1.	Stimulation, enhancement and use of human resources	180	
8.2.	Use of major installations	30	
8.3.	Forecasting and assessment and other back-up measures (including statistics)	23	
8.4.	Dissemination and utilization of S/T research results	55	
	Total		5,396

1 Source: Annual Review of Government R & D. 1984 & 1989 editions

ANNEX B

EC PROGRAMMES OUTSIDE THE FRAMEWORK, RELEVANT TO SCIENCE

(i) COMETT (Community Action Programme in Education and Training for Technology)

Definition—Five year programme (1990-94) to develop co-operation between higher education institutions and companies, particularly to respond to new advanced technologies altering skill needs or requiring new inter-disciplinary skills. Also to stimulate technology transfer between EC States, to help meet Industry's need for highly qualified manpower.

Community funding—200 MECU over five years.

Programme Management—by the Commission assisted by a committee comprising representatives of the Member States. UK representation 1 government administrator from two of the Departments concerned (DES and DEmp).

Lead Department—DES.

Status—Current Programme adopted by the Council of Ministers on 18 December 1988. Applications are invited once a year, due by end February for 1990.

(ii) ERASMUS (European Community Action Scheme for Mobility for University Students)

Definition—Five year programme (1991-95) to assist both the freedom of movement of EC higher education students and more cooperation in higher education. ERASMUS helps students study for up to 12 months in another EC state, and is helping develop a network of institutions and the mutual recognition of qualifications, including credit transfer.

Community funding—192 MECU agreed to date for first three years, 1991 to 1993.

Programme Management—by the Commission assisted by an advisory committee comprising representatives of the Member States. UK representation 1 government administrator, 1 UK academic. Administration is by an agency in Brussels, assisted by advisory panels of EC academics, on which UK representation is 2 academics in total, selected by the Commission. A UK Council awards grants for UK students to study elsewhere in the EC; it comprises nominees from higher education representative bodies, appointed by the Secretary of State.

Lead Department—DES.

Status—Current Programme adopted by the Council of Ministers on 14 December 1989. Applications are invited from institutions every year by 31 October for the following year.

(iii) SPRINT (Strategic Programme for Innovation & Technology Transfer).

Definition—Five year programme (1989—1993) to help improve the competitiveness of industry (especially small and medium size enterprises) within the Community by ensuring that technology and innovative aids can be shared across national boundaries. These aims are achieved through the establishment or consolidation of community networks of agents for technology transfer and innovation support and the support of projects which demonstrate the intra-community transfer of innovation.

Community funding—90 MECU over five years.

Programme Management—by the Commission assisted by the Consultative Committee for Innovation and Technology transfer (CIT), an advisory committee of government officials nominated by member states.

Lead Department—DTI.

Status—Programme adopted by the Council of Ministers in March 1989. Call for proposals issued three times a year.

(iv) STRIDE (Science & Technology for Research, Innovation & Development in Europe).

Definition—A four year programme under the Structural Fund Initiative, intended to boost regional research and technological development capacity. The main aim is to finance research centres and university laboratories and to promote direct links between research establishments and businesses.

Community funding—400 MECU over four years.

Programme Management—still under discussion between Commission and member states.

Lead Department—DTI.

Status—A working paper by the Commission which has the powers to decide on the programme.

ANNEX C

EC FRAMEWORK PROGRAMME: PROGRAMME LINES WHERE DES HAS LEAD RESPONSIBILITY

A: Second Framework Programme (1987–91)

(1) MAST (Marine Science and Technology Programme)

Definition—Four year programme (1989–1992) to contribute to better knowledge of the marine environment; encourage the development of new technologies; improve coordination among national programmes; strengthen industrial competitiveness; assist development of common standards; assist European participation in world-wide ocean programmes; and facilitate training and exchange of personnel.

Community funding—50 MECU over four years.

Programme Management—by the Commission assisted by an advisory committee comprising representatives of the Member States. UK representation 1 government administrator: 1 UK scientist.

Status—Programme adopted by the Council of Ministers on 20 June 1989. Call for proposals issued in March 1989.

(ii) SCIENCE (Stimulation of the International Co-operation and Interchange needed by European Research Scientists)

Definition—Five year programme (1988–92) consisting of a range of temporary financial support measures to assist the training and mobility of researchers, communication among scientists, and the development of scientific cooperation in the Community. The programme applies to multi-national projects in all fields relevant to the natural sciences.

Community funding—180 MECU over five years.

Programme Management—by the Commission assisted by CODEST.

Status—Programme adopted by the Council of Ministers on 29 June 1988 and a Guide for Applicants has been issued. Applications are invited at any time: awards are decided quarterly.

(iii) SPES (European Stimulation Plan for Economic Science)

Definition—Four year programme (1989–92) to assist the mobility of economists, improve training in economic science, encourage young European economists to return to the Community and enhance communication among Community economists.

Community funding—6 MECU over four years.

Programme Management—by the Commission assisted by CODEST.

Status—Programme adopted by the Council in February 1989. Call for proposals issued in April 1989.

(iv) LARGE FACILITIES (Community Support Plan to Facilitate Access to Large Scale Scientific Facilities of European Interest)

Definition—Four year programme (1989–92) to maximise the use of large scientific and technical installations and facilities through an EC financial contribution to the cost of adapting, upgrading and operating them, in return for access being given by the institutions to European researchers.

Community funding—30 MECU over four years.

Programme Management—by the Commission assisted by CODEST and an advisory committee comprising representatives of the Member States.

Status—Programme adopted by the Council in March 1989. Call for tenders issued in April 1989.

(v) HUMAN GENOME ANALYSIS PROGRAMME

Definition—Two year programme (1990–91) to use and improve new biotechnologies in the study of the human genome for a better understanding of the mechanisms of genetic function as well as the prevention and treatment of some human diseases by precompetitive Community research, setting up and reinforcing networks of European laboratories, and training.

Community funding—15 MECU over two years.

Programme Management—by the Commission assisted by an advisory committee comprising representatives of Member States.

Status—The Council reached a Common Position on 15 December 1989, and is expected to reach a final decision in February 1990.

(vi) MEDICAL AND HEALTH RESEARCH PROGRAMME

Definition—a five year programme (1987–91) to co-ordinate work carried out in the individual Member States on the following themes:

Sub Programme I: Major Health Problems

(i) Cancer
(ii) AIDS
(iii) Age-Related Health Problems
(iv) Environment and Life-Style related Health Problems.

Sub Programme II:

(i) Medical Technology Development
(ii) Health Services Research

Community funding—65 MECU over 5 years.

Programme Management—by the Commission assisted by an advisory committee comprising representatives of Member States.

Status—Programme adopted by the Council in November 1987.

B: Provisional DES Lead Responsibilities Under The Third Framework Programme (1990–94)

Although relevant decisions on programme content remain outstanding, it may be helpful for the Committee to be informed of working assumptions about DES lead responsibilities for programmes under the 1990–94 Framework Programme. Following the contraction of the 31 specific programmes into six main programme lines, responsibilities are identified—in the case of B(i)–B(ii) below—at the sub-programme level. In the case of B(iv) (Line 6), no decision has yet been taken on disaggregation.

LINE 3: ENVIRONMENT

(i) MAST (Marine Science and Technologies)

Definition—to build upon the MAST pilot programme by special focus on relevant basic research (including oceanography); coastal engineering; and technologies for the exploration and exploitation of resources.

Community funding—estimated at 104 MECU over 5 years.

Status—Precise programme content under discussion between Member States and Commission. Council decision to follow.

LINE 4: LIFE SCIENCES AND TECHNOLOGIES

(ii) BIOTECHNOLOGY PROGRAMME

Definition—a programme to reinforce basic biological knowledge as the common and integrated foundation needed for applications in agriculture, industry, health, nutrition and the environment. The goals of the current BRIDGE programme (Biotechnology for Innovation Development and Growth in Europe), whose aim is to strengthen technology transfer from research to industry, agriculture and medicine, will be expanded.

Community funding—estimated at 164 MECU over 5 years.

Status—Precise programme content under discussion between Member States and Commission. Council decision to follow.

(iii) BIOMEDICAL AND HEALTH PROGRAMME

Definition—a programme to improve the effectiveness of R&D in medicine and health through better coordination between Member States, in terms of both the use of resources and the application of findings. The main focus will be on new approaches to tackling economically and socially significant diseases (in particular cancer, AIDS, heart disease and mental illness), ageing, the problems of the handicapped and workplace health. Activities will also cover the study of the human genome.

Community funding—estimated at 133 MECU over 5 years.

Status—Precise programme content under discussion between Member States and Commission. Council decision outstanding.

(iv) LINE 6: HUMAN CAPITAL AND MOBILITY PROGRAMME

Definition—a combination and extension of the existing SCIENCE, SPES and LARGE FACILITIES programmes. A scheme of fellowships will be established to enable more young research staff to spend up to two years working in high-level scientific and technical establishments in other Community countries.

Community funding—estimated at 518 MECU over 5 years.

Status—Precise programme content under discussion between Member States and Commission. Council decision to follow.

ANNEX D

INTERNATIONAL COLLABORATION: UK CONTRIBUTIONS

This Annex lists major scientific collaborations within the field of DES responsibility. For the European Space Agency, DTI is the lead Department. In COST the Cabinet Office S & T Secretariat takes the lead. More detail is provided on the sheets following concerning collaborations where UK spending exceeds £2m p.a.

£M	89/90	90/91	91/92
MRC			
+European Molecular Biology Organisation	2.6	2.8	2.8
+European Molecular Biology Conference	0.6	0.6	0.6
+International Agency for Research on Cancer	0.5	0.7	0.7
NERC			
*Satellite Remote Sensing	0.1	0.2	0.2
*North Sea Programme	1.3	0.9	0.7
+Ocean Drilling Programme	1.4	1.4	1.4
SERC			
+European Organisation for Nuclear Research (CERN)	48.9	45.2	45.8
+European Space Agency	26.8	25.8	27.2
(DTI contribution	51.8	53.2	52.3)
*Institut Laue-Langevin	8.7	8.6	8.9
*European Incoherent Scatter Facility	0.4	0.5	0.5
+European Synchrotron Radiation Facility	3.8	4.8	5.2
*Roentgen Satellite (ROSAT)	0.2	0.1	0.1
*Along Track Scanning Radiometer	0.1	0.1	—
*Infra-red Space Observatory (instruments)	0.7	0.5	0.4
*Observatories on La Palma (note 3)	1.0	1.0	1.0
European co-operation in the field of Scientific and Technical Research (COST) (note 4)	1.0	(1.0)	(1.0)

Symbols: + DES signatory; *Research Council signatory.

Notes

1. The list includes research programmes and subscriptions where payments exceed £0.1m p.a.

2. The European Science Foundation is not listed since UK annual expenditure falls below the threshold specified.

3. A bilateral collaboration jointly funded by UK and Netherlands research organisations.

4. UK subscription paid by the Cabinet Office S & T Secretariat. Participation in research programmes financed by industry, individual Departments and Research Councils.

5. All figures are in cash terms.

Source: Research Councils

MAJOR UK/EUROPEAN SCIENCE COLLABORATION OUTSIDE THE EC

1. European Organisation for Nuclear Research (CERN)

Objectives—To promote European collaboration in high energy particle physics.

Date of Inception—29 September 1954: Convention of the European Organisation for Nuclear Research.

UK Contribution—1989/90: £49m, 16% of total CERN budget.

Staff Numbers—3450 as at 1/1/88 (Falling to 2,950 by 1/1/96).

Principal Facilities—Synchro-Cyclotron
Proton Synchrotron
Super Proton Synchroton
Large Electron—Positron Collider (LEP) completed 1989

Other Full Member States—Austria, Belgium, Denmark, France, Federal Republic of Germany, Greece, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland.

2. European Space Agency (ESA)

Objective—To provide and promote, for peaceful purposes, European cooperation in space research technology and applications.

Date of Inception—1975: merger of European Space Research Organisation (ESRO) and European Launcher Development Organisation (ELDO)

UK Contribution—1989/90	(figures at March 1990)
Present UK expenditure through ESA	=£87m
Funding for applications and technology	=£53m via DTI
Funding for Scientific Programme	=£22m via DES/SERC and DTI
Funding for General Budget	=£12m via DES/SERC and DTI

Other Member States—Austria, Belgium, Denmark, France, Federal Republic of Germany, Ireland, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland (Associates: Canada, Finland).

3. Institut Laue-Langevin (ILL)

Objectives—The High Flux Beam Reactor and associated instruments provide a central neutron facility for specialists from laboratories in the partner countries to carry out research in nuclear and fundamental physics, chemistry, biology, and materials science.

Date of Inception—1967 ILL Protocol (started operating 1972)

UK Contribution—1989–90: £8.7m.

Other Member States—France and Federal Republic of Germany. Scientific members—Spain and Switzerland.

4. European Molecular Biology Organisation (EMBO)

Objectives—A private self-governing organisation of approximately 700 molecular biologists aimed at the development of molecular biology throughout the world. It awards fellowships, and organises exchanges, courses and workshops to facilitate this aim. The funding countries interact through the European Molecular Biology Conference (EMBC) and all but Belgium, Iceland and Ireland help fund the European Molecular Biology Laboratory (EMBL) based in Heidelberg.

Date of Inception—EMBO 1963
EMBC 1972
EMBL 1974

UK Contribution to EMBL—1989/90: £2.6m through MRC.

Other Funding Countries—Austria, Finland, Iceland, Israel, Norway, Sweden, Switzerland, and the EC countries other than Portugal and Luxembourg.

5. European Synchrotron Radiation Facility (ESRF)

Objectives—To achieve a significant enlargement of the range of experiments possible through existing synchrotron radiation sources by means of significantly enhanced brilliance and extended energy range.

Date of Inception—16 December 1988: Convention and Final Act of the European Synchrotron Radiation Facility—phase one to be completed in 1994.

UK Contribution—£3.9m in 1989–90 increasing to £5.2m in 1991–92.

Principal Facility—High energy (6 GeV) electric storage ring source of high intensity X-rays.

Other member States—Belgium, France, Italy, Spain, Switzerland, Federal Republic of Germany, NORDSYNC (comprising Denmark, Finland, Norway, Sweden).

Supplementary Memorandum by the Department of Education and Science (ES 29)

VALUE OF UK RECEIPTS FROM THE EC FRAMEWORK PROGRAMME

1. The Committee have requested additional information specifying:—

(i) the total value of EC research grants and contracts received by United Kingdom higher education establishments and Research Council establishments, for the most recent three years for which figures are available; and

(ii) information about how such funds have been distributed among different fields of scientific research

2. Although the Committee's questions refer to the Framework Programme as a whole, information has hitherto been provided only in relation to programmes within the Framework where DES is the lead Department. The issues raised by these questions are, however, of wider application.

3. It is a feature of all the FP II programmes where DES takes the lead (marine science; medical health; large facilities; economic stimulation; SCIENCE) that support is given only to research projects that are internationally collaborative in nature. There will therefore be several participating research establishments, drawn from a range of different countries. Data available from the European Commission relates only to numbers of research contracts recorded under the *lead* contractor who is

then required to make payment to sub-contractors (i.e. other research establishments and companies) in their own and other Member States. This makes it impossible to display payments to higher education and Research Council establishments in the UK. To establish a perception of the UK share from EC science contracts it is therefore necessary to extrapolate from data about UK lead contractors. On this basis, the Government's best estimate is that overall the UK receives slightly more than 20 per cent. of contract payments which would be slightly above the UK's proportional share of the EC budget overall.

4. Available details from the European Commission on *numbers* of contractors is as follows:—

Programme:	SCIENCE		SPES	LARGE FACILITIES	MAST	MHR
Year:	1988*		1989	1989	1989	1990
	(a)	(b)			(c)	(d)
Proposals received	448	435	216	79	200	(e)
Proposals accepted	114	175	10	11	27	119
No. with UK involvement	73	47	N/A	(e)	26	most
No. where UK has led	37	N/A	6	2	8	30

(a) Twinnings & operations of laboratories
(b) Research Grants & Bursaries
(c) Up to Jan 1990
(d) Current projects
(e) Figure not compiled by EC Commission
*1989 data not yet received.

5. Comparative data for years before 1988 is not available for the SPES, Large Facilities and MAST programmes which commenced only recently. Information for earlier years of the Stimulation Programme, the predecessor to the current SCIENCE Programme, and for the Medical Health Programme are not immediately available but could be sought from the European Commission if the Committee wishes.

6. As far as areas of science benefiting are concerned, it can be assumed that programmes in specific areas of science (for example marine science) will be entirely directed towards those areas, or sub-divisions within them. Further information could be produced about the distribution of projects within such programmes though this would require a separate exercise for which additional time would be required. The SCIENCE Programme differs from others in that applications may be submitted for support across a wide range of sciences. An indicative analysis of applications supported under the SCIENCE Programme in (1988) based on information derived from on the SCIENCE Programme (CODEST report: December 1988), indicates a distribution of awards made as follows:—

Laboratory Twinnings etc.

	Maths	*Physics*	*Chemistry*	*Biology*	*Total*
Proposals supported	8	50	19	37	114
No. with UK involvement	7	33	12	21	73
No. where UK has lead	5	15	7	10	37
Research Grants and Bursaries					
No. of individual scientists supported*	19	105	29	37	190
UK scientists included above	9	26	13	8	56

*Some successful applications involved support for more than one scientist.

Examination of Witnesses:

MR ROBIN RITZEMA, Grade 5 Officer, Science Branch and MR MICHAEL HIPKINS, Grade 7 Officer, Further and Higher Education Branch 1, Department of Education and Science, MR MICHAEL MERCER, Grade 5 Officer, HM Treasury, MR ROBERT FOSTER, Grade 5 Officer, Department of Trade and Industry, and MR PHILIP THOMAS, Grade 5 Officer, Cabinet Office, were examined.

Chairman

1. Good afternoon, gentlemen. Mr Ritzema and your team, may I welcome you to the Select Committee and thank you very much for coming along to assist us this afternoon. If any of us, particularly myself, seem a little slow in our questioning, perhaps you will bear with us, given the fact we have had an all night sitting last night. I hope it will be a productive session. Would you like to introduce your team and give a brief statement before we start our questions?

(Mr Ritzema) Perhaps I could introduce my colleagues: on my left is Mr Philip Thomas, who heads the International Science Section in the Cabinet Office Science and Technology Secretariat. On his left is Mr Michael Hipkins, who is from the Department's Further and Higher Education 1 Branch, which is responsible for university issues and liaison with the Universities Funding Council. On my right is Mr Michael Mercer, who heads the Treasury division responsible for European expenditure matters. On his right is Mr Robert Foster, who heads the division in the Department of Trade and Industry dealing with international scientific relations with the EC. Thank you, Chairman. I would also welcome an opportunity to say just briefly where the Department of Education and Science stands in relation to the matters for discussion today and to explain why we have assembled the team you see in front of you. Perhaps I can first explain that the Science Branch of the DES is a small branch consisting of an under secretary, two assistant secretaries, a senior principal and six officers at the grade of principal. The Branch's responsibilities are to advise DES ministers on their science policies and particularly oversee the Research Councils, including the science budget from which the Research Councils receive grant-in-aid. The Department does not employ any scientists as such, though some branch members possess science qualifications. We do not run any laboratories. Specifically European collaborative issues form part of the command I head. European Community matters are intended to take up only 20 per cent of my time and 70 per cent of the officer in the grade immediately below me. International science matters generally, including those which go outside Europe, are assumed to claim about 65 per cent of my time overall. So we are a small unit dealing with a range of issues with constantly varying priorities, but we do of course have the Research Council network, with its own staff dealing with international matters, to assist us in what we do. We see our role in international scientific collaboration as being to advise our ministers on their policies for international science, to represent the interests of the Research Councils and the science base generally in dealings with departments of Government elsewhere in Whitehall, and to advise ministers on issues arising for them, including those which come from other countries through ministerial contact in other parts of Europe. We also become involved where particular collaborative agreements require the approval of countries at ministerial level, for example CERN in Geneva, ILL or ESRF in Grenoble. To cover what is undoubtedly a very wide stretch of territory, we must naturally interact closely with the other key agencies in Whitehall dealing with international science. This has particular application to the present inquiry. Because many departments have an interest in European science, co-ordination takes place at the centre in the Cabinet Office Science and Technology Secretariat. That is why Mr Thomas is here today. In meetings of the Research Council in Brussels, there needs to be a lead UK minister. DTI programmes form the largest proportion of the Framework Programme and Mr Douglas Hogg consequently attends the Research Council meetings. That is why Mr Foster is here today and he also accompanies Mr Thomas to meetings of CREST, which is the senior meeting of Government officials in Brussels. And finally, of course, there are important underpinning expenditure questions involving the Treasury, and that is why Mr Mercer has come along today. Thank you, those are the only introductory remarks I wanted to make.

Sir Gerard Vaughan

2. Can I question what Mr Ritzema has said? Do you think your Department is big enough for present day needs?

(Mr Ritzema) I do not find it very easy immediately to express a view on that. It is of a certain size and undertakes with that size what we think we can manage. Of course your question is posed towards the Department as a whole, whereas of course we are only one part of it.

3. Do you feel weakened by the fact that science is spread over so many different departments?

(Mr Ritzema) I do not think we in the DES feel weakened by it, but I think it does place a very great focus on the need for co-ordination, and for the effectiveness of that co-ordination, in dealing with for example large bureaucracies like the European Community.

4. Do you find your activities distorted by not having a chief scientist who, for example, is in the Cabinet Office?

(Mr Ritzema) I can only speak personally on that. Obviously there have been discussions at times and there continue to be discussions as to whether or not there should be a chief scientist here or there. I think from our point of view we do of course take advice from the Advisory Board for the Research Councils, headed by Sir David Phillips, and we find in practice that provides us with the advice we need in those areas where we ask them for advice. We are also able to go to the Research Councils, both their heads and their staffs, for advice where scientific judgments are concerned. That is the basis on which we operate and at the moment, yes, we find it satisfactory.

5. Having logged up all those questions, can I ask one more: a number of people feel that the House of Commons is handicapped by not having a separate

[**Sir Gerard Vaughan** *Contd*]
Select Committee for science and technology. Have you any comment about this? These are all very unfair questions!

(Mr Ritzema) I think they are all very interesting questions. I think it is a little difficult for me to comment on the way the House of Commons should do its business. Perhaps that is a matter which the Committee would like to consider as part of its inquiry.

Sir Gerard Vaughan: Thank you very much.

Mr Flannery

6. First of all, I am sure you know that we have a tremendously huge remit, education, science and arts, and most of us would like a separate committee for science because it tends to come to our notice when scientists bring to our attention bluntly that they are short of money, and that internationally we could be falling behind other major nations. This is constantly raised with us and has been in other areas on previous occasions. I notice your memorandum says that European collaboration should be complementary to existing national and international activities. It is reasonable of me to ask then, do you think we should be trying to co-ordinate our own national scientific activities and the national scientific activities of our international partners?

(Mr Ritzema) To a very considerable extent, efforts are made to do that. First of all, I think one has to say that there have to be limitations on the ultimate extent to which the UK can co-ordinate other countries, but there are a range of ways in which one can work with them. Firstly, looking at the context of the European Community itself, in the new Framework Programme a recently agreed concept of "subsidiarity" has been accepted. This particular piece of jargon means doing at Community level only things which cannot be done equally well at national level. So that is quite an important mechanism, and that carries through into some of the programmes within the Framework Programme, for example the medical health programme is already primarily and explicitly co-ordinating programmes in national member countries. What I think we feel is important is good communication at the interface between national countries themselves and individual countries and European organisations, and a desire to avoid undesirable overlap. Here I think I should pause to say that one cannot accept that all overlap is necessarily damaging. We are assured by the scientific community that it is essential in some scientific areas to carry out some kind of work in parallel so one can be a check on the other, and of course we do know competition is a spur to greater activity in the scientific field as it is in many others. So our national policy aim is to secure complementarity between EC and national programmes, but there is a point beyond which it is not possible to go.

7. Complementarity as well as subsidiarity—interesting expressions to many of us. Could I raise something which I have been thinking about myself, and I hope it fits in, and that is that the tendency for world peace, because of the many political things which have happened in recent months, is much greater and easier than it has been, and competition has a role of course but so also has collaboration. I would have thought that a new atmosphere is present, as well as one which give us great food for thought and is worrying in some directions, but I do not think there is going to be a massive slaughter on the agenda. That seems to be receding. Would you think, for instance, what I have just said about national scientific activities with our international partners will possibly be rendered a little easier than it has been?

(Mr Ritzema) I think that the obvious answer to that is yes. The barriers that have existed, either formal or informal, to collaboration with certain countries are likely to become easier and we already see signs that some countries are wanting to extend their scientific relations with Western Europe particularly. Of course, there are constraints, firstly, technology. Some countries in the Eastern bloc—if we can so describe it—are well behind the United Kingdom particularly and other countries are well behind Western Europe in technological terms and there are also currency problems that make it difficult for them to participate in international organisations. But the question of liaison with Eastern Europe is an interesting one. I wonder if I can ask Mr Thomas if he can add a contribution to that from the point of view of the European Community.

8. Could I, before Mr Thomas does that—and this will be my final question—mention what President Bush seems to have been saying, that there is bound to be more money available for many areas of science and education as we recede somewhat from the vast amount of money that has been devoted to the war machine. Within that background I think we are all having a lot of new thoughts about the availability of money and collaboration and so on. I thought I would mention that before Mr Thomas spoke.

(*Mr Ritzema*) I think it is obviously very encouraging news. One's immediate reaction is that the United States is well equipped with very expensive projects that they would like to fund, including particularly their superconducting supercollider, which they are a little worried about the cost of at the moment, so possibly that will help them a little.

Sir Gerard Vaughan

9. Before we go to Mr Thomas, so that we do not lose the thread, as far as I am aware all other advanced countries have a much more unified scientific voice. They are not spread over a lot of different departments like we are. Is there any evidence that we are at a disadvantage because we are spread over so many government departments?

(*Mr Ritzema*) I am not sure what sort of evidence one would bring forward to delineate that particular issue. I cannot obviously speak generally for all other countries. I am conscious of the systems in some of the European countries with which I am personally familiar. I think our impression there is that whilst some of them perhaps have an explicit ministry that covers a wider range of research than the basic research which comes under the Department of Education, there is quite a lot of pluralism in those countries with networks of research councils—perhaps not under that name—and other types of ministry. But without wishing to pass the buck to

[**Sir Gerard Vaughan** *Contd*]
my colleague, that is a matter on which Mr Thomas might also be able to comment from his viewpoint as our representative at CREST, which is where he comes into contact with opposite numbers of the central government aspect of other countries.

(*Mr Thomas*) Perhaps I can pick up those two points. On the second one, the question of whether a unified ministry of science and technology, or whatever you term it, brings a greater integration than the current British system, clearly I cannot state anything about ministerial intentions to change the system here but I think that ——

10. You can say whether in relation it is more satisfactory or less satisfactory?

(*Mr Thomas*) Absolutely. If you look at the French or German systems, where they have a ministry of research and technology, they also have a very wide range of standing committees on science and technology to compete for resources and to compete in policy terms and it is not as simple an arrangement as might apparently seem at first sight, so I think it is swings and roundabouts. In some senses it helps to have a centralised ministry of science and technology but the advantages are not all in one direction. Of course, the US administration is another example where there is a very light touch at central level, with the Office of the Science Adviser to the President being a relatively unofficial body vis-à-vis, for example, the Department of Defence, who are having an important role in science and technology or even education. The other question was on relations with third countries and specifically the Community's relations with third countries in Eastern Europe which Mr Flannery was raising. We in the Community have been trying to encourage the Commission to produce a paper which will allow discussion on the whole question of relations with third countries, with EFTA, with Eastern Europe and with the wider world, the wider advanced world. The Commission are supposed to be coming forward in about the next four weeks. We do not think you can separate out Eastern Europe as a special case because EFTA is currently collaborating to a great degree with the Community and it is important not to upset those very close arrangements. Just to give you an example, Sweden and Switzerland are, for example, full participants in the fusion programme in the Community. What the Community now needs to decide is whether EFTA member states should have the right to participate on an *a la carte* basis where they are not paying full overhead costs for participation, or whether they need to have a more far-reaching association with the Community. On Eastern Europe itself I think I would separate out the two things, science from technology.

Mr Flannery: Can I interject a moment. I was not particularly thinking of Eastern Europe. I was thinking of more availability of money for collaboration with Western Europe. There are other questions to come later. That was basically what I was after but immediately one thinks of Eastern Europe and I was not really thinking of that. It was about enlarged collaboration with Western Europe.

Chairman

11. Perhaps, Mr Thomas, whilst you are on the subject you can also pick up the point of whether or not the Ministry of Defence has a large influence on R&D policy in this country?

(*Mr Thomas*) Definitions of "R&D" are particularly difficult when it comes to discussing the activities funded by the Ministry of Defence. There are those who would claim that the MoD is not actually funding research but is principally funding development. You have to choose your criteria very carefully in order to form a judgment on that. The fact is that, according to current government definitions, if you look at the annual review of R&D the Ministry of Defence is still taking very nearly 50 per cent. of the total budget for R&D at government spend level. I do not think I can take you any further forward than that.

12. Can I move it on a bit and refer to your memorandum, for which we thank you. In paragraph 3 of your memorandum you say that the United Kingdom's general policy towards European collaboration is to support research where the "added value from collaboration will exceed the unavoidable extra costs involved". This seems to suggest it is possible to work out what the added value is and what the extra costs are. Have you made any estimates of the added value of particular things, for example the UK's participation in ESPRIT and, if so, what results do those estimates show?

(*Mr Ritzema*) ESPRIT is a programme where the DTI takes the lead and perhaps, when I have made one or two general remarks, I can ask Mr Foster to comment since he knows more about ESPRIT. Looking at the matter generally, first it is a matter here of the balance between value on the one side and cost on the other. The extra cost takes a fairly obvious form, like time spent on meetings, international travel costs, possible need for language preparation for people collaborating, the cost of currency exchange where currency exchanges are involved, and long decision time, because one is likely to have more bodies involved in taking decisions, different kinds of systems and so on. All these add to cost, either directly or indirectly, but they are likely to vary considerably from one bit of collaboration to another, and they are probably difficult to cost in advance and possibly difficult to cost at all; one can make arbitrary assumptions but they would be arbitrary. On the other hand, how does one identify added value in the scientific field, and I am concerned with the basic scientific field? Here again there is an obvious problem of quantitative assessment. Essentially this is, I would have thought, a subjective matter; it is a matter of scientists themselves judging that international collaboration on particular problems will have special benefits. What might those benefits be? They would include the effects on the studies of scientific cross-fertilisation between those of different training and different backgrounds with different national experience. On a more practical level, I understand, I am advised, it is extremely useful for scientists taking part in international collaboration to have earlier access to the actual scientific value of those collaborations. They then can turn them to other purposes. There is often quite a delay before published papers come forward from collaboration, so they get a bit of advantage that way. That is not a very satisfactory answer I can see, Chairman, in the sense it does not lead to a calculation, a mathematical calculation, which enables one thing to be placed against another, and perhaps added

[**Chairman** *Contd*]
value could be equally expressed as good value for money, which would be another way of putting it, although it is not quite the same concept. We are, as are other countries, engaged on work on performance indicators in our desire to introduce a quantitative element into assessing scientific output, but it is fairly early days and quite difficult territory, and I think it would be unrealistic to think we are going to be in a position to make more detailed mathematical calculations in the future.

Mr Bowden

13. You have made the point quite well. There is a possible contradiction between the two ideas, you need to collaborate in some circumstances and be in competition in others in a national sense in order to monitor, by running in parallel and cross-checking on this programme. Can you explain that a little further? With those organisations which are not national bodies but maybe international private bodies, which might be pursuing a similar line of investigation in a particular field, what line of communication do you have with them to either co-operate or cross-check?

(Mr Ritzema) Perhaps I can ask, Chairman, would a possible example of that be an organisation like CERN in Geneva, the particle physics organisation?

14. Yes.

(Mr Ritzema) Because there the relationship between the UK scientists working in the particle physics field and those at CERN is an extremely close one. The decision was taken some while back that the preponderant part of the UK's particle physics ought to be undertaken at and through CERN, and as a result there is close cross-representation on committees, not just UK people on committees in Geneva but also people from Geneva attending committees of SERC in this case. That means that when projects come forward, research projects come forward, to be carried out at CERN facilities, they will be considered and approved by bodies that include representation from the UK and whose judgments can be taken as to whether it is valuable competitive work in parallel or whether the eggs go in one basket or the other. The question is how widely does that extend into other fields? Here I can only give you an impression, but on the basis of the information I have, it is fairly widespread. For example, in the european medical organisations there is very close interchange between the Medical Research Council and their scientists and the organisation in Heidelberg, and this is the general practice. Certainly it is part of our objective to make sure there is this kind of interaction, because obviously if you do not have it, then damaging and unfruitful activity could result.

15. When you come to the distinctly private organisations which are researching something in commercial competition as a trade or concern, what degree of co-operation can you expect in that area?

(Mr Ritzema) It is obviously more difficult in these areas. One has to say the ground rules are probably different in those areas. Far from the competition being overlapping and unsatisfactory, it is precisely to compete that that research is being carried out. So I would have thought that one was not there looking to stop people doing things that were in competition, but I think it would also be fair to say, and this is something of a generalisation, that scientists continue to publish and wish to publish even when they are engaged in industrial collaborative work. There are perhaps limitations on how much people can say and how soon they can do it, but my impression would be that scientists would be quickly turned off a lot of industrial work if they could not publish, because their careers rest on that. That produces another competitive effect.

(Mr Foster) Do you want me to comment on the earlier point about value of different programmes?

16. Yes.

(Mr Foster) If I can talk about ESPRIT, it is a major pre-competitive European programme run by the Commission on IT, information technology, and it is in the area of micro-electronics software, computer integrated manufacture and office systems and was launched in 1984 with 750 million ecu support from the Community. Subsequently there has been a further ESPRIT 2 with 1.6 billion of support. It has been evaluated, by the ESPRIT review board. Again it is very hard to put quantitative figures on what the actual value is, but the thing the review board came out with is that it pointed out links between universities and industry have been strengthened and there has been particularly good work in a number of areas on international standards. These are the pre-normative standards, for instance, open system software interface standards where the long-term impact must be to help the European market through standardisation so that suppliers can supply equipment to inter-work with equipment from other suppliers. The long term benefit is very difficult to quantify. There are advantages in terms of the wider sharing of facilities and so forth. As Mr Ritzema has said, we are moving towards trying to evaluate testable objectives. In future reviews one of the things we would like to see the Commission doing is work towards criteria for testable objectives in a form which will be based on those for the Department of Trade and Industry programmes. Our own experts are working with DGXII and Professor Fasella to develop these criteria. These are long term, and the testable objectives are more likely to be more qualitative than quantitative. That is the first point. Going on to the second issue on the conflicts that there are in openness of research, I think if one looks at something like ESPRIT, clearly from the DTI's point of view the emphasis should be on pre-competitive strategic research which enables exploitation. In theory this means one should not get IPR (intellectual property rights) problems. Of course one does. However, the Commission itself has a framework for IPR agreements. They are complex; there are a lot of difficulties with them but the fact is that their R&D programmes have been running successfully. There are a very large number of companies who have been collaborating with universities and so forth and many of those problems have been ironed out. Consequently, it is up to the companies and organisations to come together to agree the particular IPR arrangements but they have to be agreed within the Commissions framework to allow openness. Because clearly it is important that small and medium-sized firms should be able to

[**Mr Bowden** *Contd*]
exploit the outcome. But the focus is on pre-competitive strategic research rather than the actual product development phase.

Chairman: Can we move on to the scope for Europe.

Sir Gerard Vaughan

17. Do you think that the EC is beginning to dominate the thinking at our end of international collaboration?

(Mr Ritzema) Shall I take that one and my colleagues may wish to comment after me. I think it is important to remember that the EC came into scientific collaboration much later than many other European scientific organisations and it now operates alongside some very well established bilateral and multilateral links. Its proposed objective is to increase European activity with other advanced countries but particularly with USA and Japan, and whilst EC science expenditure has increased it still has the emphasis on strategic science and the overall amount funded by the EC is a very tiny proportion of the overall R&D funded throughout Europe. We are talking of 4 or 5 per cent. It is as low as that. Our policy continues to be one of supporting EC action in areas best tackled on an EC-wide basis and that includes obviously plugging the gaps and the co-ordination we talked of a little while ago to achieve wider benefit. But I think we continue to believe that pluralism or plurality is important because large bureaucracies can stifle small initiatives. Admittedly some of the international organisations in Europe are also large bureaucracies but I think to have several funding sources within Europe is probably a healthy state of play.

18. I think I used the words "beginning to dominate our thinking" and I wanted to ask you if you thought that was desirable?

(Mr Ritzema) I am not entirely convinced that it is dominating our thinking. It is a very significant element and it raises significantly different issues from the types of collaboration that we have engaged in before. One could say that it is right that it should be fairly central in our thinking because it is an increasingly influential feature on the European science map but I do not think it is necessarily harmful or damaging, provided we turn it to our advantage.

Mr Bowden

19. In considering national priorities, you have consultation on a limited basis. Having a Community view on priorities must take a great deal more negotiation. I wonder if you can say something about how these priorities are set, how they are revised, any issues which should be looked at and how they respond to changing need. If I could give an example, the sudden public preoccupation with the greenhouse effect, with AIDS, is something which clearly requires a scientific response. Whether that is a research response or whether that is to some extent a public relations response is nevertheless, I feel, a responsibility of those concerned with setting scientific priorities.

(Mr Ritzema) Perhaps I could make one or two observations on that and then I would like to invite Mr Thomas to speak on that since he has an overview of the entire EC framework. First of all, I think one has to say on the specific question of the greenhouse effect that has had a galvanising influence, not just on the EC but across the entire scientific field, and there are many other collaborations, not just Europe-wide collaborations but predominantly world collaborations, that bear on that particular question. Coming back to the starting-point, which is the extent to which the EC is flexible enough to adjust its priorities and how it sets them for the longer term, I think it is useful to look very briefly at how it reached the present position. It started off with a motley, in a sense, of science programmes which were gathered together into a Framework Programme. That was the subject of review last year and through a process of iteration we now have a new framework which overlaps with the existing one, perhaps a little confusingly, but it is now on a rolling programme basis. We attach importance to periodic reviews of that—we are talking about every two or three years—to establish precisely the points you have raised—whether it continues to be relevant, whether it satisfies scientific needs and in what ways it ought to be changed. Having made those rather general remarks, perhaps I could ask Mr Thomas, if it is agreeable, to say whether he would like to add to that.

(Mr Thomas) Clearly you are talking in the Community about negotiating between 12 Member States with the Commission making proposals, which is never an easy proposition and there is always going to be an element of compromise. The extent of the compromise between ideal scientific objectives and realisable political agreement is always going to be a balance. Secondly, the United Kingdom has been among the leading Member States pressing for very clear priorities and objectives in the increasing budgetary resources that have been allocated to R&D. The Single European Act has given research and development a particular status in the Community since 1987 and it is apparent that there is going to be a rising trend of resources. So we certainly share the view that you must try and establish very clear priorities and objectives which are not just the lowest common denominators between 12 Member States. As I say, there is always going to be a balance though with realism that comes through from that. Mr Bowden mentioned the environment and AIDS as two possible subjects where there should be a specific response. As my colleague has mentioned, these are global issues. There are major initiatives, both on the health front and on the environment problem, in the Community. The specific problem is to try and locate work done at the Community level between the national level and the wider international level, whether it is UNEP or multinational efforts on AIDS. Again the United Kingdom has been insistent that the Community must determine how it can best contribute and not merely duplicate what is going on at other levels. However, that is not always an easy task and, as my colleague has said, we are now in the process of reviewing activity on a two to two-and-a-half yearly basis and that should give us more scope for adjustment and slight redirection according to scientific work already carried out and new priorities that are drawn up in the interim.

Chairman

20. Several of the submissions we have received show that British scientists have only very limited influence in the early stages of planning EC scientific programmes. Do you think that either the DES or a body like ABRC should be more active in presenting the views of the United Kingdom scientific community in Brussels?

(Mr Ritzema) I note what you say about the submissions you have received. I think I have to say I am mildly surprised because if you are talking about the Framework Programme 3, which is the one agreed upon last December, the Research Councils were fairly extensively involved in developing the United Kingdom position, both generally and in relation to specific programmes. If one is talking, as I think we have explained in our memorandum, the DES is to a considerable extent their voice in Whitehall but that does not prevent them from participating themselves in discussions and, indeed, they have participated in discussions. There are systems in place for ensuring an adequate input from us to, for example, the development of the Framework Programme. There are procedures, briefing arrangements, for regular attendance of the United Kingdom's delegates at CREST, which is obviously an influential body, and at the Research Council, where ministers meet, and at the other meetings where these matters are discussed, for example meetings of the permanent representatives. Also the programmes within the Framework—and we have to remember here that we are still waiting for decisions on the individual programmes in the new Framework Programme—are often the subject of discussion in working groups, and where expert working groups are established in areas where the DES is in the lead, we will ensure attendance at those meetings by the right experts, who will generally be experts decided on in consultation with the Research Councils. So, on the whole, we have made a considerable effort to involve the Research Councils in the progress on the UK's position. There is of course the difficulty you cannot take everybody to every meeting, and of course there will sometimes be regrets; not everything that somebody sets out to achieve in negotiation will actually be got, but I think there are some quite established arrangements in place.

21. How can you be sure that there are well qualified and responsible scientific people who are immediately available as UK representatives on EC committees?

(Mr Ritzema) We can be assured of that because when the representation on a particular committee falls to the DES to in a sense advise on, and our advice goes through the Cabinet Office system, the first thing we will do if we want scientific representation is approach the Research Councils and ask for suggestions as to who might attend. I can give you numerous examples of where this is done, and where experts from research councils do attend. I will give you two of them: one is the management committee for the Large Facilities programme, and another is the management committee for the Marine Science programme where the attendance which is occasioned is by a representative of the Department to keep an eye on policy, finance and logistic questions, and a scientific expert to participate in scientific discussions. It has to be borne in mind discussions at meetings of experts are not always totally scientific, but we try to ensure a balanced representation, and that goes for attendance at other programmes in Framework where obviously arrangements are set by other departments, for example the Ministry of Agriculture will be responsible for arrangements for the programmes where they take the lead and so on.

Mr Flannery

22. Could I ask you a couple of questions on the effect of the EC programme on the UK science base, which is bound to be very interesting, and vice-versa of course? Paragraphs 9 to 11 in your memorandum explain the rationale of the principle of additionality, by which Community expenditure on R&D is attributed to the corresponding departmental research budgets in the UK. If I can quote paragraph 9 out of those three paragraphs: "The UK's contribution to R&D expenditure which is financed through the Community budget comes from the same pool of resources, and represents the same burden on domestic taxpayers, as does direct funding of R&D by Government Departments. Much of the same public expenditure controls are therefore applied." I imagine that is, as one goes up another one, if it is a fixed pool, goes down and so on. The question I would like to ask first of all is: can you tell us what the actual effect of additionality, as you call it, has been in the policy making and budget of the DES and the research councils?

(Mr Ritzema) That question has both general and particular aspects. I wonder if it would be fair for me to ask Mr Mercer, since he has come from the Treasury and is concerned with this matter, to make a few remarks first of all, and then I will, or others will, supplement that with remarks if necessary?

(Mr Mercer) I think the key point, as Mr Flannery has quoted from the memorandum, is that the Government seeks to control the expenditure consequences of European Community spending within the same system and according to the same principles as apply to all other forms of public expenditure. Looking at that specifically in relation to Community R&D, the UK's budgetary contribution to EC R&D spending represents around 20 per cent of the total cost, and we get back 20 per cent or so in terms of receipts. Our contributions of course represent public expenditure, and receipts so far as R&D is concerned go predominantly to the private sector. So for the UK the allocation of funds is such that EC R&D spending gives rise to a significant transfer of resources from the public sector, in terms of our contribution, to the private sector in terms of receipts, or if you like a flow of resources from taxpayers to institutions like universities and research associations. Strategically the key question is how far should that transfer of resources from public to private sector add to planned levels of public expenditure. This issue, the issue that lies behind that question, is sorted out in the context of the annual public expenditure surveys; it is an integral part of the public expenditure planning process. The fundamental principle which underlines the public expenditure survey is that the departments are required to bid for and to justify on the grounds of value for money any expenditure

[**Mr Flannery** *Contd*]
in excess of planned levels. The principle applies to all bids for spending, whether we are talking about demand determined expenditure on social security or defence expenditure or public expenditure contributions to EC programmes. There is no exception to that principle, indeed it would be illogical if there were. In the course of the public expenditure survey process bids are considered one against the other on their relative merit within overall public expenditure constraints. It is important to note, I think, that so far as EC expenditure is concerned, public expenditure bids are required only for the UK contribution to European Community expenditure above pre-determined levels. This means European Community R&D is bound to lead to some increase in public expenditure devoted to UK R&D, indeed that increase is substantial. If one looks at the present Framework which was agreed in December, the 1990–94 Framework Programme, what that will mean is an increase of at least £250 million over the next 7 to 8 years, over the life of the programme itself, in the level of public support for the United Kingdom's research effort. And depending on decisions by ministers in the context of the annual survey, that increase of £250 million may be a great deal larger. If you like that increase represents the additional effort, the additional funding, the minimum additional funding which would arise out of the new framework programme.

23. The framework programme being the EC programme?
(Mr Mercer) Yes.

24. The Second Report from the Select Committee on European Legislation noted that the UK spent less in real terms on civil scientific research than most of its European partners. This is a fundamental problem and one of the problems which many of us want to know more about. The UK itself has also called for, and achieved, cuts in spending on both the next Framework Programme—the first one was 1987-1991, and the other one overlaps, 1990-1994—and the UK has also called for and achieved cuts in spending on both the next programme and CERN. Do the stringent spending controls which the UK applies to funding research both in this country and internationally undermine the UK's standing in the international scientific community? Do they affect this country's ability to develop and exploit scientific and technology advances, in other words can this be a basis for our falling behind our competitors, unless it is looked at very closely, if cuts are occurring and so on?
(Mr Ritzema) Mr Flannery has raised quite a range of points there, some of them applying to particular organisations, and I would like to make a few comments on them and I would like to invite Mr Thomas to comment on them as well. Whilst it is true that the UK frequently goes into international scientific negotiations with a brief to constrain cost and secure value for money, these are a Government priority and they are Goverament priority for particular reasons. First of all, they do not override, either necessarily or otherwise, scientific value. On the particular matter of the EC, as I say, I would like Mr Thomas to comment in a moment but generally speaking the increase proposed at the outset was a very large one, and it is fairly widely known that the first figure suggested by the Commission for a programme is very rarely the one which emerges at the end of the process. But I think Mr Thomas will be able to speak better on that than I can. There are one or two other points to make, if I may. Although the United Kingdom is often out front, as it were, in arguing the case for cost control and for efficiency and sound management, we have plenty of reason to think there are other countries who support us in this; indeed, we have plenty of evidence to think there are other countries who support us in this, and I could quote one or two examples. I will in a moment. As far as good management goes—and that is one way in which you can reduce costs without sacrificing scientific quality—we have kept up pressure in the EC context for all programmes to have an appropriate management committee. A management committee is obviously a way of keeping an eye on the way in which the Commission is handling particular matters in its bureaucracy and administration, and the decision, which is called the comitology decision, which is the one saying that all these programmes have to have a management committee, was a significant step forward and a significant negotiating aim from the United Kingdom side. Outside the EC the United Kingdom has pressed for quite significant managerial improvements and Mr Flannery did mention CERN where about two years ago, as I expect the Committee will be fully aware, the United Kingdom really got together with its other partners in CERN and decided the costs were really becoming extremely heavy to bear and they thought there should be a review of the way in which CERN was managed, and quite a wide-ranging review. As a result of that review a lot of studies were set in train and very fundamental and far-reaching changes have been made at CERN and are still being made at CERN, which were only possible because they were supported by a large majority of the member countries there, and that is indeed enabling CERN to do more science within the resources available. That is not to say—and I am conscious that the Committee will visit CERN—CERN does not feel it is short of money but that is because it is engaged in expensive science and the boundaries constantly move forward, so there is a continuing dialogue on that particular matter. Another area would be the European Space Agency, where again there has been difficulty in the past about whether or not exponential increases in contributions should be payable by the United Kingdom particularly and where again it was finally agreed between the United Kingdom and other countries in ESA that there should be a fairly critical management review of the organisation. That too has recently emerged and has led to quite a lot of recommendations which we are hoping will be implemented. So I think the general answer is that it is not incompatible our supporting scientific quality, and wanting to be international too, but at the same time supporting cost-effectiveness and getting good value.

25. So you are really saying the cuts you do not think will have caused any real trouble? Cuts usually do cause trouble.

(Mr Ritzema) I do not think in the remarks I have made I have actually referred to any cuts.

[**Mr Flannery** *Contd*]

26. No, but I did. Our Select Committee did on this subject say that that goes on and, therefore, that is why I am saying it. I am not on that Select Committee, of course.

(Mr Ritzema) I am not familiar with that either, Chairman. All I can say is I am not conscious of the particular cuts that Mr Flannery is talking about but obviously if he would like a separate note on any specific area of difficulty we would let the Committee have one.

Mr Flannery: The other point I made was that they noted that the United Kingdom spent less in real terms on civil scientific research than most of its European partners. I was wondering if you could comment on that?

Sir Gerard Vaughan

27. Mr Ritzema, before you come on to Mr Thomas can I just say something, I hope not out of place, but a lot of the answers seem very bland and complacent, that all is reasonably well considering everything in Europe, whereas we have a lot of information that all is not totally well. In no way are we trying to put you on the defensive. We just honestly want to know your views. Do you think everything is satisfactory because at the end of it we sincerely want to know if it is unsatisfactory from your point of view and try and do something to help you over it?

(Mr Ritzema) If we could take that in different parts, Chairman, if we look specifically at the EC area we have not come along here to sound complacent. At the same time we have, particularly Mr Thomas, been engaged in leading on a very difficult negotiation and I think the memorandum that was submitted to Parliament associated with the Commission's Framework Proposal made it clear that we were dissatisfied with several aspects of the proposal as it originally came forward. We have talked already about the cost aspect. The other aspects that we felt dissatisfied about concerned the management arrangements for the programme, they concerned the disaggregation of the programme from a very broad level of generality down to greater detail and they also concerned the monitoring and evaluation arrangements taking place within particularly the new Framework Programme but also with the general issue from the previous Framework Programme. I do not want to steal words from Mr Thomas' mouth but I think a very considerable amount of progress has been made in those areas. There is now greater disaggregation in the programme, although there remain discussions, and probably difficult discussions, to come on programme content. There is an agreement to have management committees right across the board, as I mentioned a moment ago, and it has been agreed that every programme has to contain explicit elements about monitoring and evaluation. Obviously the United Kingdom will want to see these are not just words on paper but actually given weight in actions that follow, and the fact that we place priority on that obviously suggests that we have not been happy in the past with the way those particular elements have worked. But I wonder, having said that, if I could ask if Mr Thomas could also make a contribution on that, without wishing to evade the question.

Mr Steinberg

28. Before we come to Mr Thomas, I sat very quietly and listened, I always sit very quietly and listen to the DES because I have never heard the DES yet ever criticise their own employers. We have had several reports to this Committee which have given us evidence that suggests the level of government funding for research to universities has caused problems, certainly in the provision for renewal of laboratory equipment, and the ABRC report appears to confirm this. So will the lack of state-of-the-art equipment hinder the ability of United Kingdom universities to attract funds and scholars from abroad?

(Mr Ritzema) There are two things on that. First of all, on the general matter of funding, it is no surprise to anybody from the DES to hear the expressions of discontent about the levels of funding they get. All one can say is there is some consistency across the board. These things come from most organisations and that has always been the case for many years under all administrations. Groups of particular kinds will always press for more resources for their general area, but these are questions for Ministers in the last analysis.

29. But you advise Ministers?

(Mr Ritzema) That is indeed true but Ministers decide. I think if one wanted to question the absolute levels, the macroeconomic levels of money going into universities, that is the right place to address those questions. But you did raise the question of the ABRC review of equipment and I must obviously hesitate before sounding complacent on that. Certainly that report did reveal some quite significant shortcomings. It was a review, as I understand it—and I am not an expert in this—which took the form of a questionnaire and responses from individual institutions judging the state of their equipment. The outcome of that was that whilst 80 per cent of individual institutions felt that they were working in what are known in the trade as well-found laboratories, that obviously leaves 20 per cent who did not. The Government took the findings of the survey into account in the settlement they made for the 1990–91 science budget and it is expected that some of that additional money will flow through into an increased equipment element, and also in that year the UFC equipment grant is up by a significant amount and there is extra money for equipment for polytechnics and colleges. So your specific question was whether or not this will hamper universities—and I suppose we extend this to polytechnics—in bidding for EC funds, and the general answer has to be probably not very much because the review of equipment did show that the shortcomings, where they exist, were spread pretty widely across the disciplines, so that I think from that background there must be very many strong, well-found laboratories fully able to bid, and remedial action—which you may think sounds complacent—where necessary is being taken.

30. Whilst we are talking about universities, it would appear to me that it would be in the national interest if British universities and British industrial companies were to team up for the purposes of entering EC collaborative programmes, otherwise the funds of British universities could be more at the disposal of companies of other EC countries. Do

[**Mr Steinberg** *Contd*]
you think the DES could play a co-ordinating role in bringing the universities and British industry together?

(Mr Ritzema) I think, Chairman, one has to say the record of UK industries and UK universities getting together and bidding is quite a good one. We have only a limited amount of data available, but on the whole our information is that a good many bids received at the Commission are of that kind. If I can I would like Mr Foster to comment on this in a moment because he sees it from particularly close perception. As far as the question of involvement with foreign companies goes, there is a balance and not a very easy balance to be struck there. On the one hand from the interests of the science base one is concerned with the advancement of science as a prominent objective, and that is without regard to national frontiers, but there is the dimension of the position of the UK itself. All one can say pragmatically is that we certainly would not want to stand in the way of UK universities collaborating with foreign companies if foreign companies want to fund them, and of course it is a pity if UK companies do not. I do not think we would particularly see it as our role to step into the ring and try and force unwilling partners together as it were, but where foreign companies are coming in—and of course where we are talking about multinationals it is difficult to categorise them as foreign companies—where companies regarded as non-UK companies, are coming together with UK universities, we would hope to see them basing some production in the UK or basing R&D laboratories in the UK and not sucking at the scientific talent of the UK without return.

31. You think you have a co-ordinating role in bringing British universities and British companies together?

(Mr Ritzema) I do not think we as a department do have a co-ordinating role; I think we do have responsibilities with the Research Councils and with others involved to secure information about the opportunities available. Of course if we are approached to do specific things in the field of co-ordination, we will consider doing them. But, as I said at the outset, on the whole this process is going probably reasonably well and Mr Foster can give you his own perception of this, and I do not think we have been asked to take on a co-ordinating role.

Mr Bowden

32. Before you present your bumper bundle to Mr Thomas and Mr Foster, I am much taken by the thoughts you have given us on value for money and am attracted by the idea of additionality, which you have introduced me to this afternoon, and yes, this is a criteria for evaluating programmes which are brought forward for collaboration or to run in parallel. I wonder if I might come back to a question which Sir Gerard started with in this session, which was about the scope and size of your own unit for dealing with the problems which you have to oversee as it were, and whether that principle of additionality is applied to the Department of Education and Science and is applied to the research programmes in their policy-making perhaps and in setting their budgets?

(Mr Ritzema) I am sorry, Chairman, although I listened very carefully to the question, there were several points in it and——

33. I am trying to study the role which the DES plays and the councils play in actually deciding whether they themselves, in the management of their own affairs, are getting value for money, and whether additionality is a principle or criterion which you can apply in self-examination of the role which you play in relation to science as a whole?

(Mr Ritzema) Perhaps I can, Chairman, if I have taken it right, tackle it like this: if the question is, if there were more of us, could we do more in this field, the obvious answer has to be yes.

34. I was trying to avoid that crude question——

(Mr Ritzema) I am afraid I am cruder than you are!

35. I was trying not to elicit a bland answer but give you an opportunity to develop a more sophisticated answer.

(Mr Ritzema) I am sorry if I have over-simplified your question. As I said a moment ago, obviously every part of Government is concerned with what it can achieve with the resources it has at its disposal. There are very significant resources essentially in the science field, in the science administration field, when you add in the Research Councils and people working in universities as well. We have already talked about the liaison arrangements which apply between the Department and other departments in other parts of Whitehall. Clearly one of the key elements of this is the amount of time which can be spent working interactively with Commission officials, and there the Research Councils certainly do not take orders or do not need orders from us, their representatives go to and from to Brussels regularly for talks with Commission officials and Commission scientific experts. I do not find it easy to go much beyond that; I have not come along to complain about shortage of resources, but yes, it is true with more resources one could adopt a more active profile.

36. If you were marginally increased, could you disproportionately give a better service or get better value?

(Mr Ritzema) I do not think that is a question that really I can comment on very easily this afternoon, if you do not mind.

37. Is it something we could return to at a later stage because this really lies at the heart of this.

(Mr Ritzema) I think it is a question of analysis and trying to judge whether there are defects in the present arrangements. As I have said, we see the present arrangements working reasonably well. Nobody is saying any set of arrangements could not work better, but as I say since we have argued the present arrangements work well, it would be inconsistent for me to argue they ought to work in a different way.

Chairman

38. Now your bumper bundle which you were going to refer to two of your colleagues?

(Mr Thomas) First of all Mr Flannery's point as to whether we had alienated our Community partners through negotiation on the Community framework budget . . .

Mr Flannery: I did not put it like that of course.

(Mr Thomas) I was summarising. Budget issues are settled by unanimity and it takes 12 to tango—one Member State cannot dictate the size of the budget. Whatever our partners would tell you, we play a constructive role in the negotiations. They would probably say we drove a relatively hard bargain on the budget but that we were not unreasonable. There are always going to be demands for more money, you have to fix the level somewhere and we managed to get consensus between Member States, and that is never easy. On the second point, as to whether the UK relative to its main industrial partners is spending less on civil R&D, I cannot add very much to what are publicly available figures, principally from OECD, which reveal the UK spend in absolute terms and as a proportion of GNP—and I think the Committee will be able to draw its own conclusions from that at least as well as I can. On stimulating university-industry links, which is an extremely important question, as my colleague has said, there has been a real growth in the ability of higher education institutions and British industry to collaborate: it is a requirement in Community research that you have a transnational partner as well. We think that both sides of this equation are becoming more and more used to looking for partners on the other side of the boundary of academia/industry and transnationally. We in the various departments, from my position in the Cabinet Office, are actively trying to encourage that, to make sure that they can get maximum benefit from the Community funds which are available.

Chairman

39. Before we move on to our last group of questions, can I just question on universities? We understand that EC research awards to universities and industrial companies allocate only 50 per cent of the full cost of the research, which is markedly less even than the 70 per cent recovered by universities when supplemented by elements in the UFC block grant. The question I would like to ask is this: what steps is the DES taking to reduce this financial disincentive to participation by British universities in EC research programmes, and would you give any consideration to the possibility of earmarking funds to top-up EC awards to British universities?

(Mr Ritzema) This is obviously quite a technical question concerning university finance and I would be grateful if Mr Hipkins, who has come over from the universities branch, would comment on that.

40. I was hoping there would be an opportunity for Mr Hipkins to talk to us this afternoon!

(Mr Hipkins) It might be worthwhile having a look at how the 50 per cent of total costs contracts work. Essentially what happens in that case is the the institution calculates the total cost of the project it wishes to undertake, taking into account academic staff research time which will be used on it, research assistant technicians and all the other factors that come into play, including those extra costs that will be involved in employing extra staff for such work. Then the university applies for a contract which covers half those costs and that half probably covers most of the increased costs that the institution faces through taking on the research grant. But I think it is probably true to say that because the grant conditions mean it can only pay against actual costs incurred, the universities have to go through some rather long, complex calculations, particularly trying to separate out the costs of teaching from the costs of research, and in some cases this will leave the universities with extra funding to find. Having said that, the Commission has agreed that universities can apply for a second type of contract which is 100 per cent of the marginal costs plus a 20 per cent overhead mark-up. It turns out, as I understand it, that the institutions prefer to go for the 50 per cent of total costs contract because they feel it is better value. The universities, of course, as you mentioned, Chairman, also get funding from the UFC, the Universities Funding Council, and whilst in calculating each institution's block grant the weight applied to European Community research grants is not very great, institutions are free to apply those block grants to whatever research projects they wish to. So in some cases they use it to support research grants in part funded by the research Councils; in other cases they will choose to use those funds in support of parts of European Community grants that are not fully funded. You also asked whether the DES would help out the universities by applying a topping-up grant. I think the answer to that must be no, on two grounds. First, the Department applies funding to the institutions through the Universities Funding Council and leaves that independent body to decide how that money should be split up between the individual institutions. Second, as I understand it, such a topping-up would be contrary to EC rules.

Mr Flannery

41. We would like to take one or two questions about European science collaboration outside the EC. I remember some years ago when we were putting out a report, really at the request of some of the Research Councils, about the fears for the biotechnology base, many of us did not quite understand what that meant and one of the things that came into our view was CERN. It took us a lot of finding out exactly what it meant because I do not think it is actually in English. One of the things we have been thinking about is the question of the collaboration which individual countries have with an organisation which is outside the EC and whether for instance, it would be better if collaboration was on a wider scale, a group of countries coming together. One of the things we learned, for instance, was that about a quarter of the money of an individual Research Council could go into CERN and it had us wondering, and we are still wondering about it, if this could be funded by the DES, for instance, or the Advisory Board for the Research Councils. These two things go together but it is a very real problem, it seems to us, what big science should do and you know more about this than we do, but it is something which, clumsily as I may have put it, I am sure you grasp what we want?

(Mr Ritzema) Yes. There are one or two issues there, I think. Just starting with CERN and particle physics, I think it has to be accepted, first of all, that particle physics is probably one of the two most expensive forms of world science. Perhaps that is a slightly exaggerated statement but space and particle physics must certainly be among the most expensive

[**Mr Flannery** *Contd*]
facilities that now have to be built in order to undertake science at the forefront, so expensive they are well beyond the capacity of individual countries and they are beyond the capacity even of the largest countries, and so we see the United States wanting to build a better model going around asking for contributions from others, for very understandable reasons. In the United Kingdom the procedure we adopt is for the contribution to be payable from its budget by the Research Council which obviously covers that area of science. In this case it is the Science and Engineering Research Council. Yes, it is a very large slice of that budget and yes, we quite understand the concerns expressed and the experience you had a few years ago when it appeared it was likely to engulf all sorts of other areas of activity. As I said in an earlier set of remarks, one of the actions that was taken both by SERC and the Department acting jointly and, indeed, involving other departments, was to press to see that the money being spent at CERN was being spent well (if I can put it like that). Our second objective was to see that our contribution there was actually less than it was showing signs of becoming, and again we did achieve some quite significant results there. Nevertheless, the sum will continue to be substantial. You asked whether that particular contribution should be taken out of the SERC budget and handled in some other way and, of course, there are arguments either way on this. I think the argument as we would see it, and the argument which has obtained up to now, is that when you are considering what scientific activities you can fund within the package of money available at one level, for the science base as a whole and at the level below that, as apportioned between the Research Councils, you immediately come into the area of scientific judgments and those judgments we believe it is right for individual Research Councils to take and obviously they can proceed through the Advisory Board for the Research Councils if they want to change and so on. But if you took the CERN subscription out of the SERC finances, in a sense you would insulate it from the process of peer review against other scientific disciplines. Of course, you may come back and say there are rigidities in the system; there is a charter obligation. It is a charter organisation and you have to go on paying your contribution. You have a choice of paying it or withdrawing, and this is why the question was posed in a very stark form two years ago. Nevertheless, it is possible to argue, and indeed the United Kingdom has argued, that it is right in this very big organisation to bring in more optionality in the sense that you can participate whether or not you join in particular projects as a way of deciding whether you want to put your money in that particular direction, into more and more projects at CERN, or whether it should go into support for other areas of SERC science.

42. Was there ever an intention to withdraw from CERN?

(Mr Ritzema) The position two years ago, at the time the United Kingdom re-negotiated in a sense its membership of CERN, was that it was regarded as necessary to say to the organisation that unless changes came through that actually reduced costs overall and put a brake on this tendency for costs to run away, the United Kingdom would seriously consider withdrawing, and as the Committee will probaby know, it was announced following on negotiations that we would be staying in CERN. That was on the basis that they would continue to develop cost-consciousness but not in any way as a criticism of the science there, which we have never challenged, which is first-class and which we will continue to regard as first-class.

Chairman

43. Could I ask perhaps a final question, whilst my colleagues reflect if there are any particular points they would like to pick up? There appears to be widespread agreement on the valuable networking functions performed by non-government organisations, such as the European Science Foundation. Do you think there is a case for strengthening such bodies, especially strengthening them financially, as an alternative framework for European collaboration in basic science outside the EC?

(Mr Ritzema) In one of the earlier exchanges we had talked about the role of the European Community in relation to other types of European science, and I think I commented there we did support the idea of pluralism and it was a good thing to have a variety of funding sources rather than one, as with other types of monetary situations. As far as the European Science Foundation goes, it is held in high esteem by UK Research Councils and the UK science community, and I think that is for at least two reasons. One is the fact it is an organisation that brings together research councils of all countries but it is an organisation which is not a governmental organisation, and maybe that gives it a bit of automatic value. The second interesting element about it is that it is optional whether you participate in its activities, with the result since different national science programmes have different priorities, they can go into particular collaborations through the ESF if they wish to. Of course it has to be remembered the ESF also has a wider membership than the EC, which is a feature of European organisations we have not brought out in earlier questions, which is they all cover a slightly different parish. On the question of whether it should be strengthened, I think we are sympathetic to the idea that there are certain functions it can perform very valuably. There is some talk about whether there may be some link-up between the European Science Foundation and some parts of the Framework Programme, and here obviously there is scope for collaboration, but also there are dangers when a small organisation starts getting involved with a very large organisation, it can lead to the lack of plurality that I have talked about. As for whether the DES should stimulate it in some way, I have explained that the organisation brings together Research Councils. They decide amongst themselves what contribution they will put into its central management, and I believe there is a standard payment through SERC and beyond that it is *a la carte* and they decide how the money goes in. It would detract from that and change it and alter it, if we were to start becoming involved. If the Council thought there were certain activities which would be usefully done through ESF and justified the additional scientific expenditure which would be

[**Chairman** *Contd*]
channelled through into that process, they would come forward to the ABRC and make a case for priority over other cases, and it would come through to our ministers in the normal way.

Sir Gerard Vaughan

44. Just a quick question: when we were discussing science funding with your Department and others a few years ago, we were told that the increasing cost of keeping up with international literature was becoming such a great burden that it was actually withdrawing funds from research generally. Is that still a problem?

(Mr Ritzema) I am afraid I cannot give as quick an answer as the question. I do not personally know. It has not come to my attention as a problem, but I think I would need to consult my scientific colleagues to judge to what extent it was a problem for them. Since people have not come to us about it recently, it cannot be that much of a problem.

45. It was put to us as a major problem by a number of different organisations. Could you look into it and let the Committee know?

(Mr Ritzema) We would willingly look into it and will let the Committee have a supplementary note.[1]

Chairman: It only remains for me to thank you, Mr Ritzema and your colleagues for coming here today. I am quite certain when we look upon the evidence of this afternoon there will be a few detailed points we would wish to raise with you and if we may we will write to you on those and seek further clarification, but we thank you for coming along and assisting us this afternoon.

ANNEX

Letter to the Clerk from the Department of Education and Science ES 37

COSTS OF INTERNATIONAL SCIENTIFIC LITERATURE

I am writing to respond to a question raised during the oral evidence given by this Department on 14th March. The Select Committee requested information whether the increasing cost of international literature was, as they had been told a few years ago, diverting funds from research.

As suggested on 14th March, this is not a matter that has been brought to the attention of the DES recently. Subsequent enquiries have shown that, while increases in the cost of subscriptions to an increasing number of international scientific journals tended to exceed general inflation indices over recent years, Research Councils are not aware of any significant inroads having to be made into science undertaken.

The first reason for the lack of any major effect on scientific effort was that journal costs were a relatively small part of scientific expenditure. A second reason was that actions were taken to avoid the full increases in costs without cutting research. Such action included reducing numbers of subscriptions (duplicate copies, or journals of marginal interest); exchange programmes; loans; and the use of abstracts. These points also applied to UK journals.

While Councils had in some cases diverted funds from research, literature for them was generally a minor aspect of the larger question of equipment costs. But the Research Councils were less affected by this than were the higher education institutions. In response to the situation three years ago the then University Grants Committee earmarked £3 million per annum, over three years from 1987–88, for the purchase of books and periodicals by university libraries. It is now for universities to fund their own priorities within the resources available to them.

I hope this information is of assistance to the Committee. I shall naturally be glad to provide such further information as the Committee may wish to seek.

R. P. Ritzema
Science Branch

4 June 1990

[1] See Annex.

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HOUSE OF COMMONS SESSION 1989–90

EDUCATION, SCIENCE AND ARTS COMMITTEE

SCIENCE POLICY AND THE EUROPEAN DIMENSION

MINUTES OF EVIDENCE

Wednesday 28 March 1990

THE ROYAL SOCIETY

Professor M A Epstein, FRS, Sir Eric Ash, FRS,
Mr S J Cox and Mr D J H Griffin

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Members present:

Mr Jacques Arnold
Mr Gerald Bowden
Mr David Evennett
Mr Martin Flannery
Mr Harry Greenway
Mr Win Griffiths
Mr Dennis Turner
Sir Gerard Vaughan

In the absence of the Chairman, Sir Gerard Vaughan was called to the Chair.

Memorandum submitted by The Royal Society (ES15)

1. INTRODUCTION

This submission was compiled by an *ad hoc* group of Fellows under the Chairmanship of Professor M. A. Epstein, Vice-President and Foreign Secretary. The other members were: Sir Geoffrey Allen, Professor E. A. Ash, Lord Flowers, and Professor T. W. Goodwin. It has been endorsed by the Council of the Royal Society.

2. SCIENCE IN ITS INTERNATIONAL CONTEXT

The Council welcomes the Select Committee's enquiry into science policy and the European dimension and the opportunity to submit evidence. The Society has a tradition, derived from its 1662 Royal Charter, of encouraging international cooperation in science, and its current support for international collaboration accounts for 29 per cent of its Parliamentary Grant-in-Aid (£11.5M in 1989–90).

It undertakes this work because it recognises that science is international by nature. The health and strength of an individual scientific community depend to a large extent on its ability to interact with other communities world wide to exchange ideas, to compare results, to discuss and challenge their own and others' theories and to expose their science to the scrutiny of the best of the world's scientists. Similarly, many branches of science, notably those concerned with the oceans, the atmosphere, the biosphere and the Earth, are global concerns, and the threat to the environment posed by current human activity highlights the need for international cooperation. Moreover, much scientific work depends on access to unique features of the geosphere or biosphere wherever these may be located.

Accordingly, adoption of any narrow political definition of support for science in Europe would be damaging to the development of European science itself, particularly if it were to restrict, in any way, free access to the findings and ideas of the international scientific community. Any move towards a 'fortress Europe' approach in science should be resisted.

The Society's own European Science Exchange Programme (ESEP) involves research councils and academies in 17 West European countries, including strong scientific nations which lie outside the European Community such as Austria, Finland, Norway, Sweden and Switzerland. Moreover, the Society has recently agreed with the Hungarian Academy of Sciences that the latter should join ESEP, thus making Hungary the first Eastern European participant in this informal programme that funds scientific exchanges. It is hoped that other Eastern bloc countries (with which the Society currently has formal bilateral exchange agreements) will follow as the political climate changes. It would be helpful to the development of European science as a whole if actions by the European Community were to increase contact between the scientists of member and non-member states or encourage European scientists to gain benefit from the liberalisation in Eastern Europe. ESEP was started in 1967 and has grown in scope each year; in 1988, 248 scientists travelled to or from UK under the scheme. Roughly one half of these were young postdoctoral research workers spending one or two years in the host laboratory.

3. MOBILITY OF SCIENTISTS AND SCIENTIFIC IDEAS

There are clearly areas in which a European-wide rather than a national approach to science funding may be preferable. The provision of large facilities such as those of the European Organisation for Nuclear Research (CERN), the Institut Laue-Langevin (ILL) or European Incoherent Scatter Radar facility (EISCAT) may be beyond the resources of a single nation but can be afforded by several nations acting together. Other areas of research, such as space science, are by their nature too expensive for one European nation to make a significant impact alone. However, the single most important area for concerted action should be in encouraging greater mobility of scientists and scientific ideas in Europe as a whole.

The cost of printing and publishing this Report is estimated by HMSO at £2,145.

European science is potentially as strong as that of the United States of America, but divided as it currently is into several nation-based communities of scientists, it is still highly regarded but lacking in the resources and the political will necessary to compete with the USA and (increasingly) with Japan. Moreover, because of language barriers, communication is rather less than is desirable. It is notable, for example, that many British scientists do not have as close contact with their Continental European colleagues as they do with their American counterparts.

A major thrust of Government policy, acting with other governments and with international groups in Europe, should therefore be to remove impediments to the mobility of scientists and work toward building a community of European scientists. The Community's European Community Action Scheme for Mobility of University Students (Erasmus) programme is most welcome because it provides the basis of European-minded attitudes in the future, but it applies only to undergraduates; many difficulties remain for postgraduates and postdoctoral scientists. These include career and family considerations, difficulties over the mutual acceptance of qualifications and provision of individual support such as research scholarships. The Stimulation Programme (retitled 'The Science Programme') is a very valuable contribution to encouraging collaboration and to facilitating mobility of scientists, but more needs to be done. It is particularly important that this programme should support the best and most promising science. A particularly worrying trend in Britain is the increasing need by laboratories, because of dwindling resources, to levy substantial bench fees on visiting postdoctoral researchers, thereby actively discouraging European scientists from undertaking work in British laboratories. The Royal Society has agreed with its ESEP partners that under that programme bench fees for visiting postdoctoral researchers will not be levied in any of the 17 participating countries. The Council of the Royal Society would wish to see this stance adopted throughout European scientific establishments but proposes that any additional costs which fall on the institution for their visitors should be met from a European fund set up to alleviate problems of mobility.

Moreover, UK universities are at a disadvantage in funding under the EC Framework Programme since they receive only 50 per cent of the costs from the Commission, as compared with recovering about 70 per cent of costs in accepting a UK Research Council grant because of 'topping up' by the University Funding Council. A similar 'topping up' scheme should be instituted for EC grants if UK universities are to compete vigorously for EC research funds.

The Society welcomes attempts by the European Commission and others to rationalise and standardise patent law within Europe, not only to help scientists protect their discoveries but because it believes it will make collaboration between European scientists easier, since they will no longer need to be concerned about different regulations in different countries.

Similarly, the Society urges a European approach to the issue of intellectual property rights, bearing in mind that moves towards standardisation should not inhibit the rapid publication of the results of fundamental research.

4. Excellence in European Science

Currently, the Commission provides substantial support for European science through its Framework Programme (5.4 bn ECU over five years). The size of this, though considerable, does not in any way approach the volume of support given to science by national governments. It is essential to ensure that this programme does not support science which national bodies have rejected, nor provide 'topping-up' finance for national projects; most importantly it must ensure that the quality of the science supported is at least as good as that in national programmes.

In the UK (and several other member states) excellence is assured through the peer review system operated at one remove from government by the scientific community. To ensure comparability of standards of support, a similar system must be established by the Commission. This too should operate independently of the Commission itself and, by analogy with the British arrangement, the European Science Foundation (ESF) based in Strasbourg, which is an association of European Research Councils and Academies, would be the appropriate body to undertake the task. The recently formed Academia Europaea, which is a non-governmental organisation of individual scientists selected by their peers on the grounds of scientific excellence and covering the humanities and the social and natural sciences, could complement the work of ESF by providing a prime source of independent advice for the Commission. It is not clear what role the Commission envisages for its proposed 'European Scientific Assembly', but as this would be a creature of the Commission it would not be appropriate for it to undertake the roles suggested for the ESF or the Acadamia Europaea.

Furthermore the British Government needs to give careful consideration to the appropriateness of its representation on Community scientific committees. All too often this responsibility falls to a Government department which may have only an indirect interest in the matters under discussion. It is important that the UK play its full role in shaping the Community scientific programmes and make fuller use of the expertise of the British scientific community, including consulting research councils and the Royal Society on its representation on such scientific committees.

5. RESPONSIVE MODE FUNDING

The Council of the Royal Society has vigorously argued for protection of 'responsive mode funding' (ie, the provision of grants on the basis of applications from individuals or groups of scientists using the scientific excellence of the research as the sole criterion for support) against the pressures for directed programmes of research. Almost all major fundamental scientific discoveries have been achieved through curiosity-driven, not by directed, research; nevertheless, it is recognised that bodies which provide finance from public services have a duty and a responsibility to lay down broad guidelines for its expenditure and may wish to give emphasis to particular fields at any one time. It is also accepted that directed programmes are necessary in areas such as AIDS research undertaken to address a specific problem in the interests of society at large.

European support for research concentrates on clearly defined programmes which, in the case of the European Community, are mainly funded under the Framework Programme. The Commission is responsible for both the formulation and implementation of the programmes and, though they have advice from the Committee for the European Development of Science and Technology (Codest) and from national scientific bodies through member governments, it is still a strongly centralised system, which appears to be predominately based on direction from above.

The Council of the Society urges that European support for science should, in future, better balance responsive and directed funding and can draw on the advice of the scientific community in Europe, through their organisations like Academia Europaea and ESF.

6. CONCLUSIONS AND RECOMMENDATIONS

The following recommendations are put forward to the Select Committee for its consideration:

(a) There is a serious danger that the adoption of narrow political parameters for supporting science in Europe could harm the development of European science in the wider sense, and every effort should be made to avoid adopting a 'fortress Europe' approach to the promotion of science. Of all human endeavour, perhaps science is the most international and does not recognise national boundaries.

(b) National governments and international bodies should work towards reducing impediments to the mobility of scientists within Europe as a whole and should provide money for a European fund to alleviate particular difficulties.

(c) An independent peer review system should be established for projects funded by the European Commission, making use of the European Science Foundation and the Academia Europaea, bodies already established by the scientific community in Europe.

(d) Efforts should be made to increase the funds available to individuals or groups of scientists applying to pursue curiosity-driven science in the Framework and other European programmes, rather than concentrating upon directed programmes of research.

2 November 1989

Examination of Witnesses

PROFESSOR M A EPSTEIN, FRS, Foreign Secretary, The Royal Society, SIR ERIC ASH, FRS, Rector of Imperial College, MR S J COX, Assistant Secretary, International Affairs, and MR D J H GRIFFIN, Head of European Affairs, of the Royal Society, were examined.

Sir Gerard Vaughan

46. Professor Epstein, in the absence of our Chairman, who is out of the country on a Fellowship and who sends his apologies, can we welcome you and your colleagues and thank you very much for coming. Thank you also for the paper that you have submitted, which covers quite a range of topics and is very clear. As you know, in this Select Committee, unlike many of the other Select Committees, we all join in and ask questions, we hand things round. Would you like to start by introducing your colleagues to us?

(Professor Epstein) Thank you very much for your warm welcome. I have with me Sir Eric Ash, Steve Cox, who is from our office at Carlton House Terrace, and David Griffin, who is helping us also from the office at Carlton House Terrace.

47. Before we start to ask you detailed questions, is there any general comment that you would like to make to us?

(Professor Epstein) No, I do not think so.

48. Would you like to point out to us the priorities in your thinking, otherwise we will go straight into our questions?

(Professor Epstein) Whichever you like. I could make a short statement to start, but I am sure we will come to it so we will only be going over it again.

Sir Gerard Vaughan: In that case, we will start to question you, if we may.

Mr Flannery

49. I am not a scientist at all but I feel very scientific because last week we crushed in a visit to Heidelberg, Grenoble and finished up with CERN, in a very deep hole in the ground, actually. I noticed in your submission, under the second item "Science in its International Context", which I am sure is something this Committee

[Mr Flannery *Contd*]

believes in, you mentioned the high percentage of your Parliamentary Grant-in-Aid (£11.5 million), but what I really want to mention is something in your submission which I am sure we all feel happy about and that is the no "fortress Europe" which seems as though it is very dear to many of us. You say, for instance: "Any move towards a 'fortress Europe' approach in science should be resisted" and I should like you, if you will be kind enough, to expand on that and give the reason why?

(Professor Epstein) I will do that with pleasure because quite obviously The Royal Society all through its history has emphasised that science is international, from the very beginning in the 17th century. It is even more international now and anything which would tend to limit it by putting up a sort of political fence would, in our view, be damaging to international scientific exchanges. If you think in terms of Europe as a "fortress Europe" in EEC terms, that gives an additional, even if it is only a psychological, block, or hurdle, for the East Europeans who are coming out from behind the former Iron Curtain to join the whole European community of science. Our policy at the moment is very, very strongly to encourage, and that would be a high priority which you asked me about a moment ago, our relations with the East European countries. I do not know if you picked up somewhere in this document that we have this flourishing European Science Exchange Programme, which is not limited to EEC Europe but more Council of Europe nations, and we are now bringing into that the Hungarians, who are the first that we have been able to switch from our former arrangements and bring into the European arrangements. We have a delegation coming from the Polish Academy of Sciences at the beginning of May and we would want to explore with them the policy of perhaps bringing them in in that way. The next on our list are the Czechs, and so on, and I think that if we have science limited to EEC Europe those countries will have difficulty joining in as freely as they might if it were an open European community of scientists. Does that answer the question?

50. It does to some extent. I was very happy, and I am sure our Committee was too, when we went round CERN—which is a city, it seems to me—to see the internationalisation of the streets as we entered—N Bohr and then I Newton—and the way the streets were named. Do you think that the British Government or the European Commission have a "fortress Europe" attitude at all? Is there any particular area where you think that particular viewpoint exists?

(Professor Epstein) It is quite difficult for The Royal Society to make comments on political matters and I think that we would really only be concerned with scientific matters.

Sir Gerard Vaughan

51. We are not asking you to talk on political matters, Professor Epstein. We are asking you to talk on your views on the structure of science and government and overseas, if necessary?

(Professor Epstein) As I said, our main priority is to keep everything open to allow the East European countries to join us as they emerge from confusion. We increased our exchanges with the Soviet Union two years ago, we doubled them again last December and we have now signed an agreement with them for post-doctoral exchanges; that is to say, young people under the age of 35 to come for one year or more as Fellows. The Soviet Academy has never sent young scientists abroad on a regular basis to Western countries. That is the kind of thing that we feel is absolutely imperative. Look at what happened in China when they sent 80,000 young people abroad. It is the only way forward.

Mr Evennett

52. Could I just come in and elaborate on that, because we had, as my colleague Martin Flannery said, a most interesting time last week, looking at European scientific achievement and advance. You mentioned that you do not want "fortress Europe"; is there not a "fortress America" on science? Secondly, there seems to be, and from what we heard last week, tremendous competition between Europe, in the places that we visited, as Martin Flannery mentioned, and Japan and America; vast competition, often duplication. Why, not "fortress Europe", not open the whole of the Western world into scientific advance together? Thirdly, we did discuss at length during our visit last week, particularly with the people at CERN, opening up Eastern Europe to come and participate in European scientific advance, but they did raise certain important problems about Eastern Europe and we certainly did as well. I wonder if you could address your minds to that point, too?

(Professor Epstein) Can I ask Sir Eric to come in at this stage. He was on the Kendrew Committee which looked into UK subscription and adherence to CERN and clearly can deal with the CERN side of what you have raised much better than I.

(Sir Eric Ash) I think it bears, really, on both the two questions that we have had. The first thing to say is that CERN has been a brilliant success; it is the first really major collaboration between European countries, I would almost say on anything but certainly in science, and the results which have been obtained in the last few years have really been quite marvellous, are continuing to be pre-eminent in the world. Nevertheless, I think the question of "fortress Europe" really does come to the fore here because, as Mr Flannery said, we are still devoting a rather large percentage of the total Grant-in-Aid to high energy particle physics and one does feel that the competition between high energy particle

[**Mr Evennett** *Contd*]

physicists in Europe and in the United States is something which one would like to see avoided. It is a marvellous subject and it ought to be done, but there is really no reason why one should be doing it as if it were a test match and there is a tendency for this to happen. I think the only solution for this would be on the political level. If, in fact, Members of Congress could, for example, visit the European Parliament or, come to that, come here, then I think there would be a possibility of the kind of discussion which would actually allow for funds to be pooled, which I think, as long as scientists just talk to each other, is rather unlikely to happen. I think that is the clearest example of where there is what I would see as a problem with "fortress Europe". When one talks about most other sciences, "small sciences" in particular—molecular biology, for example—until recently, at any rate, the scale has been such that I do not think that one has really needed to worry about the competition between two countries; there is a vast amount to be done and the chances of destructive, unnecessary overlap were very small. The human genome problem may be very different.

Mr Flannery: This is what I was trying to get at, because at the back of my mind—I hope this is true what I am going to say—the world can become a more peaceful place, and war and politics can stop scientists coming together, and in that new atmosphere I hope collaboration will flower.

Sir Gerard Vaughan: Did that answer your question?

Mr Evennett

53. I endorse what Martin Flannery said, but it did not answer the question, bearing in mind that America and Japan are so advanced in their scientific technology and development, as we heard last week, about why we are concerned to bring in Eastern Europe, which is not so scientifically advanced, rather than doing all we can to bring everybody in—Eastern Europe, Japan and America—so that we get the benefit for all of mankind?

(Professor Epstein) I was going to come back to your question, Mr Evennett. I think it is a very good question. If you look at world science there are, as you say, three major gravitational centres; North America, including Canada; Japan and that part of the Pacific Basin, the South Koreans are coming up very fast; and Europe. I do think that we have the resources and manpower and expertise and people in Europe to match the kind of things that are going on. Quite obviously, everybody should come in together, that is perfectly correct; and on all scientific matters interchange of information and knowledge and the visiting of laboratories goes on world-wide, it is one of the things which The Royal Society programmes foster. In order to keep competitive with what is going on I think the resources of Europe should be drawn in, and it is all very well to say that there are parts of Eastern Europe which are very backward, that is true, but even in the Soviet Union, which in my kind of field is very backward, in mathematics, in space, in metallurgy, and so on, they are extremely far advanced and at the front. I think we do need a focus embracing the whole of Europe to counter-balance the Pacific countries and North America, and anything we can do to exchange people and to open it up in Europe we think is good, and not to be limited to the EEC; I think that is the point we are trying to make.

Mr Bowden

54. There are two themes which have come through which I would like to perhaps pursue in parallel. I noticed your hesitancy about what you thought to be a political dimension to some of our questions and Martin Flannery raised the point that it would increase understanding and harmony between nations if there were greater collaboration and it would be of ultimate benefit for world stability and world peace. I accept the diplomacy which international science may offer, in terms of these opportunities, but what is that really to do with science itself? Are you regarding the exchange of scientific information between countries as part of the advancement of science, or the advancement of understanding between countries in that area? I am not sure whether I make my question clear but perhaps I will elaborate by saying, at what levels do you think this collaboration should take place, and to what degree? Should, at undergraduate levels, there be an exchange of a year between students in this country and Eastern Europe and the United States, as it were fulfilling their course, perhaps as we do in modern languages in our universities in European countries? Should it be at post-doctoral levels, as you suggest, to a greater degree? Where would you put the emphasis on this collaboration which advances science?

(Professor Epstein) Perhaps I should make an explanation before I answer your question. I put the emphasis on post-doctoral because The Royal Society is not concerned with any exchanges of any kind below post-doctoral level, so that is why I mentioned it. The answer to your question I think is that it should take place amongst the young people in the formative years and that is why we are putting a great deal of emphasis on post-doctorals. We do not want visits of delegations of 70-year-old academicians from here and there; that is much less profitable than sending people away for a year or two at the formative period. You then asked the question, is this a question of fostering science, or is it also fostering human interchange, and so on? Our preoccupation has to be, because that is our role, with science but the people you send are people and as people, quite obviously, it is jolly good to get them to see other ways of life in other countries and how other laboratories are organised; so the answer to your question is yes, though strictly our remit is only with science.

Sir Gerard Vaughan

55. You do appreciate, Professor, we are asking you to give a view on the whole of this field, not just on The Royal Society remit?

(Professor Epstein) Yes, but I do have to confine it to science, because The Royal Society does not concern itself, under any circumstances, with other matters; in fact, it is in our Charter that it should not meddle with other matters, including theology!

Mr Greenway

56. How wise! Theology is a science, some say.

(Sir Eric Ash) I have on my right an officer of The Royal Society. I am merely a Fellow, so I am freer to say what I think about this matter. If I could attempt to give a very approximate answer to Mr Bowden's question, I would say interchanges between ourselves and Japan and the United States are in the interest of science. They may be stronger than us in some places, we will be stronger than them in others, but I think it is a communion of peers. On the whole, very broadly speaking, when we have scientists from Eastern Europe coming to us at the moment it is not really to enhance our science, it is the other dimension that he mentioned.

Mr Greenway: Chairman, I hope we will not have any more of this modesty. Really, gentlemen, you do not need to be modest!

Mr Griffiths

57. Chairman, Professor Epstein mentioned in the course of his opening remarks the European Science Exchange Programme, which you also mention in your brief, and obviously you are justifiably very proud of it. I wonder, could you tell us, first of all, how it is funded and what your annual budget is, and obviously, from what you said, you do try to expand it year by year? How does that programme compare with some of the European Community programmes, such as ERASMUS and SCIENCE, in terms of its organisation and what it sets out to achieve; and, finally, could you just elaborate a little more than you did earlier on the scope you see for expansion of your activities in this field?

(Professor Epstein) The European Science Exchange Programme: how does it compare with ERASMUS? ERASMUS is for university students, ours is only post-doctoral and more senior. How does it work? It works on an entirely informal series of agreements with our 16 partners, now to be 17 with the Hungarians joining. What is the mechanism? The mechanism is that we have a meeting once a year with representatives of each of the partners, at which each partner says how much money they are going to devote to the programme, and The Royal Society puts in matching funds for that country. We usually have enough funding and the size of the funding is set by the partners. What scope? It is running at just under £1 million a year from our money, which is Parliamentary Grant-in-Aid, through the Science Vote, through ABRC to us, and that £1 million is then matched by an equivalent amount in local currency from all the other partners. The way it is spent is as follows. The sending side pays the fares, the receiving side pays all the living expenses and some local travel within the country to allow people to go to a meeting here or a laboratory there. The administration is kept to an absolute minimum and is extremely cost-effective because it is done by the receiving laboratory, the host laboratory, and the person who wants to go there. Does that answer the question? I do not know whether Mr Griffin would like to add something, because he is actually the person in charge of the whole programme.

(Mr Griffin) I think Professor Epstein has explained it very well. All I would point out is that I believe ERASMUS is centrally funded and centrally run from Brussels, whereas The Royal Society's European Science Exchange Programme is run by each of the partners, there is no one real centre. The Royal Society is perhaps the co-ordinator in this but the centres are the partners in the whole enterprise.

Sir Gerard Vaughan: Professor Epstein, we are really asking you to be very frank with us. Are these funds adequate from your point of view?

Mr Griffiths

58. I would just like to come back on two things; one is the funding aspect. If you had more money would you, in fact, be able to expand the programme because your partners could respond——?

(Professor Epstein) The answer to that is yes, and in one particular way, and that is that we now fund visiting Fellows for one year and it would be much more profitable if we had the money to fund them for two years. We do not like to keep them on for two years because that, at the moment, deprives somebody else of coming the next year, and the two-year period is much more fruitful than one when you are visiting a laboratory. You come to a strange country, you are in a new department, you have got language problems, you have got to settle in, and by the time your work starts your year is up; and a two-year period would be much better and we would like more money for that, yes.

59. On that particular theme of the more fruitful approach of a two-year period, I was going to ask you, could you give us one or two tangible examples, some specific examples, of the value of the exchanges?

(Professor Epstein) Do you mean in terms of what sort of subjects people come and work on, or some other aspect?

60. The benefit which accrues because of a transfer of knowledge, which happens because of the exchange, that sort of thing?

[Mr Griffiths *Contd*]

(Professor Epstein) Very frequently, if it is a successful visit, there will be publications by the visitor in collaboration with the people in the receiving laboratory. Very frequently, if it is a good collaboration, the visitor will go back to his own country and start joint projects between his home laboratory and the one that he has visited; and as these people become more senior, naturally, if the UK is the place where they have had their post-doctoral formation abroad, they will tend to look to UK science rather than to America, or wherever.

Sir Gerard Vaughan: I think we are asking you to be as robust as you possibly feel able to be, not too diplomatic, because we really want to know your views, you see?

Mr Greenway

61. Hit out! Really hit out, gentlemen?

(Sir Eric Ash) Could I just add one thing to what has been said so far, which is that I think it is important to recognise that The Royal Society's scheme is for the scientific élite. The ERASMUS scheme, it is hoped, will embrace most of the students in Europe. Quite apart from the fact that one is postgraduate and the other undergraduate, the mission is entirely different.

62. Can I pick up this point, Mr Chairman. You state in your evidence, gentlemen, that because of dwindling resources, UK laboratories are charging substantial "bench fees", as we call them, to visiting post-doctoral researchers from abroad and that this discourages European scientists from undertaking work in British laboratories. May I ask you this? Do you think that a reciprocal agreement to waive these fees throughout the region is feasible, or is a special European fund to reimburse laboratories for the costs of visiting scientists a more realistic objective? Hit out! Come on!

(Professor Epstein) It depends on what continues to happen to our university laboratories and research institutes. The reason this business with needing "bench fees" has come to the fore in recent years is the gradual erosion of the effectiveness of the dual-support system. The UGC, now UFC, leg of that system has not left university departments with free money sufficiently available to fund the modest requirements of a visiting scientist, but Sir Eric Ash, who is Rector of one of our great institutions, will, I am sure, be able to tell you that better than I.

63. Yes, that is a factual situation, but what is your answer to my question within the context of that situation, that is what we would like to know from you, please?

(Professor Epstein) Do you mean in international terms, or in national terms?

64. In European terms, we were talking about?

(Professor Epstein) In national terms, something has jolly well got to be done about the university system.

65. What? Come on!

(Professor Epstein) It has got to be properly funded.

66. How is it going to be done?

(Professor Epstein) By proper Government funding.

67. What do you mean by "proper Government funding"?

(Professor Epstein) Enough to give the well-found laboratory.

68. How much?

(Professor Epstein) That depends entirely on what discipline you are talking about. What is needed in chemistry is different from botany.

Mr Greenway: Yes, but have you not thought about these things? Have you not got answers to these questions? They have got to be answered for the nation, and it is not good enough for you to come here and answer in such general terms. I would ask you if you could be more specific please?

Sir Gerard Vaughan: You can see that Harry Greenway feels very strongly about this subject.

Mr Greenway

69. I think we do want something to bite on. We have got to make recommendations to Parliament and we cannot put waffle before Parliament.

(Sir Eric Ash) We do, for example, discuss these things within ABRC and numbers have come out of that. I am going by memory now, but I think the shortfall we were talking about in the scientific equipment of universities, the shortfall to be made good at the moment, is of the order of £200 million. I do not know whether any of my colleagues here can confirm that figure. It is of that sort of order at this point. Can I just say one thing very quickly about "bench fees" and you mentioned my institution. We take a very pragmatic view of this, and if we have somebody coming in who is a scientist who will be a collaborator, in the normal sense of the word, we would not normally charge "bench fees". We tend to charge "bench fees" when somebody is coming essentially in a tutorial role.

70. Would it be appropriate to think in terms of two-part grants; one part to the visiting scientist and the other part to the receiving institution to cover "bench fees" or overheads? What about that as a possible approach, despite what you have just said?

(Sir Eric Ash) That would make a big difference.

(Professor Epstein) That would be fine, yes, but that would require an increase in the monies we have available to make that possible.

71. That is understood. We need to know this. Thank you very much indeed.

(Professor Epstein) That would be fine; and if you want a figure, £2,000 or £3,000 per annum per incoming person would make a big difference.

72. Is that £2,000 or £3,000, Sir?

[**Mr Greenway** *Contd*]

(Professor Epstein) It depends on the discipline. If it is molecular biology, it is something around £7,000–£8,000.

Mr Greenway: I think if you can give us some specific figures it will help us no end. Do not think I am aggressive, but I want to get to the heart of it.

Mr Evennett

73. Two things come up from Mr Greenway's comment. Firstly, you mentioned in your submission that there was closer co-operation between UK scientists and the Americans because of the language barrier being less, but during our trip last week we were told that European science is done in the English language which is the international language of science, I would like your comment on that because the two do not tally. Secondly, on the funding situation, of course there are always limited resources and the question is how best they can be utilised for the national good, of course; but is there, would you say, following on from what you have just said, a stronger role here for the European Science Foundation and would its funding need to be increased?

(Professor Epstein) I will try to do those sequentially. The first one you have raised is the question of language. You are absolutely right, the scientific international language nowadays is, of course, English. When I was at the Institut Pasteur in 1952 I jolly well had to learn French because nobody spoke English and there were political reasons for not doing so, actually. That has all gone and the scientific language is indeed English, but there are, nevertheless, difficulties for young Fellows going with families, perhaps, to Stockholm or to parts of Germany. It is not that they cannot talk to their colleagues in the lab but it is that there are difficulties of settling in because of the national language, whereas it is jolly easy to go to Pasadena, California, or Boston, Massachusetts. I hope that answer that part. The second part was the situation with regard to the ESF. I am not quite sure what you are asking me about ESF.

74. You said that you want more money for the funding of the universities here. My comment was that, obviously, there is a limit to what the taxpayers are willing to pay in any field. If, therefore, you are saying that you need more cash, would you not think it better than there be an increase in funding to the ESF; would that be a better utilisation of resources?

(Professor Epstein) I do not follow the sequitur there, but I could tell you something about why we——

75. The situation is, if we are looking at European science, where we put the money; we could either put the money in European institutions that are a collaboration between Europe or we could put the money into British universities, for example?

(Professor Epstein) Yes, but ESF is not a collaborative laboratory. I think I can answer your question about ESF. The reason, really, for putting more money into ESF, in our view, would be if it is given a role in peer review of what the Community in Brussels is doing in science. To do that, which it could do, it would need much more in the way of resources.

Mr Evennett

76. Would you like it to do that; that is the question? Would you think it should have a stronger role?

(Professor Epstein) Let me just finish that second question and then we will get Steve to tell us how it is funded. Would I like to see it have a stronger role? I do not really mind whether it is ESF or whether it is the Academia Europaea or what it is, so long as there is some body in place to act as an umbrella or organiser of peer review of science, in Brussels, independent of the Brussels bureaucracy. They must have some body freestanding. To do that they need money, Steve can tell us exactly about that.

(Mr Cox) I think the question is, should we put more money into ESF? The money which ESF currently gets comes from the Member countries, and in the case of the UK it comes from the UK Science Vote. If we put money from the Science Vote into ESF we are simply taking it out of one pocket and putting it into another, if you do not increase the total resource, so it is not a particularly useful change to make. What we are saying is that to have any impact from the UK you have to increase the total resource and then we could decide on the sorts of priorities and where we should put the money; but we are funding ESF at the moment.

(Sir Eric Ash) May I just add that peer review takes about 1 per cent, at least that is a sort of a typical number. If one looks at the total Brussels programme, 1 per cent of that is a large number, so if one were going to give this role to ESF one would have to take a rather major step.

77. To continue to the European side of things, you emphasised that the quality of the science supported by the EEC should be at least as good as that in national programmes. Are non-scientific criteria given too much weight in decisions about the content of EC scientific programmes?

(Professor Epstein) I think probably yes, for national. It is a bit of a colloquial exaggeration, but most of European science is in the hands of the Italians, at the moment.

Mr Evennett: Really? Is that right?

Mr Griffiths

78. That is because of the way it has developed historically. It does need to be corrected, though.

(Professor Epstein) That is right.

Mr Greenway

79. Can I say that several of these submitting evidence to us, including yourselves, have

[Mr Greenway *Contd]*

mentioned that there is a financial disincentive to UK universities in obtaining research funds from the EEC, in that they cannot recover any of the costs of overheads in the way that they can if they receive grants from the UK Research Councils. We understand this means that they receive only 50 per cent of the total costs of EEC-funded research instead of the approximately 70 per cent they would receive through a combination of UK Research Council and UFC top-up grant. Can I ask you this: is it reasonable to expect UK universities to accept EEC contracts under such disadvantageous terms? I have two follow-ups, if you could answer that. What do you think, Sir Eric?

(Sir Eric Ash) It is a very major problem for us. We do not really have any matching funds for the 50 per cent, so one's first instinct is to double all your costs so they can then halve them, but that turns out to be against the law and therefore undesirable, so one has to deal with it in other ways. Incidentally, it is slightly better than the 50 per cent because, in fact, they do allow you some overheads of about 10 per cent; but, even so, the difference between the 60 per cent and the 70 per cent which we would get from Research Councils is very significant to us, and the 70 per cent we get from Research Councils is also inadequate to cover all our overheads. One of the great problems we have in universities is that we are not, in fact, maintaining our buildings, for example in such a manner that we are not putting a further load on the future; so 70 per cent is not really adequate, and 60 per cent is worse. The other thing which bothers us very greatly is that, as far as we can make out, in most of the other EEC countries the universities there do not have this disadvantage; their overheads are essentially paid for by the state. We are disadvantaged with respect to other universities and we are disadvantaged in that we get a grant from Brussels rather than from the Research Council, and yet one would have thought that it would be very important to give universities every possible incentive to get money from Brussels rather than from the Research Councils in this country; so it is a problem.

80. Thank you, Sir Eric, it is a most important point and what you have said is noted; it is an obvious recommendation that we could make. Could I go on to ask you whether you have any evidence that the present rules, which preclude the UFC from topping-up research grants from the EEC, actually discourage universities from bidding for EEC contracts; it is a follow on?

(Sir Eric Ash) My guess is that they have not been discouraged all that much and one of the reasons is that we do not do enough arithmetic, enough accountancy. It all seems like marvellous new money, until you find that you are actually sinking. It is a problem which hit Imperial College some years ago. We were more successful than any other university institution in getting Alvey funds and there was no overhead component to those at the time; and it almost sank the place right there and then. On the other hand, the researchers, the academics, of course want to get on with their research and that is, after all, what we are there for; so we actually carry on bidding for these grants and getting them as fast as possible, but somebody suggested that this might be a little bit like drinking sea-water when you are dying of thirst in an open boat.

81. I can see that, but somebody needs to take hold of your needs in this area with some specific information from you and to push these important points forward. Could I, finally, ask how The Royal Society, which really has an interest, does it not, would recommend that this anomaly be resolved? What would The Royal Society recommend?

(Professor Epstein) It should be possible for these to be reclaimed. There should not be this barrier here; it is illogical.

Mr Griffiths

82. Do you not think that, in fact, the simple way of dealing with it would be for the Government, the Research Council, whoever, to undertake that any university successful in applying for EEC grant aid should have a pound-for-pound funding which would then see that you are totally covered?

(Professor Epstein) Certainly.

Mr Flannery

83. That is forbidden, is it not? The topping-up is forbidden?

(Professor Epstein) Exactly.

Mr Griffiths

84. No, it is not topping-up.

(Professor Epstein) There is a more important issue than that here. It is not international and it is not European, but since we have touched on it this is a major problem with granting money that comes to universities, say, from the medical research charities. That might sound like trivial money, but at the moment the medical research charities are contributing more this year to medical research in this country than the Medical Research Council itself, and in coming years they will overtake the funding of the Medical Research Council. There is no provision for the recovery of overheads by universities for grants that they may get from Cystic Fibrosis, Cancer Research Campaign, Imperial Cancer Research Fund, and so on. It is a very major problem.

(Sir Eric Ash) Can I just comment very briefly on what Mr Flannery said about this being illegal. It is terribly hard to sort this one out. What I do know, from a colleague in one of the universities, one of the Grandes Ecoles in Grenoble with which we collaborate, is that if his roof leaks it is repaired. That is really paying a contribution to the research there which happens automatically. When our roof leaks we have to find the money

[Mr Griffiths *Contd*]

somehow or other to repair it. I am not convinced that the Brussels legislation in fact provides a level playing-field.

Mr Bowden

85. Does this bring us to the point where we look at the competing claims of the, what is from your phrase, curiosity-driven research, as opposed to directed research? I, like others here, have no specialist scientific training but I remember from when I did general science at school that there was a notice in the laboratory which said "No structure without function; no function without purpose" and I am conscious in many things we saw last week that I could see the structure in every case, I could see the function on some occasions, but I was hard-pressed to discover the purpose on a number of occasions. I accept the idea that excellence could or should be pursued for its own sake, but how do you balance the equation with the very real scientific need to find a solution to a particular problem, whether it be cancer or AIDS or whatever, and how can you justify against that making claims for funding which really provides excellent scientific or challenging entertainment for brilliant minds?

(Professor Epstein) I think I should simply repeat to you the unanimous view of the present Royal Society Council and the one before and the one before that, that it is absolutely essential for the scientific health of a national community that what we call "bottom-up", curiosity-driven research should be adequately supported. The answer to your question is that no committee, no wise men, can possibly sit there and tell you what to do which is going to hit the jackpot; it is totally impossible to predict. If you do not have a fostering of the brightest and most innovative people you are not going to come up with the new things which are going to pay off in the long run.

Mr Flannery

86. Do you think then that the EEC is a suitable instrument for the funding of science? It is highly centralised, intergovernmental, and is it a good method of funding science?

(Professor Epstein) No, simply because it is highly centralised in that way. We believe very strongly that responsive mode funding, that is to say funding in response to somebody's bright idea and project which they put up, is the life-blood of scientific progress, and when we are asked where this bright idea is going to lead nobody can predict that. You would not have penicillin if it had been directed research, you would not have monoclonal antibodies if it had been directed research, and I am only picking up things that I know about from my side of science.

Mr Griffiths

87. Yes, but on the other hand, Professor Epstein, if what you are saying is absolutely true then the EEC-funded "guided" research, as you put it, would be of no value whatsoever and none of your colleagues would ever bother to apply for it. Surely there must be some value and purpose in it otherwise you would not get involved as scientists?

(Professor Epstein) The point I am trying to make is that there must be a balance and the reason why I am banging on about responsive mode funding is that the balance in this country has swung against it. You have got to have directed research. Let us go back to penicillin. The discovery of penicillin was blue-sky research; somebody discovered this thing. The application of it, for which Florey got his part of the Noble prize, along with Fleming, was the directed research; he actually directed his team to exploiting this thing. You have got to have a balance; but to say that just allowing people the intellectual satisfaction of following the particular idea which gives them a kick I think is rather dangerous because that could be the very thing which tomorrow you want to capitalise on.

Mr Bowden

88. How can we control this? We recognise your expertise in the field but we, as a Select Committee, go and hear learned men talking about the important work they are doing and the significance of their discoveries, to which I can see no direct application; I accept as a matter of faith their word and your word that it may lead somewhere, that something might come out of it, but with constrained resources there did seem to be something self-indulgent about it.

(Professor Epstein) Let me say that this brings us back exactly to one of the things we started with, which is the question of peer review. I think Sir Eric wants to say something.

(Sir Eric Ash) It is very deep water. I accept everything that Professor Epstein has said. There is no way in which you can predict where curiosity-driven research is going to lead. Nevertheless, I would myself believe that if one tries to decide whether curiosity-driven research in high energy particle physics or astronomy is going to lead to something applicable, some utility, or compare with your own field of molecular biology (I would myself plump for molecular biology), so I think there is a question to be asked, even within curiosity-driven research, where in fact you put your resources, and that is something, precisely as you have said, which is one of the central themes of peer review.

(Professor Epstein) That is priorities.

(Sir Eric Ash) It is priorities. It is peer review but a stragetic peer review. It is a very difficult business. On the question of why anybody bothers to apply to Brussels, you can put in unsolicited proposals to Brussels in a certain area, and applied science is as fascinating to some people, like myself for example, as pure science is to others. I do not think one is discouraged nor does science lose its fascination even if you have an objective in view, quite apart from curiosity.

Mr Flannery

89. Did you find something which we found some years ago when we did an inquiry into the bio-technology base? This seemed to be in danger at the time, and indeed it was, and every Research Council came to us about this. We did not know a great deal about it. People like me had to learn first of all what the very name meant almost. I want more money for science, clearly, and that is one of the motivating things with me. One of the things we learned during the course of the inquiry, was just how much money out of the grants that the Research Councils get has to go as almost the joining fee for being in a great international body. I thought first of all, "why does not the Government pay that?", which I think was not a very good question, but it is such a huge amount. Have you ever explored this at all?

(Professor Epstein) Did you get an answer to "why does not the Government pay that"?

90. The answer more or less was that out of the funds that come to research councils from Government they were still giving the money, whether research councils paid the fee or the Government, and that would be an extra that the Government paid.

(Professor Epstein) You see, this is one of the points we are making here, that science funding in this country is at the mercy of exchange rate changes. You are paying these international subscriptions that you mentioned, which are very large, in currencies . . . CERN, for instance, is Swiss franc equivalents, and in the last few weeks, I hardly need to tell you here, there has been a drift dramatically downwards in the pound versus the Swiss franc and therefore our subscription is that much bigger and that extra has to come out of the rest of the science budget available for research. There is no account taken of these changes and that is a very dangerous situation, particularly since the change in currency rates is almost invariably to the disadvantage of the science budget. We never seem to have a great windfall because the pound suddenly leaps up.

91. In the arts, we managed at one stage to have it arranged that they went on just an annual basis, that they could, for instance, go over into the next and they have now got a three-year budget. How long is it, the money that comes to you from Government? Is it just for one year and is there a carry-over?

(Professor Epstein) I can only tell you from my own experience, which is on Medical Research Council and that money cannot be carried over, no. You are planning from year to year.

92. That limits your research, does it not?

(Professor Epstein) Correct.

Sir Gerard Vaughan

93. You must find that very unsatisfactory?

(Professor Epstein) Of course.

94. Would you put that as a very strong point to us in our considerations?

(Professor Epstein) Yes. It is a piece of silliness, is it not, and if you save on something for some unexplained reason which is, you know, you could do it terribly well the day after tomorrow; the day after tomorrow is the end of the year, end of story.

Mr Griffiths

95. In relation to this funding question, do you think there is a case for all of that science spending which is related to things like the CERN programme to, in fact, be hived off from the general science programme, and then whatever effect the exchange rate has on that should come from a contingency reserve which the Government has got?

(Professor Epstein) Yes, absolutely. The Foreign and Commonwealth Office does not have this problem with the cost of their embassies abroad.

Sir Gerard Vaughan: You are making a formal recommendation on that?

Mr Flannery: I should hope so!

Mr Evennett

96. Two weeks ago we had the DES here giving us oral evidence and they gave us the fullest assurance that the most appropriate scientific experts were always chosen to represent the United Kingdom on Community scientific committees, yet in your submission which we have had you express serious concern about this point of view. Could you give us more specific comment or evidence on this point, first of all, and secondly, accepting your view in your submission, do you think that the deficiencies occur through lack of skill or attention when choices are being made, or are they intrinsic to the structure of our system dealing with Community science matters as they affect the United Kingdom?

(Professor Epstein) I think a comment, rather than anything else, is the answer and that is as follows, that, for instance, The Royal Society is not consulted regularly on who these representatives should be.

97. Never?

(Professor Epstein) "Never" is a big word; hardly ever. The recommendations tend to float up within the Departments. We feel that the Fellowship of The Royal Society, which runs to about 1,050–1,100 people, depending on the death rate, at any one time, covering all the disciplines of science, really has within it expertise which is not necessarily being used or consulted, and we think that that is a pity because, of course, we are independent of Government.

98. How can we get you more noticed so that you can redress this omission?

(Professor Epstein) Simply by pointing the Departments at us and saying "Go and solicit some advice".

Sir Gerard Vaughan

99. Have you made actual representations on this?

[Sir Gerard Vaughan *Contd*]

(Professor Epstein) I think we probably have, yes.

Mr Greenway

100. Is not the Prime Minister a FRS?

(Professor Epstein) Yes, she is.

101. She has some say in Government matters, does she not?

(Professor Epstein) Yes.

(Sir Eric Ash) Perhaps we could add the Fellowship of Engineering to The Royal Society in this context because, although we have been talking about science all afternoon, probably a large percentage of it is really engineering.

(Professor Epstein) To take it one step further, we should also include the British Academy, for the same reasons.

Mr Evennett: That at least answers the question. Thank you very much.

Mr Turner

102. Several of those providing evidence to the Committee have suggested that the level of Government funding for research in universities has caused problems with the provision and renewal of laboratory equipment. A recent ABRC report appears to confirm this. I wonder if I could ask you if this lack of the "state of the art" equipment inhibits the ability of UK universities to attract funds and scholars from abroad?

(Professor Epstein) I think Sir Eric actually touched on this earlier.

(Sir Eric Ash) Yes, but I did not answer that specific question. Let us start by confessing that this is a bottomless hole. We have looked it up in the meantime and my figure of £200 million was, in fact, the correct figure; but if you give £2 billion to the universities to spend tomorrow they would not find it at all difficult, so it is a matter of judgement where you pitch it. That £200 million seemed to us to be what is needed in order to bring universities up to a standard which would make them comparable to, for example, American universities. Does it stop us attracting visitors from abroad to do research with us? I would say not, on the whole. What it really does do is to put constraints on the particular research that we can do in a particular situation and things are not so desperate that we cannot, in fact, do research at world level in a restricted area, but it is a constraint and is a constraint which has got worse over the last few years.

103. So I can deduce that you have got a great deal of concern about the level of Government funding for this particular area?

(Sir Eric Ash) Absolutely yes.

(Professor Epstein) Yes.

104. So we should really draw that out in the evidence that we produce as a Committee?

(Sir Eric Ash) Yes, please.

(Professor Epstein) The "well-found laboratory", which was the key end of the UGC, now UFC, funded dual-support system is a thing that people are very worried about.

105. You feel robust about this point, do you, as Harry asks?

(Professor Epstein) Yes.

Mr Arnold

106. I think you have expressed a lack of contentment with certain aspects of funding of science and research,. I wonder what your views would be were there to be a specific Minister of Science?

(Professor Epstein) That depends on what he is tied to. If he is tied to a tiny department with no clout at all that is not really going to help. If he is taken away from where he is now and put with Trade and Industry, that perhaps also is not going to help. This was tried in the 1950s and did not really get anywhere. If you are going to set somebody up who really does have clout that would be marvellous, but to just have a sort of bit of window-dressing going on and calling it Minister of Science, independent of DES, I do not think is going to help.

Mr Griffiths

107. Can you point to a country which has got a Department or Minister on the lines you would like to see?

(Professor Epstein) Yes, indeed, The first one which comes to mind, because of the incredibly impressive Minister that they have, is the Federal Republic of Germany, Herr Riesenhuber. I wish we had a clone of him over here.

Mr Flannery: It does find its reflection in the Select Committee. Our remit is education, science and the arts. People tend to come in for education. I had better not go any further on that!

Mr Arnold

108. You could not identify for us any budding clones over here, could you?

(Professor Epstein) I think that is for those who make Cabinets to decide.

Sir Gerard Vaughan

109. Are you actually recommending that there should be a Government Department for Science?

(Professor Epstein) If it was what you would call "robust" and had some clout, yes.

Mr Griffiths

110. Along the lines of the German model?

(Professor Epstein) If it just a sort of small, two men and a boy and give it a name and say, "Look what we have done", I think that would be worse than what is going on now.

Sir Gerard Vaughan

111. Can I backtrack a little bit for a moment. Do you think that "big science" in this country—UK "big science"—should be more rationalized and perhaps made the responsibility of some international body?

[**Sir Gerard Vaughan** *Contd*]

(Professor Epstein) You are asking me a question I do not want to get involved in because I am not in "big science". Ask Eric. This is over to him. I am not in "big science".

(Sir Eric Ash) I am not in "big science" either, so my answer would not be the answer that you would get if you had somebody who was an astronomer or a particle physicist. I think all one can say on this is that I cannot see a rational judgement as to how much of your resources you should put into "big science" and how much into the rest. I am absolutely sure that in the past we put too much into "big science". I would think myself now that we are getting closer to the right kind of a level, but it is a judgemental thing and one really cannot argue it. It is not terribly different from asking how much we should put into opera.

Mr Flannery

112. I noticed in the last of your recommendations that you more or less say this when you say, "Efforts should be made to increase the funds available to individuals or groups of scientists applying to pursue curiosity-driven science in the Framework and other European programmes, rather than concentrating upon directed programmes of research"?

(Professor Epstein) That is back again to responsive mode funding.

Mr Flannery: Indeed, yes.

Sir Gerard Vaughan

113. I hope you think we have been reasonably robust?

(Professor Epstein) I hope we have given you some of the answers that you can chew on, anyway.

114. Are there any comments you would like to make before we close the meeting?

(Sir Eric Ash) I do not think so.

(Mr Cox) No.

(Professor Epstein) No.

115. No last thoughts?

(Professor Epstein) More money for science, is the last comment here.

116. Can we thank you very much indeed.

(Professor Epstein) Thank you for giving us such a good reception and so patiently listening to our non-robust comments.

Sir Gerard Vaughan: Thank you.

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THE EDUCATION, SCIENCE AND ARTS COMMITTEE

SCIENCE POLICY AND THE EUROPEAN DIMENSION

Wednesday 25 April 1990

Confederation of British Industry

Dr J Hall, Dr R Bullough, FRS, and Dr J Taylor

European Science Foundation

Mr M Posner and Dr J Smith

Ordered by The House of Commons to be printed 25 April 1990

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WEDNESDAY 25 APRIL 1990

Members present:

Mr Malcolm Thornton, in the Chair

Mr Gerald Bowden
Mr David Evennett
Mr Martin Flannery
Mr Harry Greenway
Mr Win Griffiths
Mr Gerry Steinberg
Mr Dennis Turner

Memorandum submitted by the Confederation of British Industry (ES30)

1. EC Research programmes should focus on areas which are relevant to all member states, such as the environment and health care, and those of strategic importance such as biotechnology and enabling technologies. Members are satisfied with the areas of research identified by the new Framework Programme, and support the trend towards greater selectivity. As an increasing amount of research is conducted at the European level, the UK must ensure that its research base is sufficiently strong to allow active participation in such programmes. UK programmes should also focus on the dissemination and exploitation of EC research.

2 EC research should continue to place emphasis on programmes which strengthen the economic and social cohesion of the Community. Collaborative projects between different member states are central to EC science policy, and there is growing evidence that the goal of greater integration is being achieved. Members welcome the involvement of non-EC countries in such collaborative research.

3 A balance between basic, applied, and 'near market' research must be maintained. At any point in time different technologies will be at various stages of development and therefore demand appropriate support. For example, biotechnology is less mature than information technology, and therefore requires a greater balance of funding for basic research. Members favour such a spread of funding, rather than any bias towards 'fundamental' or 'near market' research.

4 Members believe the budget of 7,700 million ECU originally proposed by the Commission represents the minimum level of funding necessary to support a critical mass of EC research. Support for research on a European basis is increasingly important due to the progressive decline in resources from national governments. The compromise budget of 5,700 million ECU agreed by the Research Council in December is therefore unsatisfactory.

5 Members are generally satisfied with the quality of the Commission's evaluation of bids for projects, but believe that the existing win-bid rate is too low and could be improved by greater transparency during the definition of programmes. Nevertheless, the relatively low probability of success is to some extent balanced by the level of funds available for EC projects. Larger member companies clearly prefer EC research programmes to UK programmes, but the participation of small and medium-sized enterprises is more problematic. Isolated pockets of excellence exist, but in general SMEs perform little formal R&D and are much stronger at 'near market' development. UK programmes may be more appropriate in such cases.

6 Members believe that exchanges between young researchers in different member states are an essential part of EC science policy and strongly support the programme for the management of intellectual resources under the new Framework programme. There are also moves to harmonise qualifications on paper, but members feel that significant changes are needed to harmonise the training of science and engineering graduates throughout the Community. In particular, degree courses in the UK are thought to be much too narrow by comparison with those in some other member states. Greater harmonisation would improve the mobility of researchers and increase integration within the EC. However the UK must ensure that its research base is sufficient to attract and retain young researchers.

7 We are unable to comment on the effect of EC research on HEIs or their success in obtaining support. However, we note that in the past UK organisations have received a greater proportion of EC research funds than the Government has contributed. Our recent Innovation Trends Survey indicates that UK companies are planning significant increases in collaborative research with both overseas companies and HEIs.

March 1990

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Examination of Witnesses

DR J TIDD, CBI Technology Group, DR R BULLOUGH, FRS, United Kingdom Atomic Energy Authority, and DR J TAYLOR, Hewlett Packard, Members of the Research and Manufacturing Committee, Confederation of British Industry, were examined.

Chairman

117. Good afternoon, gentlemen, and welcome to the Select Committee. We are very grateful to you for coming along this afternoon to assist us with our inquiry. The format of the afternoon is that we will take about three-quarters of an hour and we have a number of questions we will be putting to you, passed around the Members. Perhaps I could start by asking you a question about your submission. In it you indicate that the CBI are satisfied with the areas of research identified by the new EC Framework programme but you indicate that you have some reservations about the ability of the UK to participate actively because of the strength of its research base. Would you like to expand on that particular point for us?

(Dr Tidd) I think it comes across clearly that members are satisfied with the main strategic points identified by the third Framework programme and, as you are aware, although it is more selective in the longer term at least in its present form, it is much broader than the previous Framework programmes, so it leaves a lot of flexibility. I do not think we have any comments on the strength of the UK science base. Rather we show concern that it must be sufficient to participate actively in the Framework programme and I think that past experience, which is all we have to go on, suggests that the UK gains more than it contributes to European research. I think that UK industry and UK academe have been very actively participating in previous Framework programmes, so that it was really concerned with the condition of active participation in European research and development.

118. Would any of your colleagues like to comment further?

(Dr Taylor) I broadly agree with that. The issue which is beginning to engage people is the question of selectivity. As more and more of the science base and the technology base in the UK is funded by European sources, multinational sources, rather than just the national source, then the question is what is UK technology, what is UK science, and making sure that science, which is being funded on an international basis, is made thoroughly available to people in the UK who then wish to build upon it and use it and so on.

Mr Flannery

119. In March we went across to Europe and visited Heidelberg and Grenoble and CERN in Geneva. Most of us are not scientists, although we have put out reports previously on various aspects of science, largely due to the shortage of money for science. Therefore, that is one of the dominant things in our minds and I am sure it is in yours, and it came home to us rather more clearly when we saw at first hand just how much work and research is done at a European level that is separate or in conjunction with the UK level. In your submission in the first paragraph you say: "As an increasing amount of research is conducted at the European level, the UK must ensure that its research base is sufficiently strong to allow active participation in such programmes"—that is, the EC research programmes and so on. "UK programmes should also focus on the dissemination and exploitation of EC research." I wonder if you could expand on that because it seems to me to be so very important. We met scientists working in the place of almost all nationalities in Europe and it came home to us just how much work is done on that kind of communal basis.

(Dr Bullough) If I may comment, it is interesting to note that the investment in Germany in in-house research, as it were, is far higher in proportion to their investment in Europe than our investment is. We have a very large investment in Europe. In fact, with the exception of France we have the major presence in the European scene. I am personally quite worried, particularly in the future, that because of this large participation it might give the impression that all is well because we have the credentials to get the large participation. We are very well liked. The quality of our endeavours is very well appreciated by our European colleagues, but I think there are signs which are worrying, particularly in pre-competitive programmes like BRITE and ESPRIT, because of the decreasing level of support for basic science in the UK, and we all know the various changes in the national laboratories are indicative of this and the restructuring of funds for universities and so on. There is a lovely example of this in the almost complete demise of polymer chemistry in the UK, verging on the scandalous. So I think the notion that we can remain a major participant should be questioned.

120. Of course, one of the things is that to belong to a great international organisation is very expensive. We have talked about CERN continually over the years but except for one of our people who is not here at the moment I do not think any of us has been. It is a city; all the streets, for instance, are named after great scientists, Nils Bohr and Isaac Newton. There is N Bohr Street and I Newton Street and so on and you have a general impression of something very vast and very expensive. We went into a hole in the ground and emerged in something like the size of St Paul's Cathedral, with a huge machine in it, which must be violently expensive and it is bound to make us think that in order to keep pace

[**Mr Flannery** *Contd*]

with the other countries we really need to have quite an input into that financially. Those were the thoughts I had anyway. I do not know what you think about it?

(Dr Bullough) I think we have to maintain our endeavours in this. High energy-physics is a particularly colourful science. I am not particularly enamoured of it personally but at the same time it is very important that mankind should do this thing.

Mr Griffiths

121. Could I take up the specific point you mentioned about polymer chemistry. Are you saying that in the public sector, that is, in the universities, we are vacating this particular field?

(Dr Bullough) I quoted it as an example.

122. Because surely there are major chemical companies in the UK who must be carrying out their own research?

(Dr Bullough) But nobody is being trained to be employed by these companies in the future.

123. So it is the public funding area that we are talking about here?

(Dr Bullough) Yes.

Mr Steinberg

124. Put more generally, are you actually saying if there are no more resources available as a whole you then believe that perhaps more resources should be transferred from Europe back to the UK for our own individual use rather than the vast budget in Europe?

(Dr Bullough) It would be very interesting, in my humble opinion, to compare the effectiveness of investing in Europe in the proportions that Germany does—it has a huge proportion of internal investment in R&D—as compared with other countries; in other words, the proportion of investment and how it relates to the GDP, will be quite interesting.

Mr Bowden

125. I think you can help me because I follow the argument so far without understanding the actual terms of reference. You used the phrase "in-house", Dr Bullough. In what sense were you using it?

(Dr Bullough) Investment within the nation itself.

126. The nation itself investing in itself rather than individual companies?

(Dr Bullough) In partnership with overseas companies.

127. But if ICI were to be conducting its own research you would see that as in-house within in-house investment?

(Dr Bullough) Yes, if it was done in this country.

128. Because I think we are in danger of not knowing quite where the investment is being directed?

(Dr Bullough) Yes.

Mr Greenway

129. We are talking about publicly-funded investment?

(Dr Bullough) It is total funding.

130. So that we are comparing like with like, that is what you are talking about in terms of investment?

(Dr Bullough) Yes. I was talking about funding in R&D.

131. Total funding?

(Dr Bullough) Yes, in R&D, investment from total funding.

132. Are we talking about public funding from public resources?

(Dr Tidd) No, about total public and industry-based funding.

133. But they are both higher than in Britain anyway?

(Dr Tidd) They are both higher than anywhere else in Europe.

(Dr Taylor) I think, roughly speaking, as a percentage of GDP the French and Germans spend about 0.9 per cent of GDP on government-funded R&D and we spend about 0.5 per cent. So they spent about half as much again in government funding for civil R&D, but I would just like to come back to a point you raised. I think one of the issues people wrestle with is that, if more expenditure is made in Europe on research and development, then essentially pro rata the amount the United Kingdom Government spends on UK-funded research and development decreases because that money comes from essentially the same pot. So in going to government-funded EC, European Community, R&D there is in a sense a considerable loss of control and discretion and so on. The money that goes into the R&D funds of the European Community is controlled by the way that they decide to spend that. I think that gives people a lot of problems of selectivity. We see in various ways such as my colleagues described that we cannot cover the whole base in the United Kingdom, certainly not on the UK funds, so there is a lot of pressure on how to be selective and yet the policy machinery for deciding how to be selective is very difficult.

Mr Flannery

134. Another question connected with this: you say that EC research should continue to place emphasis on programmes which strengthen the economic and social cohesion of the Community. Then you go on—this is something I agree with profoundly—and say you welcome the involvement of non-EC countries in such collaborative research. One of the things which was noticeable to us was that many countries are poor countries and do not have the amount of money to put in and, therefore, they are almost *ex officio*; nonetheless, they are in on what happens. Could you expand on that briefly?

[**Mr Flannery** *Contd*]

(Dr Tidd) I think, with respect, perhaps the priorities—in particular the R&D priorities—of different countries, newly industrialised countries, are very different from those of industrialised countries. I think to a lesser extent you see that contrast within the European Community, north and south, and there are active efforts to encourage collaboration between European Member States in the north and south. I think our members feel that, although it is very difficult to find centres of excellence, they are in fact very productive once the links have become established and both parties gain by that. But they are difficult to establish in the first place.

Mr Greenway

135. Gentlemen, no one would dispute that a balance must be maintained between basic, applied and near market research, and this may be different for different technologies. In the past few years we have built up government machinery for deciding this balance nationally, for example, ACOST. But as science becomes more and more international, as we have already seen in this discussion, we need to think about how to do this at the European level. I would like to get into the European level a little more deeply and put three questions to you which you can take separately or together. Do you think that EC funding for research should have this spread from fundamental to near market? How should the EC go about deciding these priorities? Would it be acceptable if the United Kingdom were to cease efforts in certain areas of basic science and to specialise more in others, by international agreement, to gain the benefits of an international division of labour in research? It is probably best if you take them separately but I leave it to you.

(Dr Tidd) On the first issue, which I believe was the spread between types of research—basic, applied, near market and other such descriptions—if I recall, the twin aims of all the Framework programmes have been to enhance the European science base and to increase the competitiveness of the European industry. Clearly those were two different ends of the market, if you like. So in the basic policy statement the foundation of the European Framework programme is based on those two criteria. So we have straight away the requirement that some research will be near market or pre-competitive rather than near market, whereas others will be basic or fundamental. But the overriding principle beyond those two points is that the research must be trans-national in character and the overriding principle beyond that is subsidiarity, Eurospeak for what can be done best at European level should be done at European level. That brings us neatly to the second question, how do you decide what should be done at European and what at United Kingdom or national level and how do you set those priorities? I think UK industry is fairly satisfied with the current mechanisms of selection but would like greater transparency when the specific subprogrammes have been defined so that there is greater industrial input at that level rather than at strategic level of defining, for example, in the case of the Third European Programme fifteen broad areas of strategic research of interest to all Member States. So industry is happy with the current mechanisms for broad strategic areas but would like more involvement at the next level, the definition of subprogrammes.

136. Anybody else? Can you take the final point?

(Dr Taylor) I think the issue of specialisation can be coupled with your first point about the balance between near market and basic research. I think, as you get towards near market things, then your really have to be looking particularly in collaborative programmes—most of these are—at the involvement of various kinds of companies, not just companies involved in creating the basic technologies but those involved in applying them, exploiting them and so on. I think one of the issues that we will all be grappling with in this area is how to ensure, particularly if you decide in a specialisation mode to say "We will do that technology in an international way, not necessarily physically in the UK", that you then achieve the coupling you need to the near market organisations that are going to take this on and do something with it, because that coupling gets quite difficult as geography intervenes. Also the notion that we have about how to spend technology transfer funds and so on tends to be concerned with technology transfer of national technology. Increasingly, if we specialise and decide certain things will be done on a European basis, then we need to focus quite especially on how to make sure that the technology that is being created on the Continent somewhere is physically available and coupled into people who might use it, exploit it, develop new business and new applications from it. That is a somewhat novel dimension for something that flows from having the programme we have had growing in the last five years in Europe.

137. Is there any difficulty about doing that? Why is it not already happening?

(Dr Taylor) I do not think there is any great difficulty in principle in doing that, but the business of actually focusing on doing that, emphasising the need to do that, emphasising the need to put people creating technology in other countries in touch with people who might apply it and exploit it in the UK, particularly if we use national funds to do that, is something that probably needs a higher priority as time goes on.

138. Who should do it? Civil servants? What mechanism is in place now, if any?

(Dr Bullough) Influencing the programme definition is not our strong point, if I may say so.

139. As a nation?

(Dr Bullough) As a nation. I believe strongly, although we have a large participation in the programmes, of course, and they are

[**Mr Greenway** *Contd*]

diverse—BRITE/EURAM, ESPRIT—they are all pre-competitive. EURAM is the only one I know that approaches the market and develops existing technology. So there is a good cocktail there to go for, but our influence, I believe, in defining the specific programmes is rather weak and I think the quality of officials that are involved is higher in Germany or France than it is from the United Kingdom. That is my candid opinion.

140. That is a very serious remark. Why are our people inferior? Are they underqualified or weak mentally?

(Dr Bullough) That is a gut feeling. It is not based on any tangible evidence except——

141. That is a very important thing you said. It should not be a gut feeling, you ought to be able to rationalise it.

(Dr Bullough) My rationale is from colleagues in France and Germany. They get the programmes that they want.

142. And ours do not, so they do not fight hard enough? Does that mean they are inferior or they do not fight hard enough?

(Dr Bullough) I presume it might improve with time.

(Dr Tidd) I think we have to be clear what we are discussing. Are we discussing the broad definition of programme areas like ESPRIT?

143. Yes, we are.

(Dr Tidd) In that case I think, for example, the Third Framework Programme, the one insisted on by the UK Government, is far too broad and almost any R&D project could be written and included within the fifteen programmes identified. So although that claims to be more selective than previous programmes the UK Government is claiming it is not the case and, in fact, it is broader than anything to be included. So if this problem exists it is not perhaps a problem.

(Dr Bullough) My view is that we wait to respond, whereas you do not get the criticism of these programmes from the French and German companies. They have already put in place what they wanted.

Chairman

144. Before we leave this, do you think we could solve the polymer chemistry problem, for example, by agreement with other countries on specialisation?

(Dr Bullough) I am not sure I understand the question.

145. You mentioned before that we were falling behind in this particular field.

(Dr Bullough) We have had a complete demise of polymer chemistry in the UK universities. That could be remedied by creating a department of polymer chemistry.

146. But if we were actually to follow your earlier argument through, when you were talking about perhaps moving on into areas of specialism in other countries, dividing it up with a division of labour, so to speak, is this one area which could be solved with collaboration and specialisation elsewhere?

(Dr Bullough) It depends whether we want to be in the game, and our credibility as a participant in Europe, I believe, depends on a strong science base at home.

Mr Griffiths

147. Why do you think this happened in polymer chemistry, given it is such an important field? It is an interesting example. Do your think it is because there is such a heavy industrial application with companies like BP and ICI and the Government perhaps should be sponsoring chairs in universities because of its very important direct applications in industry?

(Dr Bullough) I do not think that is the reason. I think it is because of the overall demise of chemistry and it happens to have carried down the plughole polymer chemistry.

Mr Flannery

148. Just how important is it in the industrial field?

(Dr Bullough) Enormously important. I think that in the materials field the future lies in the development of special materials, in particular reinforced materials, such as reinforced polymeric materials.

149. Does it mean, for instance, that if we are not doing it ourselves we will have to import the necessary technology from abroad?

(Dr Bullough) Of course, yes.

150. So that in the long run that could be more expensive?

(Dr Bullough) Yes. In the context of the discussion on the European science programme it means we cannot be active participants.

(Dr Taylor) I think there is a better consequence that flows from that. If the notion of specialisation indicates that we get it in some sense in innovating in the basic science and technology in that field, we have the consequences you have just referred to, but we also have the consequences of a much reduced flow of people being trained and educated in the field in UK universities and, therefore, being available to UK companies and UK industry and business, and I think there is a lot of concern around about the various different factors that are causing a reduction in the number of people being trained in science and technology and engineering in UK universities. There is the demographic trend that everybody talks about; there are a lot of academic retirements coming along; there is going to be an increasingly attractive job market in Europe for a lot of bright young people as 1992 and so on goes past and I think the business of a serious drop in the number of highly-trained and qualified people in these areas has the other effect that is likely to flow from deciding not to work in them.

[**Mr Flannery** *Contd*]

Mr Flannery: That was our experience. It was very noticeable that very few people over there wanted to come back here. They made it plain to us over at CERN, for instance, and not only there but at Heidelberg.

Chairman: Can we move on. We have spent quite a time on this subject.

Mr Griffiths

151. In a sense we are still dealing with the Framework programme and exactly what that involves. Could you confirm that when, in your memorandum, you were lamenting the size of the programme budget and comparing it with the cut in national research, you were specifically thinking of the British Government's reduction in research and development spending, because it does not apply in the German case, as you have already said? In that context, do you think that the European Community can actually make up for this national shortfall in Britain on research expenditure or that, given the gaps which could be created, in the end it is a total loss for ourselves, and that is the idea of the complementary nature of the Framework programmes, that national R&D expenditure goes right out of the window altogether and at the end of the day we are just left with impoverished national spending on R&D which there is no way that the European Community can make up because of the inevitable reduction in our own research and development programmes?

(Dr Tidd) I think that line of argument suggests it is a zero sum game, just one pot and it is all shared out of that. To some extent that is the case in the UK. I think we are keen not to repeat the experience of UK organisations participating in previous Framework programmes. Financially we have got more out than the Government has put in, so in simple accounting terms it makes good sense at that sort of level. Maybe it is not the same people who can have the money but that can be discussed later. But we must accept that there must be some international division of labour and at European level certain programmes are going to be possible which simply could not be funded at UK level no matter how much goodwill existed. I think CERN is the obvious example but it is atypical in a sense because it is highly capital intensive and built around a facility rather than people or an institution essentially. So that is an example that detracts from the scale of the argument, but to put it in perspective, we have to look at the proportion of the UK cake that goes to Europe and I believe it is of the order of 4 or 5 per cent, depending on how you define public funding for R&D, that goes to Europe, so it is not insignificant, but it is not of the order of cutting the cake into two large portions and the UK losing out as a result. Similarly, I think round about 10 per cent. of Research Council money is invested in European or international programmes. That is the order of magnitude we are talking about, between 5 and 10 per cent, depending on where you look. So it is not insignificant but it is not of the order suggested: that is, a major switch to European priorities rather than UK priorities.

152. Okay, let us personalise it in terms of the difference. Do you think very bad effects are being suffered in the UK because of our national funding of R&D, particularly our participation in benefits from European programmes compared with the German levels of expenditure and the benefits they get? Are you worried about this difference in the national support and what then follows on in the context of European developments?

(Dr Tidd) I think you have to be a bit careful about the German model because it is clearly very large and within Europe they are the exception rather than the rule.

153. What about the French? Take in the French as well because their R&D spending on civil is roughly the same as the Germans in proportion to their GDP.

(Dr Bullough) I am certainly worried, largely because of the general demise of research as a career for the young people coming through the educational system, It is patently obvious that it is no longer an attractive, well-defined career. To take physics as an example, it is very serious for the knowledge base of society. For both cultural and the underpinning of industrial activity, I am concerned about the demise of basic science in this country. We can probably get a lot of the underpinning we need by these collaborative endeavours in Europe but the bottom line is, do we want a society that has a strong knowledge base in science, where people want to study science and see research as a tremendous career?

154. Seeing current trends, are we slipping down the snake?

(Dr Bullough) All the big research laboratories are contracting. There is no sign of growth anywhere. My own laboratory, Harwell Laboratory, is one example.

155. Dr Taylor, how do you feel about it?

(Dr Taylor) I agree very strongly. I think if you look at all the indicators—the reduced number of people coming through the system, the reduced number of academics available to teach for the teaching of science in schools, the general low levels of salary, image and so on of a career in science these days compared to what it was twenty years ago—I fear very much for the ability of our education system really to provide the level and numbers of people we are really going to need to continue to expand industry and so on and so forth, irrespective of where the technology actually comes from.

156. How do we tackle that problem? Are there two or three things you would regard as being vital to reverse the trend?

(Dr Tidd) I think we are discussing at least two trends here. One is the general demographic thing. All European countries, without exception, are

[**Mr Griffiths** *Contd*]

suffering a much longer term decline; participation in subjects related to science and technology is almost inherently a UK cultural problem, an Anglo-Saxon problem—it is happening in the United States as well. They are two very separate issues I think, certainly with very different solutions. I think if we confine ourselves to one of those, the demographic thing, there is very little we can do other than bring other people in.

157. The other is more fundamental?

(Dr Tidd) The other is more fundamental and it is slightly culturally based. I think the signals new graduates get from industry are wrong, they are saying quite rightly career paths are limited, salaries are limited, in these areas, so why should graduates choose that path. But it is not immediately obvious what can be done about those sorts of things.

Mr Evennett

158. It comes back to the schools as to where they go afterwards. Surely it is much earlier than the graduate stage. Some of the reasons why the Government has brought in the national curriculum making people do more science are just to get back to people doing science in schools, to enthuse them.

(Dr Bullough) Three-quarters of the young people think the earth goes round the sun.

Mr Evennett: The fault is in the education system and the fact is that the kids in the schools are not having enthusiasm from their teachers for science.

Chairman

159. I thought it did go round the sun!

(Dr Bullough) I said the wrong thing.

Mr Evennett

160. Can I have an answer to that? How do we go about it after the event to get anybody enthusiastic in any subject? We must get them when they are young; looking at them when they are at university or where they go from university is too late.

(Dr Tidd) If one looks at the fall-out or drop-off rate of people in science and technology as they go through the educational system, it is quite dramatic when people graduate and become post-graduates opting out of science and technology and towards the service sector and finance. These are very enthusiastic people, who have often done three or four year Ph.Ds in science. Then these people turn their backs on that and to towards——

161. It goes back before that. Many people who are dropping science were in the recent past in schools so you have to start far further back than that. Of course, it is a tragedy that people who are very able and have a good degree and specialism in science do not pursue it. That is one issue. The other issue which I think you are not addressing is to go further back into the schools to make it an exciting subject—because science is exciting—and get across to the young people the excitement and opportunities and development potential and get it there. If you could start there, then you would get more people going on to science, particularly girls, and going on to universities and taking it further surely.

(Dr Taylor) But I think the case we are making here is that both careers in UK industry and, even more so, careers in UK academia do not offer you very good material for exciting people about those prospects and those opportunities. That is a very core issue.

Mr Bowden

162. That has certainly been apparent from our limited experience in looking at this so far. Those who are in science are not speaking as enthusiastically about it as to encourage any recruits to come into it. You may be talking yourselves into a decline—I suspect in many cases you are—whereas those in the City are certainly talking up what they are doing, attracting students there. I think perhaps half the fault might be seen to lie within the science community itself, but I would also come to a question to put to you: how do you see the role of the CBI? It is nice to see you here today, it is nice to hear your views—but what is the CBI's role in this?

(Dr Tidd) Role in what? Science policy?

163. Yes.

(Dr Tidd) For example, we recently completed a 12 months study, a review of the Government's support for science and technology, and that was published a week or two ago. One of the principal conclusions there was that we should ensure we had an adequate science base, more emphasis in UK programmes on technology transfer and regional networks, and that really means feeds into the European level where we have lots of influence in defining subprogrammes, quite often in a reactive role to the main strategic areas, I admit, and generally attempting to ensure that the aims, the goals, of increasing competitiveness and enhancing our science base are as far as possible achieved.

164. This was my feeling reading your submission—it is reactive rather than whatever the smart word is, proactive, or innovative. You were there, as it were, analysing what was happening. Without saying "This is what our members—we are a representative body of industry—need", how can we bring pressure to bear?

(Dr Tidd) With respect, tomorrow the Research Council meets and we hope it will rubber-stamp and adopt it. All through the process for the last ten months we have been writing submissions to the DTI, the Commission Brussels office, UNICE and so on to influence the programmes that they have evolved and they have taken on board some changes, for example, mobility of post-graduates.

[**Mr Bowden** *Contd*]

We want that widened to include not only post-graduate students but young researchers in industry. So we have some influence. I agree it is limited but it is not simply reactive. Given the nature of the Euro-machinery, there is an opportunity very early on to put some input into that.

165. Can you see that role developing? Dr Bullough was saying earlier we seemed to be behind in making our views known. In the German situation—I hesitate to go back to that; you tell me that is an atypical model—those who are the users or consumers of science research in Germany seem to have made their shopping list known before the programmes were launched, whereas here you suggested, I thought, that we come in rather later in the day and say "You are doing something which is not quite what we want"?

(Dr Bullough) Yes. As a corollary to that I wanted to say that it does appear that our influence, which is awfully important in Europe in both formulating these programmes and in participating in them, is presently quite strong. I did not want to give the wrong impression. I am just fearful that it will decline. There are examples where we do not participate, like the European Space Agency. As a consequence we have virtually no influence now in space in Europe because we did not join. You asked for examples of what we should do. We should join, that is my point.

Mr Flannery

166. Could I take the point you have here in your paragraph 4, which we have not mentioned when we are talking about this. We have not said anything about money. In your paragraph 4 you say, "Members believe the budget of 7,700 million ECU originally proposed by the Commission represents the minmum level of funding necessary to support a critical mass of EC research.". You go on further to say, "Support for research on a European basis is increasingly important due to the progressive decline in resources from national government." Then you give the figure that emerged, "The compromise budget of 5,700 million ECU"—as opposed to 7,700 million—"agreed by the Research Council in December is therefore unsatisfactory." 2,000 million out of 7,000 million is an absolutely drastic cut.

(Dr Tidd) We would accept that it is not satisfactory, but having said that, the belief is that the Fourth Programme will overlap with the Third Programme as the third with the Second and the Second with the First. So if you look at the breakdown of funding there has been hardly any reduction at all on what the Commission orginally proposed for the first two years but for the final two years there has been a massive, drastic reduction in funding that was requested, but with the proviso that the programme will be reviewed, as the present programme was, and if found satisfactory, additional funding will be provided. It is a compromise but the immediate funding will not be reduced, which is what the Commission asked for but they are avoiding in the final two years of the third programme.

(Dr Bullough) We surely know the loss of our participation in the 2,000 million ECU saved will not be compensated by a corresponding increase in funding in the UK.

(Dr Taylor) Let me give you another example. In my own field, computer communications and information technology, the figure quoted by the Commission in the framework programme was that of the total expenditure on IT R&D worldwide, the United States spends about 55 per cent, the Japanese, about 27 per cent and the Europeans, about 18 per cent. Europe currently runs a deficit of about 20 billion ecu in information technology, so it is an area where the actual level of R&D expenditure within the Community is still seriously low. As another example of a new major European programme providing new technology, one of the new programmes is the European microprocessor initiative EMI. EMI is basically taking two computer architectures—the INMOS transputer, which now belongs to the French and the Italians, and the ACORN RISC machine, which now belongs to Olivetti—and is basically having to put a lot of money into further development of those two architectures as the basis of European-originated technology in this very important area. Again I think it is very important that as this happens we make very carefully sure that the inwards technology transfer, if you like—the technology transfer from those big European programmes—finds its way back into the UK in such a way that people who want to build systems out of this can really maintain close contact with it, because as they go further away the contact gets more difficult.

Mr Turner

167. Your evidence to us as the CBI is that the Government are not investing enough? The UK is not investing enough in the science programmes?

(Dr Tidd) In Europe or the UK or generally there is no evidence that in strict financial terms there has been any rundown recently of the UK science base. There are selective pockets of evidence of subjects which are falling behind and I am not sure how much that is due to lack of funding or to information. For example, the natural sciences have often been less fashionable than biotechnology in the last few years, but at the European level really our concern is that overall the budget was not as high as originally proposed and our members believe that was a minimum requirement, so we are concerned at the European level.

Mr Greenway

168. There seems to be some difference between you as to what they are investing themselves.

[**Mr Greenway** *Contd*]

(Dr Bullough) I am concerned with the demise of basic science which is not compensated for by European involvement: the European programmes are generally three-year programmes and then they terminate. You cannot operate a basic long term science endeavour on that timescale.

(Dr Taylor) I am involved in part of the funding process on behalf of SERC and I am very concerned about the level of underfunded alpha quality basic research grants we have at the moment. A very high percentage of grant applications we have at the moment we are not able to fund.

Mr Griffiths

169. Basically what you are saying is it is a national responsibility to fund the basic research?

(Dr Taylor) Absolutely.

170. And then the EC has a role to play in the nearer market developments that we have been talking about this afternoon, even though it may be what you describe as pre-competitive?

(Dr Bullough) Yes. Collaborative ventures are very healthy for the EEC, I believe.

Chairman

171. I am afraid the clock has beaten us once again, so could I thank you very much indeed on behalf of the Members of the Committee for coming along this afternoon. There may well be other questions which we have not been able to ask this afternoon because of the shortage of time, in which case our Clerk will write to you asking if you could provide some further written backup.

(Dr Tidd) We would be very happy to do that.

Chairman: Thank you very much for coming along.

Memorandum submitted by the European Science Foundation (ES31)

ESF is sixteen years old. It is "owned" by its Member Organisations, who are the 53 research councils and academies of 19 countries—stretching as far East and South down the Adriatic as Yugoslavia, Greece and Turkey, but as yet to no Eastern European countries, although on many projects there is an active involvement of individual scientists from Eastern Europe.

ESF's UK Members are the five Research Councils, the Royal Society and the British Academy. Lord Flowers was ESF's first President; Professor Mitchell, Chairman of SERC, is currently a Vice-President of ESF; Mr Michael Posner is the ESF Secretary General.

ESF is small—it spends one per mill (one tenth of one per cent) of the budgets of its members, and a sum which is less than one per cent of the European Commission's expenditures on basic science. Its cashflow through all its accounts is currently about £5 million annually.

Typically, that expenditure is merely the tip of an iceberg—pounds spent by ESF activate a far larger expenditure by its Members. For instance, the European Geo-Traverse (investigating the Lithosphere from North Norway down to the Southern Mediterranean) has spent during the eight years of its life not much more than £1 million through the ESF accounts, but has stimulated and enabled at least 20 times that amount of useful expenditure by ESF Member Organisations. A recent Earth Science Study Centre in Marburg, F.R. Germany, assembled some 30 scientists from a dozen European countries to analyse, argue about and establish the new understanding of our continental structure arising from the Geo-Traverse experiments.

ESF is currently responsible for about 40 Programmes, Scientific Networks, etc. in all the main fields of science—"science" in a continental European sense, stretching from Byzantine History to astrophysics, from the technology of submarine exploration to the genetic basis of neurological disorders. Its field is *basic* science—which may be defined as that subset of all excellent science that nobody can be persuaded to pay for on purely commercial grounds: it will not immediately earn a profit. In most countries it is Governments, through research councils, that pay for most of such science. The ESF is an international agency, at arm's length from Governments, to stimulate and arrange for basic science to be executed on a transnational scale where that seems sensible.

Some people believe, in terms of those rear window car stickers which were popular a year or two ago, that "doing science with foreigners takes longer and costs more" than doing it at home. But there is much science that can be done only across frontiers, and much which can be done more effectively that way. Large scale installations are one example; the pooling of ideas and manpower at the fast moving edges of science is another; the use of data from a number of different sites is a third.

The biggest and (biggest spending) agencies in this business are ESA (space), CERN (particle physics), EMBL (molecular biology): but in the last three or four years, the important work from DG XII of the European Commission, across many different fields of science, has begun to dominate. ESF does not operate on that scale; but it has sources of strength and modes of operation which allow it to contribute in a significant way to the development of a community of European scientists.

ESF's *Scientific Networks*—a self-governing, informal, short term device for bringing scientists together on specific topics for tightly specified purposes—have now been running for five years. Several of the most successful are under UK Chairmanship. We intend to accelerate modestly our rate of creation of such Networks from 4 per year to 6 per year.

ESF's *Scientific Programmes* are more substantial cooperative efforts, lasting from 5 to 8 years: two of the most vigorous currently are in Polar Science; others are in the social sciences, humanities, chemistry, bio-sciences. Usually the actual experiments or hardware or salaries are paid by the Member Organisations; ESF, with a light hand, manages the coordination, planning, interpretation; the European scientists do the hard work!

We calculate that some 3,000 European scientists worked together on ESF scientific activities in the last 12 months. ESF is about cooperation between *people;* and about building a common European work place for scientists. ESF is essentially an agency for informal cooperation.

Three new initiatives bring ESF and the European Commission closer:

(i) Two advisory Committees, jointly managed by ESF and the Commission, have been set up, one in Ocean and Polar Science (Chairman, Professor Hempel, Bremerhaven), and one on Environmental Change (Chairman, Sir Hermann Bondi).

(ii) ESF has started a major series of Research Conferences—building up to about 60 per year by 1993, and is actively seeking CEC finance for this Programme. At a recent meeting with our American progenitors and now competitors in this mode of operation, the Americans noted the remarkable extent of European unity behind the ESF scheme.

(iii) ESF is hoping to secure support from the new CEC Framework Programme for a post-doctoral linked scheme, to move young scientists to laboratories in other European countries, in association with ESF Networks and Programmes.

ESF aims to help Europeans do excellent science, by removing barriers and increasing cooperation. Competition is also healthy *within* Europe; and cooperation is often useful, with Americans and Japanese, not just with Europeans.

Michael Posner
Strasbourg

10 April, 1990

Examination of Witnesses

MR M V POSNER, CBE, Secretary General, and DR J H SMITH (on secondment from the UK Economic and Social Research Council), of the European Science Foundation, were examined.

Chairman

172. Good afternoon, Mr Posner and Dr Smith. Thank you very much indeed for coming along to see us this afternoon and participating in this inquiry. We have about three-quarters of hour in which we will be asking questions from different sides of the Committee and giving you an opportunity to comment on a number of things. Could I begin by saying that in their written submissions a number of bodies have suggested that the ESF might take a rather more prominent role in the organisation and management of European science almost as a counterweight to the European Community. They referred, for example, to giving more weight to the scientific community in deciding on research priorities in basic science, to improving quality control by peer review and to funding projects internationally in the responsive mode. Could I ask you, therefore, do you envisage new functions of this kind for the ESF?

(Mr Posner) Yes, we see ourselves as performing two major functions. One is actually to organise, on behalf of our member organisations and the scientific community as a whole, in many different fields, scientific programmes and networks, and the other is to provide a service of various sorts enabling there to be interchanges of opinion, assessment procedures of one sort or another. An example of the second type of activity is the study we did over several years about the synchrotron radiation project, which eventually led to the beginning of the building of the new facility at Grenoble a year or two ago. The whole of the analysis was conducted lightly through discussions in various groups which we ran. The actual spending of the money and the building of the expensive and elaborate apparatus is, of course, being done elsewhere but that is rather typical of some of the work we have done. And yes, we do see a modest, perhaps increasing, role for ourselves in assessing priorities. We have recently been approached by Ministers of the

[Chairman *Contd]*

Europe of the 12 in two particular fields, one of them about astronomy and the other about the human genome. In doing a job of that sort our relations with the European Commission and DG XII in particular are cordial and friendly. We do not belong to them; they, alas, do not belong to us. For us to work for them or put them right or keep them on the proper path is not quite the way we approach things. To start with, they are very big and we are very small and I feel sometimes like a donkey in the same stable as an elephant. You do not have to think that the elephant is malevolent to be a little frightened about going to sleep at night in case you wake up as a sort of donkey rug! So we keep our distance, although I think we are moderately useful.

Mr Greenway

173. I wonder whether you envisage new functions of any kind for the ESF, and if you do, whether you could say what new functions you would envisage?

(Mr Posner) Apart from this question of peer review which you mentioned, Mr Chairman, at the beginning and which I am prepared to say something a little more about later, our new activities are two-fold at the moment, First, we are very keen indeed on a programme of what we call research conferences, European Research Conference. It has already got under way. We are planning six conferences this year, 20 the year after, building up to 50 or 60 by 1993, and these have been advertised recently in "Nature"—a rather nice advertisement of which we probably have a copy somewhere here. Secondly, we are very keen indeed on post-doctoral research fellowships. We hope that will do something to improve the European Community of science, because young, brilliant scientists will work in other countries before returning to their own, and secondly it will do something to replenish the supply of first-rate scientists to both universities and industry which your Committee was discussing a moment or two ago with the CBI representatives. Apart from those two innovations, our main function is to continue and expand our work in programmes and networks, particularly to bring in scientists now from Central and Eastern Europe.

174. There is another suggestion that European science is potentially as strong as that of the United States but that, since it is divided into several nation-based communities of scientists, it lacks a political will to compete with the United States and increasingly Japan. Now, if you accept that, would you agree that a stronger role for the ESF would contribute to increasing European cohesion and will in this area?

(Mr Posner) Yes, sir, I do believe that. But it is important to acknowledge that there are other agencies which in their own ways—sometimes very much bigger and more impressive ways than ours—are doing their bit. Sometimes I too am critical of the Commission but they are large, they have been successful, some of the reviews which have taken place of their activities have been already quite positive. The CERN which your Committee was referring to a moment ago is a very impressive piece of first-rate science of world significance. EMBL, the Molecular Biology Laboratory and the organisation that goes with it, has had notable success, as has the Space Agency and so on. So we, the European scientists, are doing things. But we are still operating in many fields, particularly the more traditional pieces of laboratory science, on a parish pump basis. It is as if we were organising things on the basis of a science policy for Yorkshire or for Somerset instead of doing it for the country as a whole and the contrast here between Europe and the United States is rather striking and upsetting. It is not that we want to take away from the United States the successes that they are ringing up; we want to add to them our own successes. The European Research Conference is, I think, a very good example. The Americans have been running a series of this sort for several decades. I believe their main organisation at present does 120 a year. Some of my friends wondered whether we in the ESF were being overambitious in starting with 6 and meaning to build up to 50 or 60 but, if you measure us by population, national income, prestige and the tradition of our educational institutions, we should indeed be in a position to be as successful as the United States, and that is no threat to the United States. Imitation is the sincerest form of flattery and that is what we are trying to practise.

175. So, Mr Posner, you are saying to us implicitly that you need more resources and stronger support from your constitutent membership to perform these enlarged roles you have already envisaged for yourselves, not to mention what other enlarged roles you foresee?

(Mr Posner) Yes, sir. We spent a lot of time last year doing a forward look, a corporate plan or whatever the fashionable word is in London this year (which had not been done for our organisation before) and we have now agreed to modest growth path for our main activities of around 15 per cent a year in real terms for the next few years. We believe that we can spend that additional money wisely and sensibly and, yes, we believe that we can do more in specific areas if we are asked to do so. It is striking that the last few weeks have brought a number of such requests, not only as I understand in evidence to your Committee, sir, but in correspondence directly to us.

176. Finally from me, do you see yourselves as having a propulsive role? That is rather the point brought out by Mr Bowden earlier. You say you are asked to do this, that and the other. Are you reactive or are you proactive?

(Mr Posner) My personal instincts and training, sir, are very much on the proactive basis. One of the questions which your Chairman started with, however, was about whether we would be

[**Mr Greenway** *Contd*]

prepared to finance more science in a responsive mode. Now, many people believe in chaps like me being very proactive and at the same time being very responsive. That is indeed what we like to do. Deep inside we are proactive; our external attitude is, and must be, to listen carefully to what we are asked to do and to bring forward our own ideas in response to what we perceive to be the favourable features of the external environment.

177. If you got concerned and started banging the table for money, would you lose your job or be enhanced in it?

(Mr Posner) Sometimes it is good to bang, sometimes it is good to cajole, sometimes it is good to hire somebody else to bang for you, sometimes it is good to find very powerful friends who do the banging.

Mr Bowden

178. I would like to ask you if you would care to comment on Dr Bullough's evidence earlier. He made the point when talking to us at first by saying he felt that British industry and British science and academics do not have the opportunity to affect the policy-making process in programmes and perhaps I was a little pressing on that point with him, feeling he was lacking an upbeat approach to it. I wonder whether you would like to comment in general terms on what he said?

(Mr Posner) Could I be a little reflective on this, not really pushing the ESF. There is always a conflict here. Take a programme like the Framework programme which I guess, in tune with some of the questions some of your colleagues were asking earlier of the CBI, will probably run for several years at 2,000 million ECU a year, a serious size of programme, not immeasurably bigger than some of the programmes in these fields done by the other agencies in Europe but a big programme, very big compared with the money we touch in the ESF. Admittedly the priorities in that programme are laid down from above. Now, that is no accusation of wickedness against the Commission that they are acting in a top-down way, because that is how my friends in the Research Councils in this country and elsewhere also spend a portion of their money, but it is very essential that a proportion of money is also spent at the volition of the guys at the grassroots who are doing the science and composing the responsive mode applications. We in ESF call the money which we spend in this way expenditure on our scientific network scheme—everyone has their own words to use and their own modes of operating. But someone in an organisation should be listening to working scientists. You cannot spend all the money that way because of strategic considerations, but you ought to have a substantial proportion set aside for use in that way. I do not think it is British scientists who have insufficient voice in what happens through CEC, the Commission spending; it is scientists in general who feel a little put upon, but scientists of all sorts are not slow to complain. I think that some of the features of the new programmes being developed by the Commission are very good and very attractive and those who are laying their hands on the money are very pleased to get it and, on the whole, spending it quite well.

179. When you come to the position which you outlined earlier, that you are going to hire a dog to bark for you, do you think that dog should be kennelled in the DTI or the DES? Which officially should negotiate this? Should it be the CBI as a special favour to the DTI, I wonder, or should it not be the DES?

(Mr Posner) My job and the job which my organisation has is what I will call basic science. You could spend a lot of time and people on defining basic science. I believe it is just that part of very good science which you cannot get anybody to buy for commercial reasons. Maybe they will buy it tomorrow or the day after but they will not buy it today when it needs to be done. In basic science the DTI and its equivalent in other countries is seldom very interested, although I will say that we get letters from Ministers called Ministers of Industry, asking us to investigate extremely basic matters, but in, say, the Netherlands or the UK Ministers of Industry look after industry and Ministers for Education and Science tend to be preoccupied with the things we in ESF are worried about, namely basic science. So yes, in my present professional activities I would wish to turn to Ministers of Education and their servants rather than to Ministers of Trade and Industry and Technology. But this is a long-standing issue in this country, sir, as you do not need me to tell you, and I would not like to lay down the law on the best form of organisation. I am inclined to say, do not let us spend in this country—you in this country—too much time and trouble in the next two or three years sweating about the best method of organisation of science. I rather doubt that that even then the right answer would appear.

Mr Flannery

180. The Foundation is now 16 years old, is it not?

(Mr Posner) Yes.

181. I understand it has a very harmonious relationship with the European Commission and yet there are signs that the Commission is getting more interested and involved in basic science. Is there to any extent any rivalry between you?

(Mr Posner) I have to say that I believe it to be in the public interest and in the interests of science that the Commission does spend some of its funds on basic science. I say that, first of all, because basic science needs a net addition of money and is benefiting from it. I think it is very often artificial to try to find a distinction between downstream science and upstream science, between the basic and the applied. You can spend

[**Mr Flannery** *Contd*]

a lot of time and trouble drawing the line. It might be easier in many cases, or in some cases, not to bother to do so. Thirdly, I know that several of the very good people in the Commission are very much committed to helping science forward and if they see serious gaps in the provision of basic science resources I think it would be foolish to stop them directing some of the funds of which they are the custodians in that direction. As regards the ESF—I think we just have to accustom ourselves to that fact of life. It is no use complaining, saying we ought to be doing all that ourselves. That would not be nice. We are a small organisation. There are bigger organisations. We can fit in with them. There is plenty of good work for both of us to to. I do not regard that as a threat. What I do regard as a worry is being trampled on by accident, so to speak. Those who recommend that the ESF live in an ecological niche do frighten me because then the elephant treads on the beautiful butterfly without really meaning to and bye-bye that part of the genetic stock. I do not want that to happen to us because I think we are not only beautiful but useful. So I like to keep a little my distance from the elephant but I like also to feel we are doing work together in a reasonably sensibly co-ordinated manner. I believe that is happening but not always as fast or as successfully as I would wish.

182. Do you think that the Commission will eventually become the major policy body for the science base at European level?

(Mr Posner) At European level they could do because they are the biggest spender but that I am sure cannot be left to the Commission as such. That would be rather like, at national level, saying that we will leave it all to the DES, excellent though the people in the DES are, and we would not want that to happen.

183. Neither would I!

(Mr Posner) There is no risk of that happening for Europe as a whole because our member organisations, the Research Council world, are still bigger than the Commission if you add it all up across Europe. Yes, operating at the European level they are the lonely pinnacle; they rise out of the plain as a great big mountain and I think there does need to grow up around them a cluster, not too expensive a cluster but still a cluster, of supporting institutions which control, influence, sometimes in a democratic way, sometimes in a professional way, what they do, and I think it is quite important that not just the ESF but other bodies flourish on the "pickings". That is an unpleasant term but if you remember those animals in the equatorial climates who have birds sitting on their backs picking up the insects—there is a scientific word for that which I cannot immediately remember but there is a mutual support that goes on, and I prefer to be that bird than the donkey I was talking about earlier!

184. There are so many questions about that to be asked but we have not got a lot of time. Could I jump over a bit and ask you this. I notice at the end of your submission the really staggering amount of work you do; for instance, the number of courses you run is unbelievable, and, therefore, having that kind of input and output you are in a very special position in Strasbourg where you can observe precisely what is happening in many ways with so many people coming towards you and then going away. The question of Germany and France as compared with us is a very important question and from your lovely viewpoint in Strasbourg do you observe any significant cause for concern, for example, about the lower pay or less up-to-date equipment of UK scientists relative to the French and German scientists?

(Mr Posner) I speak to you as an international man. I treasure my British passport but I am an international employee. I have views about what goes on in the UK. I do not want to get confused and it is so difficult to get supportive data. However, let me say some things. As regards pay, I do think this is important. I know I am an economist and a fault of economists' training is that they are always interested in money. Your Committee was talking to the CBI about this. Honestly, the reason why young people are not going into science—I speak as a former university teacher—is that if one is interested in the welfare of the young people one is advising, one tells them not to go into research: you do not need me to tell you the horror stories about what happens at the age of 30 if you have gone into the PhD route compared with having gone into the City. So pay is important but I have to acknowledge to you that it is my impression that the French do not pay their scientists any better than we pay ours; in fact, I would guess rather worse. Yes, I believe that in some ways things are better in Germany. I would, however, single out one feature in particular about science funding in Germany and also in France while I have been in Strasbourg, and that is that they have managed to maintain a fair steadiness of approach through the years and we in the UK have found that more difficult. I have been trained as a Ministry of Finance man, as a Treasury man, and I know that it is very easy to say public expenditure should be kept steady. That often means that taxation and what happens in the private sector should dance up and down, so I do not want to tell you it is absolutely necessary that science funding should be kept steady but science is a form of investment and it is very difficult to run an investment programme sensibly and effectively if the money is turned on and off. Looking back over the last ten or fifteen years I think the Research Councils here may not have done badly, but if you watch the fluctuations and you see from their point of view how it looked

[**Mr Flannery** *Contd*]

each year planning for the next year, then things are not so good. I think that is the contrast between us and some of our European partners, which is important. I believe that our scientists are extremely good and I believe that they do extremely well in competing for the money and the projects in Brussels. That is how I see it. Maybe they are not always as good as they ought to be in turning them into industrial profits later, but that is a familiar lament. On polymers, which you were talking about, we run a modest little programme on polymer surfaces. Professor Pethrick is on our steering committee for that programme. He is, I think, from Glasgow, University of Strathclyde or Edinburgh and he would be rather shocked to be told there were no polymer scientists in the United Kingdom. I know that two predecessors of Professor Mitchell in the Science and Engineering Research Council—Sam Edwards and Geoffrey Allen—were polymer scientists. So I guess that, even in particular fields which are a cause of worry to informed persons, the United Kingdom is not all that backward. I think it is much more important to see ways forward for Europe as a community of scientists than to be too worried to compare ourselves with the beauties of other countries—but then I would say that, it is my duty to say that.

Mr Bowden

185. How do you see the national and European role developing in relation to the changes which have recently taken place in Central Europe and Eastern Europe? What impact will the political and social changes there have on collaborative programmes and how they develop?

(Mr Posner) We are taking the changes extremely seriously. We always had a fairly good contact with individual scientists in Eastern Europe and the Soviet Union. I guess there is probably not a single one of our programmes at any rate which has not got somebody from the Eastern countries deeply concerned in its work, and that is probably true of most of our networks as well. We have no Member Organisations in the former Socialist bloc. There are distinct signs that that might change. I am doing a little travelling in Eastern Europe next week and I will be talking to one or two of the Academies there. We are interested for two reasons. First of all, there are a number of very good scientists there whom we would like to work with more closely in the common interest. Secondly, I suppose there is a general view in my organisation at the moment that we owe a bit of a duty to help colleagues who have been through difficult times and are now very short of decent equipment and opportunities. It will be sometimes expensive to do this but it may be a very good form of investment for Europe as a whole. There is a very good set of articles in the current number of "Nature" which are worth looking at from that point of view.

186. Will this require changes or modifications in existing programmes to accommodate new areas of research or will it require modifications perhaps to accommodate additional personnel so that it can be seen to be a truly collaborative arrangement?

(Mr Posner) I suspect more the second than the first. That is, I think it will be more about people than about changed perceptions of science, because even in the darkest of the last twenty years there has been a world of science which has existed apart from the world of politics. They have published in the same journals, met each other at meetings and gone and worked in Novosibirsk, so that people have not been entirely out of touch. But in drawing our Eastern colleagues into our work more fully we will be using their strengths and possibilities and helping them overcome their difficulties which will be a considerable challenge. In some fields, for instance, geology, the opportunities are enormous. People really do want to go and make seismic experiments in the stretch of land going up from the Balkans over to the Urals. Extreme interest is being expressed there. In the polar regions, where the Soviet Union have rights of access because of treaty rights and so on, there is very important work to be done. In space science there are clearly very considerable opportunities. The Soviet Union is at the front in one or two fields, I believe in fashionable things like non-linear systems and the mathematics connected with that. There are a number of scientists in different fields in both Poland and Hungary whom my friends know, not because they want to be nice to them but because they are very good scientists to know and do business with. So that is very important to us and we do not know quite how to cope with it, but we are trying.

187. May I ask a question, Chairman, which is possibly an improper one, of Mr Posner and Dr Smith? They will be quite justified in passing it. What role do you think the CBI should have in this field and what role do you think individual constituent members of the CBI should have in this field?

(Mr Posner) I think—perhaps this is because I have been brought up in too corporatist a tradition—that it is right and proper that concern for science and technology is felt by those who have managerial responsibility for British industry and I guess that my Research Council friends in the UK would think the same. There is always a bit of tension between those who want money spent on and resources devoted to applied problems and those who want to work more on basic issues, but I hope very much that they can come together. The field of polymers is an obvious example of that. I do believe that there is much more work to be done in Europe as a whole and I believe that there is a gap for Europe as a whole between the work which could be done by the basic scientists and that which the industrial scientists want to have done but have not the men

[**Mr Bowden** *Contd*]

to do. The sort of gap is often more gaping in Europe than it is in the United States. If the CBI complain about that, although they may not be absolutely right on particular details, they are probably serving a public function. I would not want to go further than that.

Mr Griffiths

188. Mr Posner referred to what I presume he saw as one of the major roles of the foundation, that of creating this European science community, and from the evidence he has supplied to us he sees the Network programmes as playing an important part in that process. Given that the Foundation itself is intending to expand this side of its activities, do you think that in fact, provided it was funded properly—because of course most of the funds come from the national Research Councils—that is an area capable of even greater expansion which would then have a much more beneficial effect, and exactly what does the Foundation see as its role and value to the research that is going on?

(Mr Posner) Let me say we are very proud of our Network contribution. We started it in response to a ministerial push, indeed through the Council of Europe rather than through the European Community, but it is the same people basically. We believe we do it better than other international organisations, much better, but when I wrote down on this piece of paper which I have offered you that we are thinking of expanding from four to six I thought of striking out those numbers because I guess if I were reading that I would say, "There must be some zeros missing. These numbers are too small. Why are you bothering with stuff on this scale?" I think that this is a field where we are an order of magnitude out. We have spent five years; I think we know how to do it; I believe we could do much more and very successfully and that might be an operation which, bearing the Eastern European aspect in mind, should be very considerably expanded.

189. Could you foresee the European Community itself developing something along similar lines or even joining with you? Are you afraid the elephant would be too close to you?

(Mr Posner) I am an optimist. I believe in human adaptability. I do not think we are particularly clever or all-seeing or something. There are clever people in Brussels; I presume they could do it but we have been trying for a while and they and others have also been trying to do it. With great respect to them, I think we have succeeded better than they have and I think there is going to be very much more of this. A lot more should pass through our hands but we would be happy also to see some diversification and other people doing things in a slightly different way. But it is running very well at the moment and it is fun. We believe we know how to do it.

190. Do you think that as a result of the Network programmes there will develop a sort of specialisation of labour in the science field where perhaps some countries or group of countries might provide a specialisation which will then be disseminated through the programmes to other countries which are not as heavily involved in those areas?

(Mr Posner) I noted your earlier discussions on this. I believe in that in principle and the smaller the countries the more important it is. There really ought to be a matching, for some people to do some things and some to do others. There will be complementary rather than straight competitiveness. I believe that is all true but then within each major place, counted by the number of citizens or amount of GDP or number of factories or whatever, there need to be sufficient receptors, antennae, listening to what is happening. It is no use for the British science establishment to say "We will not go any further with polymers. We will just wait for somebody else to do it." That is a good economist's position to adopt but there have to be sufficient men and women at home to watch what is happening, to know what is happening and be after it very quickly, to say, "This has consequences for other branches of science or for other industrial applications other than for what it is immediately employed." And in basic science it is rather hard to say the great universities could easily shut down half their laboratory space and use it for something more productive, so that I, like, I suppose, almost everybody else you talk to, am torn both ways. I want to say there should be more specialisation but I am also tempted to say, "Do not push it too hard," and it differs from case to case. I really think it differs from case to case. I was discussing this morning elsewhere in London exploration activity on the surface of the ocean floor and the next studies which need to be done the rest of this century to develop the technology so that submarine exploration can be done in a cost-effective and successful manner, and we were indeed discussing precisely that. We were wondering how on earth we could progress to back up with the cash involved all the little schemes we were developing, each individual one, sharing out amongst countries research contracts for those developments and saying, "This is a natural one for the Italians; the Portuguese could do that; the French and the British will compete on this one but there might be enough for both of them," and so on. I am not saying that this is always right and proper and it is easier to talk about it over a cup of coffee than actually come to a workable agreement. But, yes, I do believe that, particularly on technology-rich investigations in basic science work which requires a lot of engineering to back it up and to process the data and to keep the ship in the same position while the experiment is being done, that just must be shared out in the way which you were describing. I think the answer I give is horses

[**Mr Griffiths** *Contd*]

for courses. Sometimes it is right to share things out, sometimes it is impossible, and it depends on the field of science we are talking about.

Chairman

191. Dr Smith, you have sat very patiently and we are coming to the last few minutes of our session. Is there anything you would like to add at all on any of the points raised?

(Dr Smith) If I may say two or three things on the social sciences and the humanities, you can see from your witness list that I am on secondment to the European Science Foundation from one of the UK Research Councils, the Economic and Social Research Council. I think what is rather unique about ESF is that it does incorporate social sciences and humanities in its broad remit of work, and I think, more importantly, when we try and stimulate interest in launching European wide programmes in these fields these programmes are discussed in the forum of all the sciences. You will see in the magazine we have a programme on 'Environmental Science and Society'. For that programme to succeed we have to convince people in the natural sciences councils that bringing some economists and political scientists to look at human behaviour aspects of the environment will help the general debate about the way in which environmental research should develop. So I think this broad perspective, including basic research on a European level in the social sciences and humanities, does give added value to the work we do. I would like to say I certainly do not find any shortage of enthusiasm amongst UK scholars in social sciences and humanities to get involved in creating networks and benefiting from interlinking with European colleagues. I think that is really a very positive sign. We always find interest and people willing to work at extra cost to themselves in getting involved in our activities.

Chairman: Thank you both very much indeed for coming along. It has been a very interesting and, I think entertaining session. We have thoroughly enjoyed it.

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HOUSE OF COMMONS SESSION 1989–90

THE EDUCATION, SCIENCE AND ARTS COMMITTEE

SCIENCE POLICY AND THE EUROPEAN COMMUNITY

MINUTES OF EVIDENCE

Wednesday 2 May 1990

COMMITTEE OF VICE-CHANCELLORS AND PRINCIPALS

Professor B Fender, CMG, Professor R J Haynham, Professor D Davies, CBE, FRS, Dr D Roberts, CBE, FRS, Mr D Young and Mr M Powell

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WEDNESDAY 2 MAY 1990

Members present:

Mr Malcolm Thornton, in the Chair

Mr Jacques Arnold
Mr David Evennett
Mr Harry Greenway
Mr Win Griffiths
Sir Gerard Vaughan

Memorandum submitted by the Committee of Vice-Chancellors and Principals (ES 17)

1. Vice-Chancellors and Principals have noted and welcomed European Community policy in providing a valuable complementary means of support for research, encouragement of a greater degree of cross-border contact between research workers and a means of making possible very large-scale projects, and those which are primarily regional or continental rather than national in their scope. It is necessary to safeguard the widest international view of science and to avoid isolating Europe from important developments elsewhere in the world, particularly in Information Technology where Japan and North America are so important. The opportunities arising from EC initiatives in setting up cross-border programmes for applied strategic and pre-competitive research have nevertheless enabled individual universities to move forward in some fields at a more rapid rate than they would have been able otherwise to achieve. They have enhanced the quality of research by bringing together specialists from all over Europe.

2. Universities have expressed some frustrations with the way in which the EC actually operates its policy and have identified a number of concerns, together with proposals for changes.

EC Role

3. EC sponsored research is designed ideally to complement that sponsored by individual member states and in particular to concentrate on supporting research at the pre-competitive stage. However the EC sponsors a comparatively small element of pure research which could usefully be increased, the more so since United Kingdom higher education institutions have been particularly successful in bidding for EC support for curiosity-led basic research of the type that does not have immediate commercial application. Nevertheless universities believe that the bulk of this kind of research should be funded and provided nationally. In the field of applied science and technological research and development, which may lead to commercial exploitation in the short or medium term, universities believe that smaller projects should remain under national control and funding. They confirm the advantage for very large programmes, both pure and applied, and those which involve regional or continental science and technology (for example, environmental and pollution problems and resource and meteorological surveys) to be funded and organised by the European Community. There can be major gains from economies of scale and the building of expertise in order to seek major advances in science. EC funded projects benefit from more widely based teams and there is a role for the EC in the co-ordination of support for potentially significant topics where the initial activity is in a small number of widely dispersed research groups. There may be a good model in the British Council's British German Academic Research Collaboration Programme.

4. There is widespread concern about the EC's cumbersome procedures. Considerable time and travel is involved in setting up collaborative arrangements before any award by the EC is made. Several universities have expressed concern about the way in which awards are made. It is suggested that procedures could be simplified by appointing small groups of experts from national scientific societies to operate straightforward procedures. It would be particularly helpful for universities to have feedback from the award-making bodies.

5. It is generally agreed that the success of existing EC programmes indicates that their extension would be advantageous.

Priorities and mechanisms for European research

6. There is general support for the EC's priority accorded to strategic initiatives. Several universities have suggested that there should be an expansion of both numbers and range of grants to support mobility of young research workers. To a degree the new Framework programme will help in this regard. Some universities would appreciate formal procedures to help and define suitable applicants from other countries for mobility support.

7. The EC system provides either half costs where audited detail is available or additional costs with a 20 per cent allowance for overheads. In practice, the latter is approximately the same as the former. An important issue arises over indirect costs. British arrangements through the then University Grants Committee provided a topping-up of research council funds to cover a majority of the indirect costs incurred. After transfer of funds from the UFC to the research councils, a similar proportion of total costs is expected to be covered by grants. Some universities have observed that there is little incentive for them to seek EC grants if they have to find a much larger proportion of indirect costs themselves. Nor is it an argument that universities could become sub-contractors to industrial companies. The latter have little incentive to enter into arrangements of this kind in exchange only for the ownership of the

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intellectual property generated, since they will generally be satisfied with non-exclusive licences which are automatically available to them under straightforward EC collaborative arrangements. The universities therefore believe that there is a strong case for a special UK fund to top-up European community contracts to a level comparable with those obtained from the research councils.

8. It is also suggested that the EC should have regard to the regional implications of its research funding decisions. The present EC priority of enhancing European international industrial competitiveness is tending to have a centralising effect through the close association of research, development and industrial location. Future EC programmes should lay greater stress on technology transfer between European regions to ensure a better geographical distribution of research resources.

HE/Research councils

9. Universities have observed that research groups which have been successful in attracting EC support are those which have already established a "track record" of national Government funding for research projects. They tend to have existing international and industrial contacts and have developed expertise, usually through research council contributions to funding basic research, allowing young scientists to develop and prove their potential.

10. Those universities which have been particularly successful in attracting EC funding report modest changes in their own priorities. These can take the form of an acceleration of already desirable change. They have also in some cases given rise to strain where European and British criteria appear to diverge. In mechanical engineering, for example, one university has been successful in attracting EC funding but is relying on equipment which it may not be able to replace because UK support is no longer forthcoming. A painful contrast is drawn between the equipment available to the British university and that available to its continental partners. If British universities are to continue to be able to compete it is essential that their equipment base be maintained. Both the ABRC and the CVCP have pressed Government to provide an adequate level of equipment for research.

11. One university notes that planned EC expenditure on education-related topics is set to rise significantly in the third round of the Framework programme. Although for research there are well established, though far from perfect, procedures for judging quality and allocating resources there is at present no such recognised procedure for education-related topics. If selection of projects becomes an issue, there will be an opportunity for the United Kingdom to influence the form of selection procedure which is used.

12. There are special difficulties in the medical research field. There should be greater co-operation in health services research throughout the EC. The testing of pharmaceuticals often calls for very large numbers of patients to be enrolled in order to get reliable answers. The collaborative European effort required for multi-centre trial research calls for collaboration amongst health services as well as with companies. Collaboration may bring a considerable financial benefit to health delivery costs, but may not directly benefit the manufacturer. The view has been expressed that collaborative projects of this kind should be restricted to groups of two or three countries, to limit the diversity of health care systems in any one trial.

13. After extensive consultation with a wide representation from European industry and academia, the EC has produced a harmonised form of contract which has been adopted by its principal Divisions. Once EC procedures get to the contract stage, signing of the contract is a relatively rapid process. It would be a considerable benefit if similar developments took place in the United Kingdom. It seems that the Link programme operates to a slightly different set of rules for each contract. In particular, the requirement to specify terms for the transfer of intellectual property at the outset could be avoided altogether if the EC practice were followed of leaving intellectual property in the hands of its producer. Universities which are active in EC collaborative projects confirm the new and beneficial dimension which has been added through broader contacts with other EC member states.

Government Machinery

14. Universities have stressed the need for national research to be better co-ordinated with EC programmes. As far as the research councils and the universities (the "science base") are concerned, the research councils' office in Brussels is well placed to influence European Community policy, and is increasingly effective in helping to establish direct contacts between collaborating institutions. The role of the research councils in advising Government should be complemented by means (such as the Co-ordinating Committee for Marine Science and Technology) which would enable higher education institutions directly to influence policy. For example, the existence of the Alvey network has aided UK representation among firms, universities and polytechnics in the area of information technology. Universities suggest that representation is much weaker in health and biotechnology, where UK involvement is predominantly academic but representation is by the DTI's Biotechnology Unit. Only universities and departments making their own liaison with the EC have much knowledge of EC programmes. The more general point is that the DES is concerned with research other than the "near market" research which falls within DTI's purview; but that representation in Brussels is led by DTI. Universities would welcome a significantly larger role here for the DES. The European Commission itself would welcome a greater direct contribution from universities to policy information. Individual UK universities need to be more deeply involved.

15. EC funding should be viewed by Government as additional to an already overstratched UK science budget. As such it has implications for initiatives to increase the level of scientifically trained

manpower in the UK and to expand science education in schools and in higher education. These matters should be the concern of a body able to take an overview of the implications of EC programmes for the UK. It may be that ACOST should take on this task.

Summary of Recommendations

(i) EC priorities should allow more basic research in EC programmes. (Paragraph 3).

(ii) It would be helpful to UK universities if there were formal means of co-ordinating support for potentially significant topics where the initial activity is in a small number of widely dispersed research groups (paragraph 3).

(iii) EC should clarify its procedures and criteria for making awards and permit feedback to bidders (paragraph 4).

(iv) EC priorities should provide more resources for the mobility of young scientists (paragraph 6).

(v) The UK should provide funds for topping-up EC contract research to cover a proportion of overheads similar to that of a research council/UFC grant (paragraph 7).

(vi) The EC should have regard to the regional implications of its funding of research (paragraph 8).

(vii) Steps should be taken to maintain the equipment base of British universities, without which they will be increasingly in difficulty in competing for EC funding (paragraph 10).

(viii) There should be greater co-ordination of health services research throughout the EC (paragraph 12).

(ix) Public sector bodies in the UK should adopt harmonised forms of contract on the EC model (paragraph 13).

(x) The implications of EC funding programmes for UK levels of scientifically trained manpower and for the expansion of science education in schools and in higher education should be reviewed as a whole by a single body such as ACOST.

26 October 1989

Examination of Witnesses

PROFESSOR B FENDER, CMG, Vice-Chancellor, University of Keele, PROFESSOR H J HANHAM, Vice-Chancellor, University of Lancaster, PROFESSOR D DAVIES, Vice-Chancellor, University of Loughborough, DR D ROBERTS, CBE, FRS, Provost, University College, London, MR D YOUNG, Assistant Secretary, CVCP, and MR M POWELL, CVCP Secretariat, of the Committee of Vice-Chancellors and Principals, were examined.

Chairman

192. Good afternoon, Professor Fender, may I welcome you and your colleagues to the Select Committee this afternoon and say how very much we appreciate your coming along to assit us in our inquiry into European science. As a start, could you introduce your colleagues to us, please?

(Professor Fender) I would be happy to do so. Derek Roberts, Provost of UCL, London. Professor Den Davies, who is from Loughborough University. Harry Hanham, who is Vice-Chancellor of Lancaster University. David Young, from the CVCP office and Michael Powell, also from the CVCP office.

193. Thank you very much indeed. We have got about three-quarters of an hour in which to explore with you certain questions which we would like to discuss with you to help us in our inquiry. Very briefly, we will talk for about 15 minutes on each heading, but it will be general discussion and colleagues will be able to come in as and when they wish. Do feel free. Anybody who wishes to comment, will you catch my eye and we will be delighted to hear from you. I will make a start in the first area, which is to talk about the science base. The universities spend something between £1 billion and £1.5 billion per annum on research. All of this is civil research and therefore represents a considerable proportion of the total national effort in this category. You are, therefore, in an excellent position to comment on how strong the UK science base is today and what its future strength will be if present trends continue. Can I invite you to start off on that, please?

(Professor Fender) It is a large sum—£1-£1.5 billion—though, of course, it is still a relatively small fraction of the total R&D civil expenditure. What is the current position of that base? I think one would have to say that there are areas for concern, there are undoubtedly strengths in British science and undoubtedly many sectors of British science are very competitive, but it is also true that there are severe shortages of funding which I think will show up in the future, and in the European context, of course, it will show up in the competitive way in which we go for European funds. I can be more specific, of course, about where I think the shortages of funding lie. In general terms, it is undoubtedly a shortage of money at the Research Council level, in being able to respond to good projects which exist, and you are no doubt well aware of the success rates, or rather the very low success of many good projects which are put forward. In the area that I have direct experience of, in the Science and Engineering Research Council in the general science area then we are talking about responsive grants of the order of £40 million a year, that is

[**Chairman** *contd*]
roughly the sum we spend. We could, with very great effect, spend £60 million or £70 million; we are wasting effort simply because we are not putting the resources into the hands of researchers who are keen to do it, and the story is a very similar one in engineering as well.

Mr Greenway

194. You say that it would make difficulties for our competitive effort in dealing with these people later; that was how you put it. I could not understand the remark, it had no meaning that I could see?

(Professor Fender) I think it does; it is clear. Remember that European competition is very largely the result of successful partnerships in a network, so you have got to show that you are a good potential member of a partnership in order to get funding. There are several reasons why we might not be a good partner. Certainly, we have got bright scientists, but in terms of resources we may not have enough up-to-date equipment. You are aware, I am sure, of the ABRC survey on equipment, and all the anecdotal evidence I am sure that you could get from this side of the table would demonstrate that we are very short of equipment. If you are going into a project in which you are contributing your bit of that partnership then it does depend upon the resources and back-up that you have got. We are short of equipment and we are short of up-to-date equipment.

195. What do people like yourself, who are so heavily involved in it, do, in terms of public relations, to convince the nation, to convince the people who produce the money, that they should pay more? They do not know anything about what we are discussing. What are you doing about that yourselves?

(Professor Fender) Do you mean, as it were, getting at the *grande publique*, the man on the street?

196. *C'est ça.*

(Professor Fender) That is a good question.

Sir Gerard Vaughan

197. Really, we are operating in a sort of fog. We never get a straight answer on these matters. What we want to know is how much does it matter, all this?

(Dr Roberts) Let me answer Mr Greenway's question and then answer the more fundamental one, "Why does it matter?". One of the things that we do is come here today, to talk to you and to try to influence you, because we regard, obviously, Members of the House of Commons as the most important single sector of the UK population that we need to persuade on these things; so this is one thing we do. On a personal basis, over the last three months I have been on radio twice and television twice, I have written articles and letters to various newspapers and given interviews to newspapers, and so on, and that is just my personal response, the things I am doing.

Mr Greenway

198. You are to be commended, Sir. What about your colleagues: how many letters have they written and how many interviews have they given?

(Dr Roberts) Could we go back to the more important issue, because unless we address the question of why it is important we should not even waste our time doing it. What I would like to suggest is that if we go back to what the implications of research and research funding and participation are, let us not approach it from a purely inward thing, of why we, as academics, doing academic research, think it is important; let me speak from the point of view of somebody who was 35 years in industry before moving into this and talk about why it is really important. The first thing to suggest is that one of the principal reasons for having research within universities is to make sure that we have absolutely top-flight people within universities doing really stimulating teaching, highly-motivating teaching, to make sure that both the quality of the inspiration and the quality of the material is up-to-date. The most serious aspect of allowing a decline in research to take place, in my view, is not just the erosion of the research base, important though that is in itself, but the wider erosion of the quality of education that flows from that, and these are people who are not going to be research scientists but people who are going to move out into industry and commerce throughout every function within an organisation. That is the real threat. Let me just come back on one other specific, in terms of where the shortages of funds are really biting. I agree with everything that my colleague has said about equipment, and so on, but I think that the key issues, actually, are not to do with equipment, they are to do with people. The really key issues, which are really, if we are not careful, going to drive university education and research in the same route over the next 20 years as has happened in schools over the last 30 years, are that the erosion of the self-esteem and the pay and the rewards available to academic researchers and, indeed, young research staff are such that we are actually not generating the seed-corn. The low level, for example, of awards available to young Ph.D. students means that it is very difficult to persuade young people—even more difficult if they finish as a graduate with a loan that they have to pay off, whether it is based on the new loan system or whether it is based on a current overdraft—and if they are then presented with working for a Ph.D. for £4,500 a year or getting a job for £15,000 what are they going to do? If we do not get people coming into research at that stage—they are the people who really do the research under the guidance of the senior

[**Mr Greenway** *contd*]
people—if you do not get research students you can forget research, even if you have equipment, and if you do not get good people coming into research and going on to post-doctoral fellowships and then coming on to the staff, where are going to be the creative teachers and educators in 20 years' time? That is the seriousness of the issue.

Mr Griffiths

199. Can I say that I do not think it is either your function or particularly ours to persuade the person in the street that he has got to go rushing off writing letters to say to the Government, "Please increase research funding". If a Government cannot see the need to increase research funding then we are in a very, very sorry state of affairs altogether. Do you put down this lack of funding simply to an overall Government policy of wanting to cut public expenditure, or do you really see it as a fundamental problem in the organisation of government in Britain, where we do not have a proper Ministry of Science and Technology? Would you like to see a revamped Ministry on the lines, perhaps, of something you have seen in some other European country or even a country further afield?

(Professor Fender) First of all, undoubtedly Government policy and the desire to cut public expenditure has hit rather hard and, as a consequence, if you like, there has not been enough investment in the increased wealth of the country over the last few years. That is an aspect which undoubtedly hits home hard.

Mr Arnold

200. Could I just ask, at this stage, has Government funding on research gone up or down, in real terms, over the 10-year period?

(Dr Roberts) It has gone down.

201. Can you quantify that?

(Dr Roberts) The answer is down.

202. Can you quantify it, chapter and verse?

(Dr Roberts) No, but if you are interested you can get the details: ask the ABRC.

Chairman

203. We will be interviewing them shortly.

(Dr Roberts) Can I suggest one other thing, that when you ask them apart from what they can quantify, you also take one other factor into account. You talked about the total £1-£1.5 billion spent within the universities; I presume that that is the total based really on two sources, as far as public expenditure is concerned, one flowing through the Research Councils and the other flowing through the UGC/UFC on the so-called dual-support system, so that it is when you add those two things together that you get this sum. One thing which you might like to bear in mind, which does not seem to have been picked up, is that compared with the situation two years ago, when under the old dual-support system the funds that were flowing from the UGC were at a level of 40 per cent of the cost of the Research Council funds in order to provide the basic underpinning, in the year in which we are presently that has dropped to, I think, to 38 per cent and in the year that we are about to enter it is forecast as being 34 per cent. That decline in dual-support, which does not figure on the Research Council expenditure at all, that decline in underpinning from 40 per cent to 34 per cent, implies a 6 per cent reduction in real terms just over the last two years and that is against the background that the general talk is about increase.

Mr Greenway

204. These bodies have been expected to draw their own funds from industry, and if you take Salford University it has done so substantially?

(Dr Roberts) That is not relevant, if I may say so.

205. It is most relevant.

(Dr Roberts) Please, it is not relevant. I will tell you why. We draw many more funds from industry than Salford University. The point is that you draw funds from industry to do the research which industry wishes you to perform. You do not get industry to underpin the basic and strategic science ——

206. I am not saying that. I am only saying that this is an additional source of funds?

(Dr Roberts) But you do not solve the problem of basic science ——

207. I am not saying that either. It is no good having nit-picking arguments if we are talking in broad terms?

(Dr Roberts) If we talk in broad terms we do not get anywhere.

(Professor Davies) The question was about basic research.

Chairman

208. Can I just interrupt for one moment. I am all for a degree of cross-fertilisation between two sides, but I would like some of the questions answered. We have a limited period of time and perhaps we could avoid unnecessary interruptions, whilst recognising that it may be necessary to pick up on the odd point that is made here and there.

(Professor Fender) Can we just say something about the total resource. Even if the Research Council, the ABRC, funding has shown a modest increase, that has to be balanced by the cut in the availability of funds in the university and polytechnic sector as well, and as far as research is concerned you are concerned about the total sum

[**Chairman** *contd*]
that is available. In any case, it is a lot less than the growth in the national wealth over the last few years.

Mr Griffiths

209. Chairman, I still have not had my question answered, because of the interruptions. This was whether, in fact, we need a revamped Ministry of Science and Technology and were there any countries which they thought may be a model for such a Ministry? Are you saying that the only reason for the cut in funding is because of the Government's desire to cut public expenditure, or is there something more fundamental in the way in which we approach the funding of research

(Professor Fender) A Minister of Science is one possibility but is not necessarily the only solution. It is quite clear that universities can contribute to several government activities: there is the DES activity, there is the Environment, there is the MoD, and so on. University research impinges on nearly all the main government ministries, including Health, of course, which is a very important sector, and, increasingly, one certainly needs co-ordination of those activities. Whether you achieve that co-ordination through a Minister of Science or whether you do it by other means, it seems to me that it is not obvious what the answer to that is.

Mr Evennett

210. I was very interested in Dr Roberts' comments until he threw in the red herring about student loans. The most important thing is that schools seemed to give up science in the 1970s; the result was that science tended to be boring when it should have been exciting with the technological developments of the age we live in, and it was not. Therefore, we seem to have seen a drop in the number of young people wishing to study science by going on to university and polytechnics. How can we reverse that trend? You want to see more money going into research and I think part of the battle has to come from the other side as well, getting more students in, getting more publicity across the whole spectrum of opinion within society. Nothing succeeds more than success and if you can get more students into university and polytechnics to do science and engineering then they themselves will be a good focal point for more funds to do advanced research. How can we break this cycle of what I see as less science in schools, although the National Curriculum, of course, has brought science back into the forefront in schools?

(Professor Fender) Dr Roberts has given you one answer, has he not: he has given you an answer in terms of how young people perceive science and engineering, and where do they look? They look at their teachers, they look at academic staff, they look at post-graduates, they look at young researchers and they make their view, and on the whole they are rather sharp at making a view about whether that is a profession or an activity which is well regarded by society or not.

Mr Evennett: There are an awful lot of professions which are not well regarded by soceity which do not have a shortage of people coming into them.

Mr Greenway: Such as Members of Parliament.

211. My colleague mentioned Members of Parliament; there is never a shortage of people wanting to become Members of Parliament and yet they are not perceived as whatever. But can I say that that is just not true, enhansing the status of scientists, that is one way but that is not the only way. There must be other alternatives to encourage people, if only on the fact not of what other people's view of the profession is but what you want to do because of the excitement and the opportunities. Why are you not getting that across to the young people?

(Professor Fender) We try, and in a lot of cases we do, but, for example, in the United States that is not thought to be enough and the National Science Foundation makes available about $200 million a year for direct encouragement of specific educational projects. Some of those are very strongly targeted into schools, some of them are targeted towards women, some to minority groups, and so on; so there, there is a very proactive effort to go out into the schools, bring people onto university campuses and demonstrate the excitement of science, to which you rightly draw attention.

(Dr Roberts) If I could say two things. First of all, you said that there had been a decline in science in schools in the 1970s. I think there has been a decline in science in schools back since the 1950s and I referred to this earlier when I talked about the problem with respect to people over a 30-year period. The problem which we are now addressing in the schools—and I promise I will give you a positive reaction about some of the things we are trying to do in order to cope with it—is that I think we should recognise the underlying problem why even changes and improvements in the curriculum will not actually solve the problem, they may marginally alleviate it. The fundamental problem with respect to science in the schools is that there has been developing over 30 years, and it just happens to be getting more and more acute, a shortage of people teaching in the schools who themselves are enthusiasts and practitioners in the field of mathematics, physics, etc, etc, etc. I am sure you know that, and that is the underlying problem. The fact that you see it in the 1970s is because the cumulative impact has made it rather catastrophic. My concern on the university sector, incidentally, is that I believe we are sitting today in the same situation that the schools faced in, let us say, 1960. Because nothing was done at an early stage in dealing with what should have been analysable as a potential disaster, it means that 30

[**Mr Evennett** *contd*]
years' time we will have the same situation. What are we doing about it? In the short term I quite agree that we have to get out into the schools, not just on our own but also jointly with industry, because this has to be a joint activity, to get at the 14, 15 and 16-year-olds, and not just the sixth formers, and try to influence their choices of A-levels. One of the things that I have committed UCL to doing, even though we do not actually have any money to do it with, is to launch sixth-form scholarships in schools that we interact with; that we will offer competitive scholarships to people reading physical sciences in the sixth-form. We are also talking to various companies in various sectors—the electronics industry, the manufacturing industry, Japanese industry, the finance sector—and inviting them to participate and share the cost of these, on the basis that in that way we can afford twice as many. I have no doubt that other universities are doing similar or different or better things; so we are not actually just sitting on our hands and moaning, we are actually getting out there and trying to do something about it.

(Professor Davies) Can I come in on that. I agree with you very much that this is one of the problems and, of course, the problem is not that the schools have turned away from science but that the schools have failed to recruit the staff who would motivate students in science, and if we look even at the university side, at the moment, students want to come to us in droves to read management, to read law; very few want to do education and become school teachers. Even of those who do, a high proportion, when they have actually qualified, decide not to go into schoolteaching, and that is the thing which, I think, is frightening, which you have really got to get back to. We do all we can. Last week at Loughborough we ran an engineering experience course and got 500 school-children to Loughborough to tell them about engineering, we got industrialists to tell them about industry. This way we are chipping at the edge of the problem, but basically we need high-quality teachers who will motivate school-children. That will have the desired effect; but it is going to be some years away yet and it is something which, as a university, we have great difficulty in doing ourselves.

Mr Arnold

212. I am rather fascinated that throughout your explanation so far you have never once mentioned the relative pay of scientists and engineers within industry, the applied side of your business; you have solely referred to the universities. Is not that, the relative importance that the economy gives to scientists and engineers, of particular relevance?

(Dr Roberts) I do not think it is, and I speak as somebody, as I say, who comes out of the electronics industry. Why it is not, why it does not worry me, is because that is self-adjusting. If the fact that a job as a raw, graduate engineer gets you, say, £14,000 as a starting salary, whereas going into the City gets £20,000 plus a Porsche, if there were enough of those jobs around; you hear about the big numbers but they are relatively small numbers of people. Nevertheless, if the situation became really serious, and let me speak from the point of view of GEC (I am still a director of GEC) and GEC recruits about 1,500 scientists and engineers each year, in spite of the flow of young people into the financial sector——

213. And miserable pay in GEC?

(Dr Roberts) If you like, but in spite of the miserable pay I made the point that they still recruit 1,500 scientists and engineers a year, which is more than any other organisation in the country. If, as a result of competition from the City, GEC found that it could not actually recruit the 1,500 people a year then it would put the salaries up and it is in a position to do that. The reason why I argue the problem vis-à-vis salaries in the university sector is that we are not in a position to do that. We are in the situation where the control of our funds prevents our reacting to market forces. I will give you a figure from the point of view of UCL. In spite of all this talk we have heard about the universities having a 10 per cent increase in the funds available, and therefore that should be the level of the proposed pay settlement, in the case of UCL the increase in funds year-to-year that are in total available, not available for a pay settlement, in fact is 8.1 per cent. When you deduct from that the 1 per cent that has got to go into changes in the taxation system on payment for fuel and sewage, when you allow for the fact that since we are taking on a lot more students we do need a few more staff, when you take account of the fact that we are incurring maintenance expenses as a result of responding to Government legislation—good legislation, in the areas of COSH, and so on—if you actually go through the arithmetic, and we are willing to make this arithmetic available to anybody, what we can actually afford is 5.5 per cent. You can imagine what 5.5 per cent sounds like to people against the background of inflation that we did not actually create.

Sir Gerard Vaughan

214. Before we leave this section, really what we want to talk about is this; you are probably one of the most important groups of witnesses to come to us when we are talking about science in this country, and we are very anxious to find out your views on whether the science base in this country is satisfactory or not. I just wonder, before we go off the subject, is there anything else that you would like to tell us about it?

(Professor Fender) We have touched on most of the issues, have we not? We have talked about salaries, looking at it narrowly through our

[**Sir Gerard Vaughan** *contd*]
perspective, it is academic salaries, it is the crucial question of post-graduate stipends, and unless we put those up there is absolutely no doubt that we will be cutting off our seed-corn in a serious way; and I have mentioned the question in equipment.

215. How desperate do you think the situtation is?

(Professor Hanham) I do not think this position is absolutely desperate because the quality of the work being done in British science is still extraordinarily high. The trouble is that we are not getting bright young people coming in. If you advertise lectureships, the number of candidates tends to be tiny; in many cases there are, essentially, no candidates in the first round. What you are talking about, therefore, is a situation in which people do not believe that the sort of equipment and conditions which would enable them to work effectively are available in the universities and, as many of our students now spend a lot of their time in France and Germany, the United States, and see alternative conditions they have a comparative base. What we are talking about is not the level of achievement of the people in science, that remains extraordinarily high, but the next generation.

Mr Greenway

216. Could I just clear up one thing with Dr Roberts, because he said that he thought the National Curriculum was not going to contribute to the improvement that was needed. I take the point which has been made about salaries for the profession at university and polytechnic level and for post-graduate students, but you have only referred, Dr Roberts, to higher levels of secondary education and the National Curriculum is getting science through to primary school children for the first time in large numbers of instances. Would you not expect that to be effective in the long term?

(Dr Roberts) I am sure that will help in primary schools, yes; but does it really help? This is not an argument against getting science into primary schools; I think that is a jolly good thing, obviously. However, having done that good thing, we do not actually solve the problem that we were talking about at our particular level, and this may not be the most important level, actually. Young children who have been excited about science at primary school level are moving on through the education system, within what may well be an absolutely first-class curriculum, but the quality of teaching is determined not by the curriculum but by the quality of the teachers, and the fact that somebody leaves school and wishes to read English literature or physics or history or chemistry is going to be determined by the quality of the teacher, not by the particular shape of the curriculum; that was the point that I was trying to make.

Mr Greenway: I understand that. I was myself teaching in 1960, though, and I have to say——

Mr Griffiths: So it is your fault, then!

217. I am sure I have some responsibility, Win. You were teaching yourself, but not as long ago as that. I do not see that science teachers are any worse now than they were then, if you do not mind my saying so.

(Professor Davies) If you advertise a job in school in physics you will probably get one or two applicants. If you advertise a job in history you will get 50.

218. It was the same in 1960. It is a very long-term situation?

(Professor Davies) A high proportion of staff who teach mathematics in schools are not even trained in mathematics because we cannot actually get enough mathematicians to do it, and that is part of the problem.

Chairman

219. The science base area is obviously really the meat of our discussion today. There is just one aspect of this on which I would be interested to press you a little. We have just had mention of the comparisons with other coutries. Could you say a little more about how you feel the UK science base situation compares with that in other countries?

(Professor Fender) Again, as you know, it is very hard to get absolutely hard, quantitive information, but I would have thought, just going round, visiting countries, there is no doubt that we do not fare as well as do the French and the Germans; the Germans, of course, are immensely rich in science funding, both in their universities and in their national centres. I have rather direct experience of the French situation and, again, I would say that their funding is better than the British. Others no doubt have experience in other countries; Harry, what about you, you travel a lot in Europe?

(Professor Hanham) The difficulty about this sort of thing is that there is a league table of really effective countries, in terms of providing education and science together, and not every country tries to do it. We, the Americans, and to a considerable extent the Germans, combine in the universities a big scientific operation and teaching. Not all countries try to do that. It means that it is very difficult to make comparisons. The French have got a sort of compromise because their universities are mostly single-purpose; that is, they are more like our faculties, and it is easier in a science-based university to have an associated set of scientific institutions. The Germans, who have all-purpose universities, have got a system something like ours but they also have very big national institutions which are closely connected with the universities. In terms of funding, and so on, they are at the forefront at the moment. The Japanese, who you would expect to be doing really rather well, have tended to put most of their money actually into industry rather than into the universities. In the United States the pattern is rather like ours, the amount of money going into universities at the moment is falling and there is

[**Chairman** *contd*]
great dissatisfaction in the scientific community in the United States at the moment on that basis. The people who acutally have basis for judgement are people like GEC or Unilever or any multi-national company that is trying to employ people, because they have to engage in joint research. They get a much stronger sense of how far the university labs or the industrial labs and the Governmental labs compare with one another.

(Dr Roberts) Can I follow that up and give you just one simple illustration of the fact that the UK is in a financially disadvantageous situation, in terms of academic research. If we are talking now about European Community-funded research on the various schemes, whether it is ESPRIT or BRIGHT, or what have you, then, certainly, sitting within UK industry and trying to get collaborative programmes going, from the point of view of the value of the scientific and engineering contribution, there has always been a very strong incentive for UK companies to involve UK universities. There was never any feeling that you would be better off technically to work with a German or French, or whatever, than the UK. One did work with the others because it was intrinsic as being necessary for it to be Community-funded. The very serious problem that has emerged, though, in recent years, the last two or three years in particular, and I have only become aware of it since moving into the university sector, is that the UK universities are finding it increasingly difficult to be able to afford to participate, to be able to afford to accept European Community research funds. When a new project is being put together in advanced information technology, with three or four companies from different countries and three or four universities, say one French, one in Germany, one in the UK, you then find that the UK university has great difficulty in being able to afford to participate because the funding basis that the European Community operates on, which is perfectly acceptable to the German and the French and other universities because they get adequate base funding, is at a level which, implicity, the university taking on the work is being asked to subsidise the research out of funds which it does not have. This is very serious, if only at the level that nationally, as a taxpayer, we are contributing to the framework programmne and we are putting our cash in, and if we are not careful we are not going to get our share back because we cannot afford to take it.

Mr Evennett

220. Do you think, though, that in the past the universities have been rather slow in getting more money from industry than perhaps other universities abroad; that the universities have been more keen to look for their research across the whole wide front from public funds rather than from private funds, as they do in the United States, for example?

(Dr Roberts) I do not think that is true. The United States data is based on four or five out of whatever the total number is there. If you look at the relative data across the whole sector, I have not got numbers in my head, perhaps our colleagues have, but if you look across the whole of the United States scene and the whole of the UK scene I think you will find that the industrial participation support in the UK is very similar. We do not have situations comparable with, say, MIT or Berkeley or Stanford or Cal.Tech, but when you have named those and three or four others that is the lot.

(Professor Hanham) I was for 11 years a Dean at MIT and I can assure you that the position at MIT was not as described. The amount of direct industrial involvement was, in fact, very limited because companies in the United States, as here, take the same line. We pay taxes for fundamental research, and so on, which is going to be of use to everybody. The best basis is actually a public taxation basis, so that the big universities, even private universities, like MIT, rely for scientific research overwhelmingly on governmental funds.

Mr Griffiths

221. You mentioned the difficulties your universities were having, getting involved in European Community programmes. Could you perhaps tell us about both the financial and administrative arrangements, whereby universities obtain funds through European Community framework programmes?

(Professor Davies) My university did quite well last year; I think we had over £2 million mainly for IT research. You tend to find that those departments and those areas which have the strongest contacts within Europe in a particular area tend to bring the funds in but, following Derek Roberts' comments, the difficulty that I find is that when a group of departments come forward and say, "We have a large new programme, we think we are going to get it", in no way do I want to switch them off; it is an achievement to get it, it is successful work, but I know, indirectly, that every time we get one of these we are going to have to cross-subsidise an EEC programme from some other funds. This has happened, I think, within information technology over the last few years because we have had our own Alvey programme and we have had a whole pile of programmes running together; UK-based Alvey programme, we have had some industrial funding and we have had some EEC funding and, together, it has all just about happened. Now that Alvey has finished and we are having to look at future EEC framework programmes, quite frankly the 20 per cent additional on top of the direct costs is a loss to every project we take, and that is very worrying.

222. Do you think, then, the Government should recognise that and, in drawing up the research budget, should have a specific heading to take account of your costs when joining the framework programme?

[Mr Griffiths *contd***]**

(Professor Davies) Absolutely, yes, and if that is not done the UK universities will end up having a smaller and smaller proportion of the EEC research funding; either that or, if they take it, they will effectively be taking money from other projects.

(Professor Hanham) Can I address this issue, as somebody who has been involved in talking about European research contracts. The starting point is that each country has a different system. In many countries European Community money simply goes straight into some government account and disappears, so that you do not need to worry about a large number of other countries as friends or enemies or anything like that because they are not engaged in the same battle that we are engaged in. We are actually engaged in finding a way of supporting what are our independent institutions, which are elsewhere regarded much more as part of the governmental structure. We are all, in all of the countries, engaged in a competition to get our share of the money, and particularly our share of those projects which are designed to make Europe the leader in particular areas of science and technology, particularly in competition with the United States and Japan. Most countries that are more or less like ours, and the Germans and the Danes are fairly near in this respect, do have funds to enable their universities to compete effectively in these areas and the reason is that they regard this as a matter not merely of national prestige but of ensuring that they have a share in major international efforts at the European level. One of the problems that we have got to address in the universities is how to take this message abroad. I entirely took your point earlier on talking about these things, but it is actually extremely difficult in a community of unlike countries with different structures for science support, it is extremely difficult to position yourself. In fact, British universities have been doing very well, but the people who are doing well are the scientists, and the institutions are suffering because the institutions are engaged in cross-subsidisation, which is what my colleagues are talking about. You can only do that for so long before the system breaks down.

223. If we had separate funds to take account of the shortfall once you got involved in an EEC programme, how much money are we talking about for universities in the United Kingdom?

(Professor Hanham) I think 20 per cent.

224. Roughly, we are talking about £40 million?

(Professor Fender) We are talking about contracts which we hold at the moment of the order of about £100 million. That means an expenditure of something in the order of, let us say, £40 million a year and so we are talking about 20 per cent of that.[1]

Chairman

225. How would that be administered, would you suggest, if we had a top-up fund?

(Professor Hanham) I believe that we need a policy for that and that that has to be worked out between the ABRC and the DTI. We need somebody on the science side and ABRC is the obvious agency. The DTI has to be involved because of its concern for the development of new technologies, and so on, and I think that unless you have some sort of alliance of those two Departments to try to produce a draft that can be brought to this Committee I think we will not get anywhere.

Sir Gerard Vaughan

226. Can I ask, Professor Hanham, as I understand it, the Cabinet Office is our main co-ordinating body with Europe; is that right?

(Professor Hanham) It is for some purposes the main body, but for other purposes the DTI is the lead Department.

227. So we have the Cabinet Office, the DTI and the DES, all sort of loosely working together?

(Professor Hanham) Yes.

228. Do you think we have arrived at a stage where there ought to be a major change in this?

(Professor Hanham) I was hinting at that when I was talking about the ABRC. What I am concerned about in the DES is the fact that the DES is, after all, a Department which grew out of the old Board of Education; it is still primarily concerned with schools, and rightly, because that is, at the moment, where the crises are, as we have all been saying. There is a real risk that science will be lost sight of. I personally was very happy when the Lord President was responsible for science because that gave science a certain stature in the system. If you have a Minister of Science he can be starved like any other minor Minister, because this is not necessarily going to be a big-spending Department. The question is, how do you get a structure which is accepted in Whitehall so that people do not feel they are competing with one another against other Departments? Co-operation is the secret here and it is a co-operation in which we would like to have a part.

Mr Greenway

229. That is a very exciting suggestion. I am sure we have taken that on board. Reverting to the EEC, could we look for hard evidence from you about EEC contracts which have been lost as a result of the unfavourable treatment you have been discussing?

(Professor Hanham) There are two aspects to that. If I look at my own university, we have, in fact, forbidden people to put in the final documents so they never get to the stage of——

230. They do not even start, do you mean?

(Professor Hanham) Individual faculty members say, "We would like to go forward with this" and we look and we say, "What is it going to cost?" and they tell us, or rather we would do it for ourselves because we cannot rely on them, and we then say, "No". The difficulty is in those high-prestige, expensive areas, where you have

[1] See Annex 2

[Mr Greenway *contd*]
powerful faculty members in particular institutions. We do know, and Michael Powell can tell me more about this, of one contract at the moment that we think is not going to be approved, in one university, after having gone a long way down the road, because they really feel that they are over-exposed at the moment in this European area. If you look at the European contracts, a number of universities have a disproportionate amount. One of the difficulties about looking at the statistics is that in my own university, for instance, you can see the EC money, you cannot see the other company money that matches it and is much greater than it; and Derek Roberts was talking about that before. It is the industrial money which often makes this possible.

Chairman

231. Mr Powell, do you want to comment on that?

(Mr Powell) I do know of one university which is developing a project, which it hopes to get funded from the Commission, in advanced informatics, for medicine, ambulatory care.[1] It has got to the stage where there is no more money available from the university to underpin the research contract and unless it is able to find the matching money from some other source then this project is simply not going to be able to go ahead.

232. I am sure the Committee would find it very useful if you could write to us with any details you have of such projects, giving us examples of hard evidence, which would flesh out the answer to Mr Greenway's question? That would be very interesting.

(Mr Powell) I am sure we could provide information about that particular project.[2]

Mr Griffiths

233. Chairman, there is another aspect of this which Professor Hanham, in fact, made quite clear to us, that many universities, whilst they may allow their staff to make the initial overtures to Brussels, when it comes to looking at the financial consequences for the university they do not even bother to apply. I wonder whether there is anyway you think that we could be given an indication of how you think that is affecting our participation in framework programmes?

(Professor Hanham) We can endeavour to do that.[3]

234. It would be interesting to see if you could.

(Professor Davies) Chairman, by looking for those examples we are looking at very small numbers though. I am sure the examples exist. However with every project we do take we make a loss. You could look at the whole of the EEC research programme and could have it analysed by any accountant who would say, "No-one could conceivably do this research and employ this number of people on that budget". It does not make any difference whether research is done in industry or a civil service laboratory or a university; we know very well that the typical overheads on running a graduate are round about 100 per cent. Industry will say 150 per cent; in some cases, I think some of our civil service agencies are talking about 300 per cent. As a result by comparison 20 per cent is ridiculous and ludicrous. We therefore lose money on every project.

Chairman: As I say, I think if we could have some back-up from you on that, that would be helpful. I would now like to move on to the general area of policies and priorities in international science.

Sir Gerard Vaughan

235. It is not really moving on. You mentioned co-ordination, Professor Hanham; but co-ordination led by whom?

(Professor Hanham) That is a difficult question to answer without mentioning people.

236. We would like your advice, actually?

(Dr Roberts) The ABRC: simply recognise the magnitude that we are talking about and add to the ABRC funds in the next PES round a sum of money which is earmarked to be administered by ABRC, on the basis that any successful project which gets through the peer review routine and is accepted by the European Commission and picks up the 20 per cent incremental funding automatically gets 20 per cent without any further argument.

237. But led by whom in the Government: the Cabinet Office, the DTI? We think it is a terrible mess at the moment.

(Dr Roberts) The Advisory Board for the Research Councils.

(Professor Hanham) I think, Chairman, the difficulty at the moment is that the ABRC is in the process of being reorganised to become a more executive body, in effect an executive body directing the Research Councils, so that we have not yet got to the stage where we can see that change in action. In a sense, it is disguised by the fact that the old Chairman continues, who is a very eminent man, and it is a very sensible thing to do, but we are moving in the direction of a more active ABRC and that is essentially what I was suggesting, and Derek Roberts is agreeing.

Mr Griffiths

238. Professor Hanham said earlier that he rather liked it when the Lord President had overall charge. It is all very well for ABRC to be the co-ordinating body, it is not the same thing as a Minister having responsbility. It seems one of the problems at the moment is that there is not one Minister consistently with overall responsibility

[1] Note by Witness: Advanced Informatics in Medicine is one of the programmes within the Second R and D Framework Programme of the European Community and is funded by the Commission on a shared cost basis.
[2] See Annex 1
[3] See Annex 1

[**Mr Griffiths** *contd*]
and do you not feel, therefore, that it would be helpful if there was a Minister who had overall responsbility and, let us say, perhaps had the sort of backing that exists within the German system?

(Professor Hanham) As I indicated, I actually believe in having a Minister, but I should not like to move to a situation in which some unfortunate individual in a Department was told he was, from tomorrow, Minister of Science and to get on with it. That is exactly the problem that you are trying to address. I believe that we are going to have to go through stages and, at the moment, the thing is disguised by suggesting, as Sir Gerard suggested, that the Cabinet Office is capable of doing things. The difficulty is that the Cabinet Office does not have an easy way of making its views heard, except by sort of letters or confidential leaks that we sometimes hear about. The ideal first stage would be to make sure that there was a Minister in DES and a Minister in DTI who were actually told they were to work together.

Chairman

239. Instead of having a Minister for Science or perhaps two or three Ministers with science responsibility in different Departments, how about a Ministry for Science; a Ministry for Science and Technology, for argument's sake?

(Professor Fender) The real trouble is that science and technology permeate nearly all branches of our activity and that is the difficulty, is it not, and one is nervous that if you create a Minister of Science, if that individual does not, in fact, persuade or have the power to persuade, and by the time you talk about "power to persuade" at the level of forcing, banging Departmental heads together you are getting very close to the Prime Minister in person; if it is a weak Minister of Science you actually do more harm than good. That is why we are suggesting that the ABRC, which through its network of Research Councils has contacts, through collaborative programmes, with a whole range of Government departments, is a good place to start.

Mr Greenway: The idea of using the Lord President centrally to have a propulsive role I think is very attractive.

Chairman

240. Who do you think should speak for basic science in Brussels?

(Dr Roberts) The Chairman of ABRC.

Sir Gerard Vaughan

241. It is not just science, it is science and technology, industry, everything, is it not?

(Dr Roberts) We are talking about basic science and that is not industry. Basic science is academic science. Applied science and some strategic science and development and a lot of engineering is industry, but if the question is, "Who should speak for basic science in Brussels?", it can only be the Chairman of the ABRC; it is a nonsense for it to be anybody else.

(Professor Hanham) One has always to remind oneself that there is a large area somewhere between basic science and real applications which is science in the strictest sense, and we all know it because of the extraordinary way in which computers have changed in our lifetime. Essentially, every five years you have got an almost totally new system. At the forefront of that are academic scientists and scientists in industry. What we have got to do, I was suggesting before, is to make sure that those work together at the floor level but also at the government level. At the moment we have a system of representation of the Research Councils in Brussels, we have DTI representation; I was arguing that it is natural that that representation should be regarded as joint in a lot of these areas.

Mr Griffiths

242. Still on this point, in a previous session of evidence-taking, the Royal Society seemed to be quite well-disposed towards the German system, which is why I have been pressing you a little bit about it today, but you seem to have wanted to avoid saying anything about that because I have mentioned it twice now and nothing has been said. What do you think about the German system?

(Professor Hanham) The German system has one great advantage that we do not have. In the Länder it has competing centres of power with money, and a large proportion of the money in fact comes into the system through the Länder, through the proviences, and there is a lot of back-up funding which comes this way. They also get together to compete in Bonn, going along to people saying, "Our national prestige is at stake" along the way; the prestige of Hamburg or elsewhere.

243. Is this an argument for regional government in the United Kingdom?

(Professor Hanham) I hesitate to bring that into this conversation. I am trying to argue that the Germans have a system in which they do get people working together.

Sir Gerard Vaughan

244. Win has really asked the same question. I wanted to go back to what you were saying about the other systems. Is there another system, or several, that we ought to be looking at and possibly try to move towards, or not, or do we just improve our own system?

(Professor Hanham) I think that we start on the assumption we improve our own system. The French have been extraordinarily good at various times in deciding that there is a national crisis in science, and they will move in somebody of importance to solve the problem and then move him or her on, and they dealt with the great backwardness in information technology head-on by essentially saying that it was a national need to do something. I think we are arguing that, at the moment, there is a national need, because we are different from the rest of the Community, to try to address some of these European issues. I believe

[**Sir Gerard Vaughan** *contd*]
there is a whole range of issues which need to be addressed but I would not like to develop a permanent structure on a sort of crisis basis, you have got to have something which will go on.

(Professor Fender) The French have have had Ministers of Science, they have had Ministers of Research, but the Prime Minister himself has always had a willingness to get involved in big decisions about science in a serious way.

(Dr Roberts) Can I suggest, Chairman, that it is a jolly good idea, I am sure, to identify somewhere that would appear to have, and what over 100 years has been, a rather more effective system than we have, and I would suggest that that is Germany. I can support that from several points of view. I do not think comparisons with the United States or Japan are meaningful because there are too many other scale and social differences. Germany and the UK have a very similar level of population, we are rather better off in terms of natural resources, we are supposed to share the Protestant work ethic and we are very similar, but the difference is that £1 bought 13.5 deutschmarks in 1948 and it buys 2.78 today. In 1888 Germany had only 8.5 per cent of the world market for manufactured goods, we had 23 per cent; 100 years later, the Germans have got 11.4 per cent and we have got 5.1 per cent. I will not bore you with the long lecture that I am very happy to give on some occasions, but the difference is that 100 years or more ago Germany, not having the benefits of Empire and cheap labour and cheap raw materials and a captive market, recognised that the only way they could achieve economic success was by adding value, and that meant building science and technology and education, and there was a national commitment which goes back, as I say, at least 100 years. They have so grossly outperformed us, in such a way that we ought to be grossly ashamed of ourselves, and it is not answered by saying that they benefitted from post-war reconstruction, because pre-war, by 1938, Germany was up at 12.7 per cent of the world market and we had already dropped to 10.7 per cent; so it is not just a post-war phenomenon, it has been going on for a very long time. That suggests to me that there is something that we probably ought to learn from the German system.

Chairman: That is quite a good note on which to finish. This has certainly been a very lively session, gentlemen, and I do thank you very much indeed for coming along. I think there may well arise out of our deliberations today some further questions which we would like to put to you, in which case our Clerk will write to you, and please, if there are any points which occur to you,——

Mr Greenway: Including examples.

Chairman

245. Particularly the points which you raised earlier on, but if there are any additional points that you would like to raise with the Committee would you please feel free to write to us?

(Professor Fender) Thank you very much indeed, we would be delighted to do that.

Chairman: Thank you very much indeed for coming along.

ANNEX 1

Supplementary memorandum by the Committee of Vice-Chancellors and Principals (ES40)

Discouraged EC Contracts in British Universities (Q.231 and Q.233)

The Committee's request for examples

1. The Committee asked for specific examples of projects which universities had decided not to pursue. The CVCP has communicated this request to all universities. The minute summarises their replies.

2. All stress that, within financial constraints, they encourage staff to apply for EC contracts. One observes: "The significance of research ratings for University funding and for Department funding would make any decision by a University to turn down EC contracts on any significant scale one which requires a complicated accounting balance." The majority of rejected ideas for projects are abandoned by individual members of staff before deterred by the relatively low success rate in bidding for EC contracts and in part because universities' central charging systems, under which overheads are charged out to indivudal projects or contracts, make it impossible for individual departments or members of staff to cover the costs which would be incurred if an EC contract were accepted. This difficulty is particularly sharp where a university would be obliged to opt for an EC contract on the basis of marginal direct costs plus an overhead allowance of 20 per cent. The problem is exacerbated where an equipment grant is included since projects have a life typically of *three* years, but EC costing rules require depreciation over *five* years, leading to only a 60 per cent recovery in most cases.

The effect of differenct costing bases for EC contracts

3. University College, London (UCL Initiatives) has estimated that contracts made on the basis of marginal direct costs provide a smaller proportion of total project costs than the alternative contract basis of half total costs. It is now clear that the EC's auditing requirements effectively rule out the latter for British universities. Universities which had entered into contracts on the assumption that they would be able to satisfy the auditing requirements of the latter basis have been forced into sharp changes of policy and have changed to the marginal cost basis. Universities on the continent, however, are believed to be content to undertake EC contracts on the marginal cost basis, because their own governments operate systems of financial support which in effect provide the overheads. A university observes that: "A number of EC contracts negotiated initially by the University on a Full Cost basis attracted comment from Commission officials that the UK overhead calculated on Hanham principles was substantially higher than the overheads sought by EC partners in the project. This is a direct consequence of the higher base funding of research in other EC countries which allowed EC partners to request a very low overhead contribution." A detailed minute from UCL Initiatives is attached.

The effect on project selection of a low level of support for overheads

4. Universities respond to the low levels of overhead recovery in EC contracts in three principal ways. Most universities' contracts with the EC in practice provide, and are controlled to remain, a relatively small proportion of total research income. Some universities have so far been able explicity to accept the effective cross subsidy of EC projects. Thirdly, many universities encourage acceptance of EC contracts where the necessary supporting infrastructure is already in place, and the projects contracted for specifically match university research objectives already decided. The availability of block grant from the Universities Funding Council has been the crucial factor in universities' ability to respond in these ways. As funds are transferred from the block grant to other funding agencies (for example, the planned transfer from block grant to Research Councils), and as the UFC contribution to research falls as a proportion of universities' research income, the scope for unversities to continue to accept marginal contracts will decline. About a third of all unversities responding to the CVCP request for further examples have declared that in the absence of steps to provide support for overheads they expect severly to curtail their acceptances of EC contracts. One university typically stated that "unless there is some change in the funding mechanism for EC contracts, it appears that we cannot continue to participate in the programmes."

Particular Examples of Discouraged Projects (Q.231)

5. One university reports that "lack of funding has meant that no COMETT proposals have been pursued. Within DRIVE, three or four proposals were not followed up because of problems of finding 50 per cent industrial funding." The same university commented further:

> "We have a number of cases where EC projects have fallen at the last fence because of the absence of UK funding to match the EC funds. One such contract is currently being negotiated. It is almost certain to obtain technical approval, and the European partners have been guaranteed funding by their governments if technical approval is obtained. However, the DTI will not even look at the project until technical approval has been given by the Commission. From past experience we know that even if funds are provided, which

is far from likely, there will be a delay of the order of two years, and this is unacceptable to our European partners who are, understandably not prepared to wait."

Another identified a problem with capital grants, as follows:

"What we do is a major example of a EC grant blocked and a project reduced in size by the UK Government attitude to providing matching funding. In 1985, the University built an Advanced Technology Centre building to allow collaborative research with Rover Group and other companies to be jointly developed. This project met the EC criteria for an ERDF grant, and £600,000 was awarded. However, the UK Government's attitude was that capital cover for the grant required a £600,000 reduction in the UGC's capital budget, to which the UGC was unable to agree. The grant was never received, and as a result the building project was reduced from three storeys to two, to save costs.

An application for a grant of about £700,000 has been lodged in respect of the second phase of the Advanced Technology Centre. We believe the EC will look on it favourably. However, the present rules require that capital cover has to be provided by the local authority which is very difficult for it to do, given recent cuts in its capital allocations. We fear the same fate will overtake this second grant application."

An example of problems in the area of health care is provided by a third university:

"The AIM programme has been led by a member of the Health Care Research Unit funded partly by DoH and partly by the Regional Health Authority. The core funding arrangements for the Health Care Research Unit allowed a measure of discretion to initiate new lines of research, and DoH were willing for him to spend part of his time on the AIM project. This provided some help in covering the 50 per cent shortfall.

For the future, the Health Care Research Unit will be funded on DoH programme grants, which will not allow the same flexibility. In any case, moving from definition to main phase the level of commitment required is likely to be considerably increased and so go well beyond any discretionary use of resources. There is therefore no underlying funding from UFC or DoH which can be called on to make the project viable. The UK could therefore lose the position it has gained in the application of IT to ambulatory health care which will be a major growth market for both hardware and software products during the next 10 years.

We are actively seeking partners willing to help fund our share of the project. This may significantly weaken the University's position in the consortium where, up to now, we have played a leading role.

The particular circumstances of the Health Care Research Unit has thrown this issue into sharp relief. The same problems are latent throughout the University where budget constraints make it more and more difficult to commit resources on the scale needed to be effective in European level research."

Conclusion

6. Universities have applied considerable ingenuity to arranging their affairs to overcome the difficulties of EC contracts and thus be able to encourage their staff to benefit from involvement in the international research community. It seems most unlikely that they will be able to continue to do so unless urgent steps are taken to provide them with support for overheads and equipment associated with EC projects.

14 June 1990

ANNEX 2

Letter to the Clerk from the Committee of Vice-Chancellors and Principals (See Questions 222-223) (ES40)

UK Science Policy and Europe

I understand that it would be helpful for you to have an indication of how much money the universities receive from the Commission of the European Community for research and development projects.

The returns which universities (those funded by the Universities' Funding Council) make annually to the Universities' Statisticial Record indicate that in 1988/89 (1 August to 31 July) the universities of the United Kingdom received a total of £22.79 million from the European Community in research grants and contracts. For universities of Great Britain (ie excluding Northern Ireland) the figure was £22.46 million.

A survey of universities undertaken recently by the CVCP suggest that the *total value* of existing (current) contracts with the EC is some £79 million. This represents a total of 730 projects funded by

Directorates-General XII and XIII at 49 university institutions (including colleges and schools of the University of London and Wales). The average length of projects is about three years. In addition to these current contracts, a further 228 projects, valued at about £34 million, are under negotiation with the Commission. These figures exclude 8 institutions which we would regard as having a substantial interest in EC programmes and from which we have not received information. However, the figures quoted above suggested that the annual income for R & D projects from the Commission is now at least £30 million.

Further information available to us indicates that in the five year period 1983-88 a total of £48.84 million was received from the Commission for 675 contracts, with universities, polytechnics and Research Council bodies, of which the universities accounted for about 92 per cent.

I hope this is helpful to you.

D C Young
Assistant Secretary

27 June 1990

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HOUSE OF COMMONS SESSION 1989–90

EDUCATION, SCIENCE AND ARTS COMMITTEE

SCIENCE POLICY AND THE EUROPEAN DIMENSION

MINUTES OF EVIDENCE

Wednesday 16 May 1990

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MINUTES OF EVIDENCE

Wednesday 16 May 1990

WEDNESDAY 16 MAY 1990

Members present:

Mr Malcolm Thornton, in the Chair

Mr Jacques Arnold
Mr David Evennett
Mr Martin Flannery
Mr Harry Greenway
Sir Michael McNair-Wilson
Mr Gerry Steinberg
Mr Dennis Turner
Sir Gerard Vaughan

Memorandum submitted by the Science and Engineering Research Council (ES26)

Preamble

The Science and Engineering Research Council welcomes this inquiry by the Education, Science and Arts Committee as a timely contribution to a debate which is vital to the future of UK and European Science.

Introduction

2. The Science and Engineering Research Council is the largest of the five UK Research Councils (1989–90 budget £405 million) supporting basic and strategic research and research training in all the fundamental disciplines of science and engineering except those covered by the other mission-oriented Research Councils. It gives this support by:

(i) the award of research grants to individual scientists in universities and polytechnics (c 33 per cent);

(ii) the award of research training studentships and fellowships (c 15 per cent);

(iii) the provision of major central research facilities and services for use by academic scientists in UK and abroad and industry (c 25 per cent);

(iv) the adherence to international facilities (eg. CERN, ILL, and more recently the European Synchrotron Radiation Facility, ESRF) and organisations (eg. the European Space Agency) on behalf of UK scientists (c 25 per cent);

3. The Council has always supported international collaboration for the benefit of UK science; both through the support of informal collaboration between individual scientists and their colleagues around the world and, by contributing to major international facilities or programmes whose costs were beyond the resources of any individual nation. All forms of collaboration have increased in recent years, partly in recognition that the UK needs access to other countries' science in order to compete internationally; and because of the increased sophistication and cost of the facilities needed at the cutting edge of science. Thus while we could afford to build our own synchrotron radiation source (SRS) at the Daresbury Laboratory, the next generation of much more powerful source will be a collaborative European venture (ESRF) in Grenoble. Similarly, we have increasingly attracted overseas partners to share the cost, and scientific benefit of our own national facilities, such as the major telescopes and the spallation neutron source ISIS. The last we understand to be the national facility with the highest international investment (around 22 per cent) in the world.

4. The increasing resources being devoted by the European Community to R&D, and the coming together of European countries under the Single European Act, inevitably mean that we have to focus increasingly on the Community dimension. But we are equally keen to maintain and develop our scientific relations with non-Community partners both within Europe, West and East and wider, eg. USA, Japan, Canada.

5. The Council sees great strength and flexibility in a plurality of approaches to European collaboration, in which no single mode predominates. Thus while SERC welcomes Community support in those fields for which it is suited (such as information technology); it also puts importance on other forms of collaboration—either in bi- or multilateral direct co-operation between research agencies in different countries, or through the decentralised co-ordination of national activities, such as achieved by the European Science Foundation, based in Strasbourg. SERC hopes that the Select Committee's inquiry will encompass all the different forms of European collaboration and not focus exclusively on European Community programmes.

The following paragraphs follow the headings and questions set out in the Committee's Press Notice of 28 July.

EC Role

6. So far, in areas of direct interest to SERC, EC research programmes have represented a useful extension or complement to national programmes. (Only in areas such as IT have they displaced national support to any extent). The Community can support international collaboration where

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individual member states, perhaps particularly the UK—would not be able to provide sufficient funds. Inevitably the shortage of funds for UK science has led UK HEI scientists to look for alternative sources of funding in Europe, or elsewhere. But while this may provide an initial incentive to develop European programmes, it is SERC experience that it is the inherent scientific benefits of such collaboration which provide the motivation to continue and expand it.

7. There is no single model for the involvement of the European Commission in the development of collaborative projects between Member States and other non-EC countries. In general, the initial stage of discussion between prospective partners in large collaborative projects (eg. construction of major facilities) is best carried out by direct contacts between scientists and administrators of national agencies, without the involvement of a third party (eg. the European Commission). Such discussions can lead on to collaborative projects, for which Community funding can then usefully be sought.

8. The Commission can also play a useful role in catalysing new broad collaborative programmes by convening meetings of national experts to discuss the needs of science in a particular area and to suggest a possible Community role in that area.

9. The recent agreements with EFTA countries to enable them to participate in certain EC programmes, eg. SCIENCE, are welcomed by SERC. On the other hand the SERC does not think that the European Commission should negotiate S&T agreements with third parties *on behalf of* the Community as a whole.

10. The scale of EC R&D programmes which member states should support depends wholly on the area in question. In some (mainly more applied) areas it may be appropriate for a centrally funded Community programme to predominate. In general, for basic research, particularly the more fundamental curiosity driven research which is part of SERC's responsibility, the bulk of support should continue to be distributed by national agencies on the basis of peer review. We acknowledge and welcome the growing recognition of the need for this support to be better co-ordinated and rationalised across Europe. This has operated for some time in big science (high energy particle physics, space science). The European Community may provide one means to provide such co-ordination, but by no means the only one. Direct relations between countries, and more widely based organisations such as ESF (or the COST mechanism) are other means which have their own advantages.

Priorities and Mechanisms for European Research

11. To date the Community has supported only a limited number of R&D programmes for which DES is responsible, although SERC has a minority interest in some programmes (eg. ESPRIT) for which other Departments are responsible. Of those DES programmes of direct interest to SERC, the SCIENCE programme (originally entitled "Stimulation") and the more recent Large Science Facilities programme are not discipline based. SERC is in general satisfied that the selection procedures used have resulted in the support of good quality science. SERC believes that the present responsive mode of funding these programmes is appropriate and should continue.

12. The Commission's proposals for a new Framework Programme exist only in outline and we cannot therefore at present (October 1989) provide detailed comments. The SERC will be ready to comment on the individual programmes when they are presented by the Commission following formal adoption of the new Framework by Ministers. Of the programmes of present or future interest to SERC, we would like to see a continuation and possibly a modest expansion of the SCIENCE programme and Large Science Facilities programme. We would support a European programme to promote postdoctoral mobility at a significant level. Such a programme should be developed in conjunction with the European Science Foundation. The SERC also has minority interests in other lines of the new Framework proposal where another Government Department has responsibility.

HE/Research Councils

13. SERC cannot comment in detail on the effect that the EC research programme is having on the priorities and approaches of higher education institutions. It is our perception that the availability of Community funds has encouraged UK academics to develop a more positive approach to international collaboration. In some more applied fields the need to match the requirements of particular EC programmes may have influenced the emphasis of particular academic research groups; but we are not aware of this happening on any major scale or in a way that would be counter to SERC or UK interests.

14. UK institutions are successful in obtaining EC support for collaborative research under the SCIENCE programme. According to our analysis of statistics obtained from the European Commission the UK as a country was involved in more "Twinning" contracts in 1988 than any other member state (UK 72; France 69; FRG 47; Italy 34; Spain 24; Netherlands 21). (A more detailed breakdown could be made available). In terms of the number of individual teams, UK laboratories were also clearly in the lead. The high level is however due to the high level of applications made. The overall percentage success rate of UK applications was lower than for some countries. (It is therefore possible that an undeclared "equalising" policy is operating in order to ensure that the distribution of awards is not too dominated by the larger countries.)

15. The two SERC Laboratories, Rutherford Appleton and Daresbury have both been successful in the first round of the Large Science Facilities programme wih major proposals to enhance and give wider access to the muon beam line at the ISIS facility (RAL) and the synchrotron radiation source at Daresbury.

Government Machinery

16. SERC believes that the central Government machinery for considering European science policy, as operated by the Cabinet Office Science and Technology Secretariat, is effective in drawing together the views of *Departments* to prepare a coherent line for UK Ministers to take at meetings of the Community Council of Research Ministers. Two of the principle attendees at these meetings, M Curien and Herr Riesenhuber, head research ministries of much wider coverage of scientific activity than the UK Minister of State, DTI. As the Framework proposals extend into the area covered by the Science Budget we may well—from the nature of the topics—become disadvantaged.

17. In spite of the overall comment above in relation to Departments there are problems for *Research Councils* in not having direct formal access to the central Government process. SERC at official level can be in direct contact with Cabinet Office, FCO, UK Rep Brussels, but that cannot, of itself, resolve the fundamental problem of direct involvement in formulating a total view.

18. It is also our perception that existing central Government machinery is better equipped to respond reactively to developments in the EC than to develop a positive strategic policy towards European science as a whole.

19. The second problem for SERC concerns its relationship with the policy formulation process in the European Commission in Brussels. For historical and geographical reasons UK scientists and science policy makers have less of a tradition of interacting with Commission officials than have, say, our French and German colleagues. As a result we are less well placed to learn of, and influence, Commission thinking in its formative stages.

20. We recognised this need in 1988 by joining with the other four Research Councils in supporting the UK Research Councils' European Office in Brussels, which acts as a valuable two-way liaison point between the UK academic and Research Council Community and the European Commission. Some 55 UK HEIs now pay subscriptions to be members of the "Brussels Club" entitling them to receipt of the Offices' Brussels Bulletin and use of the Office as a contact, advice and liaison point. Membership of the Club doubled in its first year, and an additional Assistant Liaison Officer is now being recruited to cope with the extra work load.

21. Although the Office makes a major contribution to information flows, in both directions, and assistance to academic and Research Council applicants to Community programmes, we believe there is a need to do still more at the policy level and are considering how this might be achieved. (One possibility is that we should increase the frequency with which our senior scientists and administrators visit Brussels and interact with Commission Officials.)

Attribution

22. It is clearly necessary to assess the gain to the science base from working on any given project collaboratively with the European Community. The ultimate logic of "attribution" is that such a decision should lead to the termination of previous higher priority national programmes. This cannot automatically be a good thing and more flexibility in the complementary support of national and Community programmes is desirable. Problems arise when SERC is asked to advise on the desirability of a Commission programme in a particular field without knowing whether resources for such a programme would come from the Science Budget, or from its own budget, and if so to what extent. This uncertainty makes planning difficult for the Council and puts a financial premium on joining a collaborative programme against initially unquantifiable gains. Phasing of attribution as a result of programme evaluation is the type of flexibility that would help.

December 1989.

Memorandum submitted by the Medical Research Council (ES16)

1. *EC role*

1.1 Article 130H of the Single European Act states that Member States shall, in liaison with the Commission, co-ordinate among themselves the policies and programmes carried out at national level, and that the Commission may take any useful initiative to promote such collaboration. To this end the MRC recently, at the EC's request, provided detailed information on the Council's objectives, priorities and research programmes.

The EC has no direct influence over the MRC's national research programme although clearly domestic activities are planned in the knowledge of EC programmes and frequently take advantage of them.

1.2 Many of the most productive international collaborations involving the MRC arise from informal contacts between individual scientists or laboratories. In some instances more formal links are established where particular national needs are seen to be best met in this way. It may not be

appropriate or useful for the EC to initiate collaborations which might disturb such national liaisons and agreements. A member state (and its scientific community) will of course be aware of EC activities when deciding on the need for collaboration.

1.3 The MRC has until now seen no need to expand the EC programme in the medical and health field, although current proposals for the new framework programme suggest that an expansion is likely. The possibility that such an increase will result in reduced support for domestic programmes is a very real disincentive. The MRC strongly supports the proposed programme on Human Genome Analysis in which the UK is well placed to play a significant role.

2. *Priorities and mechanisms*

EC

2.1 The MRC's principal involvement with the EC framework programme is through the Medical and Health Research Programme 4 (MHR 4). MRC (on behalf of the DES) and DH represent the UK on the MHR 4 Management and Co-ordination Advisory Committee and on the Working Party drawing up proposals for a programme on Human Genome Analysis.

The EC's policy is to act only where efforts at local, regional and national level do not suffice. This accords with the principle of added value which the UK looks for in assessing MHR 4 programmes and policy.

Possible areas for the new MHR programme have been identified as:

(i) Training—to exploit the unique strengths of individual countries.

(ii) Epidemiology—to exploit the cultural, ethnic and environmental diversity of the European Community to study the interactions of genetic and environmental factors in disease.

(iii) Health Services Research—studies to identify the most effective methods of health care delivery based upon the differences in clinical practice and health care delivery systems which exist between member states.

(iv) Multi-disciplinary teams in areas where local skills are in short supply.

(v) Multi-centre trials, to permit the recruitment of large numbers of patients for study over a limited period of time—eg. in major chronic diseases which naturally follow a variable course and in which clinical end-points are unclear, for the evaluation of expensive technologies and treatments, for the study of rare disorders.

(vi) Targeted areas such as AIDS, human genome analysis.

(vii) Adverse drug reaction surveillance and monitoring.

Although there is already significant activity in many of these areas within the UK, they nevertheless offer the opportunity of investing in projects which are likely to provide value for the UK and other EC member states so long as they are planned to complement rather than supplant or duplicate existing work.

The MHR 4 programme operates by concerted action whereby EC funds are provided to scientists within the Community whose research is already funded from national sources for activities such as meetings, short exchange visits and exchange of materials. This mode of support is attractive since it requires a smaller national contribution to the Community than shared cost and direct action programmes and, although there is no direct financial return, nevertheless it is an efficient use of funds. It also means that decisions on the participation in, and funding of, the research programmes themselves, as opposed to their co-ordination, continue to be taken at national level, allowing each member state a large measure of flexibility in its participation in particular concerted actions. There is also scope for certain non-EC countries (eg. Switzerland and the Scandinavian countries) to take part in concerted actions on payment of an appropriate contribution through the scheme for Co-operation in the field of Science and Technical Research (COST). One drawback to the concerted action approach is that in some areas of activity (particularly in areas ii, iii, iv and vii—listed above) valuable collaborations may not be possible with some countries since they lack the skills or financial resources to participate fully in the studies.

Nevertheless, as mentioned in 1.2 above, much collaboration already takes place between scientists who have identified common areas of interest and objectives based upon personal contact established through normal academic channels.

There is concern about the way in which EC science programmes are determined and budgets set, especially in view of the implications for the total budget available for the funding of domestic UK programmes. Priorities based on established scientific needs and strengths will lead to increased involvement by UK scientists and help to achieve a *juste retour*. At the same time better management arrangements will ensure that added value is achieved across the range of concerted action programmes.

European Science Foundation

2.2 The MRC is a member of the European Science Foundation (ESF) and of the group of the European Medical Research Councils which is a Standing Committee of the ESF. The aim of the ESF is to act as a centre of communication between its member organisations and between individual

scientists. An important feature of ESF support is the scientific network mechanism which aims to bring together scientists working in associated areas of research. Further programmes arising out of the networks are funded by member organisations from national funds.

In the case of the MRC such proposals are scrutinised and assessed against our normal criteria. The flexibility and control offered, at relatively low cost, by this bottom-up approach make it particularly attractive in certain limited areas and current proposals to extend the scheme are likely to be supported by the MRC.

3. *HEIs/Research Councils*

Priorities of scientists in HEIs and Research Councils will be influenced by the EC research programme to the extent that they tailor applications to meet the terms of EC programmes. This is of less significance in the field of MHR 4 where all support is at present in the form of concerted action. MRC Units are encouraged to apply for shared cost contracts in other areas where the work fits naturally within the Unit's remit.

4. *Government machinery*

The MRC's input to the Government machinery for determining European science policy is mainly through the Cabinet Office Committee on International Science and Technology, through DES Science Branch and through collaboration with the DH Research Management Division: these arrangements are satisfactory.

4 November 1989.

Memorandum submitted by the Natural Environment Research Council (ES22)

1. *The International Context of Environmental Science*

1.1 Much environmental science is global or regional in scale. The UK has a long history of pursuing such science through bilateral and multilateral collaboration with other countries, and through direct participation in the major international programmes of the International Council of Scientific Unions, the United Nations Environment Programme, the World Meteorological Office and similar agencies.

1.2 Increasingly there are moves to develop and co-ordinate a specifically European approach to such research through the activities of the European Science Foundation (ESF) and through programmes supported by the European Commission (EC).

2. *EC Role*

2.1 EC research should complement both national actions and capability and also the wider international science activity. It should not conflict with or seek to replace direct national involvement in international programmes.

2.2 The role of the EC should in particular focus on the following tasks:

(i) *Co-ordination:* To act as a focal point where there is a clear European dimension to the research area and a need for joint action.

(ii) *Access to Facilities:* To provide access to facilities or specialist expertise where it is not cost effective for individual countries to generate or purchase such capability.

(iii) *Support of policy and standards:* To provide for the research needs of the policy Directorates and for setting standards across Europe.

(iv) *Education and Training:* To stimulate the exchange of students and scientists between countries.

2.3 The EC has had some success in bringing together research groups and in developing and co-ordinating research. However the ways in which it generates its research proposals are often obscure, and Member States are asked to agree large sums of money on the basis of little more than the broadest outline of the activities that will eventually be undertaken.

2.4 The EC needs to develop a better and more open involvement of working scientists in the formulation of its programmes. Failing that, the UK must ensure that the ideas of its scientific community are fed into the Commission thinking at an early stage. Recently it has become apparent that in the environment area at least, the EC is turning to the ESF as a source of advice on basic science programmes. This is to be welcomed as a bottom-up input, also involving the EFTA nations, although it can only represent a sample of scientific views across Europe. It cannot replace the need for strong national inputs in the development of EC programmes. It is also important to ensure that the ESF, although in receipt of EC funding, remains an independent sounding board for the scientific community throughout western Europe (EC and EFTA nations) and with developing links to eastern European countries.

2.5 The inter-relations between the research aims of the EC and the EC Directorates' research requirements, together with the links between the priorities of the user and the research programmes proposed, appear somewhat tenuous. There is also little apparent effort being put into technology transfer between the research and application sectors.

2.6 The scale of EC programmes must take into account factors such as the need for regional research and for European level co-ordination. It often appears that the EC seeks to interpret its role in the broadest possible way and to spread its funds thinly over too large a number of research areas. If it were to target its funding more closely on areas where a specific European dimension was required, it would be more cost-effective and also provide a valuable complement to national research programmes.

3. *Priorities and Mechanisms for European Research*

3.1 As noted above, there is a temptation for the EC to spread its resources too thinly. Priorities need to be critically assessed against the criteria of the need for co-ordinated European action, the priority requirements of the policy Directorates, and the cost-effectiveness of the action proposed. Clear and achievable objectives need to be set.

3.2 The size and scope of some programmes, such as that on human capital and mobility proposed in the new Framework Programme, are clearly impractical.

3.3 The science community is often too remote from the decision making process. There are good examples where the UK community has had a strong influence on EC programmes, but most representation is at the Working Group level which comes into being once overall policy has been defined. Specialist inputs need to be made at a number of stages: policy formulation; identification and preparation of programmes; programme appraisal and approval; programme monitoring; and assessment of results.

3.4 Although EC funding can be 100 per cent it is usually limited to a maximum of 50 per cent of the costs, with the remainder coming from the Science Budget or from another customer. Hence EC funding usually influences the direction of more research than it supports. This, the considerable bureaucracy involved in the EC application machinery, and the need to expend often considerable energy in finding European partners, has in the past contributed to a lack of interest by some UK scientists in seeking EC support. However, because the Science Budget baseline is reduced to compensate for increases in EC budgets, EC funds cannot be regarded as "extra" money and must be won if they are not to be lost to the Science Budget. This will demand increasing effort and reinforces the need to attempt to ensure that UK scientists have a strong influence on EC priorities.

4. *Impact of EC Research*

4.1 In recognition of the future importance of the EC role in R&D, the NERC established an Office in Brussels in 1984 to represent and promote its interests in Community R&D, to assess the opportunities for contract work and to obtain early intelligence regarding Community programmes. In 1985 the services of this Office were extended to the higher education sector on payment of a small fee. In 1987 the other four Research Councils joined with NERC. The Brussels Office is now operated on behalf of all five Research Councils and has 54 higher education institutions (HEIs) in membership.

4.2 NERC has generally been successful in winning EC research contracts. Within the present Framework programme we have been active in seeking to influence the EC in the choice of detailed research topics within the major environmental programmes, Marine Science and Technology (MAST), European Programme on Climatology and Natural Hazards (EPOCH), and Science and Technology for Environmental Protection (STEP), and in co-ordinating the response of the NERC community (including HEIs) to these programmes. Present indications for MAST, which is the most advanced of these programmes, are that the UK will do very well. We are also actively seeking to influence the Commission on proposals under the new Framework Programme. NERC is acting as the focal point within the Research Councils for the Environment Line of this programme.

4.3 Our aim is to influence the EC research programme towards our own priorities for European collaborative research rather than for the EC programme to define our national priorities.

5. *Government Machinery*

5.1 Government machinery is needed to agree the national stance, with regard to content and size of the EC programmes, to contribute to defining European science policy, to agree the programmes to be carried out and to monitor their execution.

5.2 The extent to which the environmental science community is involved in this machinery is variable. Research Council inputs have been sought on the new Framework Programme but all too frequently requests for advice are made in an *ad hoc* way and without sufficient time for consultation. Feedback is also poor.

November 1989.

Examination of Witnesses

PROFESSOR E W J MITCHELL, CBE, FRS, Chairman, DR G W D FINDLAY, Head of International Section, and DR D WORSNIP, Information Technology Directorate, Science and Engineering Research Council; DR D A REES, FRS, Secretary, and DR D C EVERED, Second Secretary, Medical Research Council; and DR EILEEN BUTTLE, Secretary, and MR TONY MAYER, International Officer, Natural Environment Research Council, were called in and examined.

Chairman

246. Professor Mitchell, we welcome you this afternoon to what we hope will be a productive session for all of us and informative as far as we are concerned. We have about an hour and a quarter to discuss some of the issues with you. I understand that you are happy to field the Committee's questions as and when. It would be helpful, I think, Professor Mitchell, if we started off by asking you whether you would like to introduce your colleagues to us and to say a few words at the outset?

(Professor Mitchell) Mr Chairman, my colleagues are Dr Findlay, who is Head of International Section, and Dr Worsnip, who is very much involved in IT interactions in the EC and indeed has spent quite a little time in the Brussels office doing that. Perhaps I may briefly introduce some of the aspects that seem to me to relate to the issues that you are discussing and relate to us, SERC, in particular. I make three points with a little expansion on each. First, our European interactions amount in money terms to nearly one third of our budget. Our budget is £450 million a year and about £120 million goes into international but mostly European things. May I briefly say what those are. First, there are the obvious ones, the large facilities, CERN, the European Space Agency, the ILL, the European Synchrotron Radiation Facility and something called EISCAT, which is a radar in northern Norway. All those have the characteristic that they are government treaties and we are the agent for handling that. They are of course treaties that we as an organisation want to see and want to be involved in. They are formal treaties. Secondly, we have a group of things that are European and international either bilaterally or in small groups. Those two things, the large treaty things and the bilaterals and small groups, are activities outside the EC. The third group is things that relate to the EC, on which I can expand perhaps later. The fourth group is smaller activities but nevertheless ones that we regard as very important relating to groups of people meeting each other at the times of formulating research, usually on a bilateral basis in a way that we call five by five or 10 by 10 people from each country, and we have a special fund set aside to promote that. Fifthly, we are of course a member of the European Science Foundation. Again one can expand on that later. The characteristic there is that the European Science Foundation does not itself fund research directly but it acts as a catalyst for bringing organisations together. The programmes into which as a Council one decides to go are on an à la carte basis: you decide to go in or not go in, and you are reasonably in control of the processes that go on. That is the European interaction as the first major point. The second point I thought it worth making is, just what does SERC do. Each Council has different emphasis in the way it works. SERC's way of working in terms of the nature of the activities is, first, that we give grants to the higher education institutions amounting to about £150 million for an average of three years, some longer, some shorter; and roughly one third of that turns over each year and enables us to fund new things on a continuing basis. Secondly, we have the treaty things that I mentioned. That amounts to £100 million. Thirdly, we have national facilities in which we encourage international participation. For example, in respect of our neutron source at the Rutherford Appleton laboratory 22 per cent of the funding comes from bilaterals with Italy, France, Germany and so on. In this category of national with international connections I would include the telescopes. Although they are sited some on La Palma and others on Hawaii all are involved with European collaborations. Fourthly, we have a major statutory role in manpower training, and £75 million of our money goes in manpower training through graduate student training in research, including case studentships and one-year advanced studies and in Masters courses. Thirdly, let me briefly say—this is the final point in the introduction—the nature of our interaction with the EC. We regard this as very important and with the other councils—indeed, the lead in this was taken by NERC—we are part of the joint councils Brussels office, which we find very useful. It is funded partly by the councils and partly by the higher education institutions. The key thing in relation to our outlook in the EC, I think, is that there has to be some added value in what can be done in that connection as opposed to what you can do yourself nationally. There is one obvious instance where that is clear although indeed there are not many in this area yet because they all started outside the EC, things like CERN and so on. The obvious case is when bits of research are too big and expensive to be done nationally and must be done on that basis; that is an obvious candidate. There is another one which I think is very important and we are only beginning to come to grips with it. That is in relation to subjects that are very wide in which one country of the countries in Europe, including ourselves, France, Germany and so on, cannot expect to have expertise in all the subdisciplines that are necessary for this wide subject. I think

[**Chairman** *Contd*]

therefore it is very important to maximise the interactions between those subdisciplines for the greater good of the whole activity. This is very much where the networking ideas in the EC are important. I believe if it is handled properly the new line six can be of great benefit to this. Those are the two obvious areas where there can be value added and I am sure there is a spectrum of things in between those extremes. Another point in relation to our interaction with the EC, which I have to explain briefly, is the role of our establishments. All our support one way or another goes to support research in the HEI. Directly in relation to grants the international facilities and the national facilities are for use by the HEI and our establishments are for that purpose. They are not freestanding research institutes as such, although we agree and encourage a certain amount of research in them. Our interaction therefore with the EC is partly indirect and partly direct, indirect in the sense that we encourage our customers, that is, the higher education institutions, where the areas of work relate to grants that might be obtainable from the EC to use that to the full so that we can optimise the grant money we put into those areas. In some cases we have been able, as Dr Worsnip can explain, to organise town meetings and discussions with the HEI representatives so they go to Brussels and make their applications and we then try complementarily to make sure there is no duplication of funding in order to optimise the grant money. In any case, the money that comes back in those cases comes back to the HEI, not to us, so we have a secondary interest in being sure that HEI get what money comes because it helps our money to go still further. The money then does not come directly to us. In the direct sense where appropriate we encourage our laboratories to get funds directly from the EC. Indeed, in the current year we are expecting something like £2.5 million in that way. That sets the scene a bit as to the nature of our interactions, the nature of ourselves, the nature of our interactions in Europe in general and the particular way in which we interact with the EC.

247. May I ask you, Dr Buttle, to introduce your colleague, and perhaps say a word or two about the NERC?

(Dr Buttle) Thank you, Mr Chairman. Perhaps I may introduce to you Mr Tony Mayer, who is head of the International Section of our corporate affairs unit in NERC. I will try to spare your time by not repeating what Professor Mitchell has said but to highlight some of the additional points that will be useful to you. From the NERC's point of view the total value of our EC contracts in 1989–90 prices would be about 2 million ecus or £1.6 million. Put to scale that would be about 1 per cent of our total budget; in terms of our deployable resources it would be higher than that. We have participated in the first Framework Programme, in the second Framework Programme, and we are hoping to participate in the third Framework Programme. The environmental programmes in which we have a particular interest in participation are the marine science and technology programme, MAST—I am afraid that there are many acronyms in this area—the European programme on climatology and natural hazards, EPOCH, and science and technology for environmental protection, STEP. We too, of course, co-ordinate the response of the NERC community of higher education institutions with regard to the EC. We are making strong bids in these areas in the third Framework Programme. We feel confident that if those bids were judged entirely on their scientific merit we would have a good chance of winning those proposals. I support Professor Mitchell's view about the subsidiarity concept of added value of the work in Europe. We will be looking with interest at areas where there is a specific regional focus. With environmental issues we are looking at all scales, global, regional and local. Frankly, except at the local scale, environmental issues tend not to respect geopolitical boundaries. They span Europe. We, therefore, have a considerable involvement in international programmes and with EC partners in those international programmes. The International Geosphere Biosphere Programme and the World Climate Research Programme are examples of these international programmes where we sit alongside other EC member states. We share resources where we can. In particular we share ships; we have ships and so do other European countries, for example the Federal Republic of Germany. We have arrangements whereby our scientists can use ship time on their ships, by arrangement with us, so we share facilities in that way in the European context and in the international context. The benefits of working in Europe we see as being added value and our contribution to the international scene. The problems we have, as we have said in our evidence, are those of priority. We are looking very much here at strategic research addressing environmental issues. We try hard to ensure that the priorities expressed for the science in the European forum match the priorities that we set here in the national forum. This is a challenge to us because the EC naturally and properly seeks the advice of experts from the UK scientific community. Indeed, I have the view that, in the EC, the intellectual contribution that the United Kingdom plays is highly regarded. We encourage the scientists whom we support to participate in these expert consultations. Therefore, we have to ensure that our scientific community is well aware of the priorities that we set as a research council in order that there is no clash and we speak with a single voice in this arena.

248. Dr Rees, would you like to introduce your colleague and say a few words about the Medical Research Council?

[**Chairman** *Contd*]

(Dr Rees) My colleague is Dr David Evered, second secretary of the Medical Research Council. We have put in a written submission which describes the nature of our activities. I understand that at least some of the Committee have visited the European molecular biology laboratory so I think you have a pretty good factual basis and understanding of the factual nature of our involvement in Europe. I imagine that what you would be more interested in is discussing how the collaborations are organised and how that organisation could be developed to make them more effective, however one defines effectiveness.

Sir Gerard Vaughan

249. May I say, Chairman—I do not know whether this is out of place—that we have had a number of witnesses who have been frightfully defensive and slightly complacent about what is going on. It has been very difficult to get down to where we think the problems are. I am right, Chairman, am I not, in saying that that is our concern, how the priorities are set. That is what we want to know about this afternoon.

(Dr Rees) I was going to offer some suggestions, Chairman. Before I do so, however, I would like to say that equally I could offer a clasification for our activities as Professor Mitchell has done.

250. No, thank you!

(Dr Rees) We could very well go into that same sort of pattern or describe the criteria and basis for value judgments as Dr Buttle has done, but again what I would say would be very similar to that. I thought of offering a rather different perspective and pointing out that when one looks at collaborations one is looking at a very mixed scene. I find it useful to make distinctions on two levels. One is those that are started because they are politically driven. You want a united Europe and clearly a more cohesive scientific community must be part of that; therefore, you go ahead and set a budget and decide areas, perhaps sometimes pick them out of the air, then the science follows along. The advantage is that you get on with developing collaborations quickly, but the price you pay is that you start programmes without necessarily having proper evaluation mechanisms in place and perhaps without having analysed the areas you are going to develop and their relationships to national programmes. You recognise, of course, that I am thinking particularly here of some of the European Community programmes. Another example which I think is better scientifically in many respects but has the same characteristics is the Japanese Human Frontiers Science programme. It was decided first that there should be collaboration, and only afterwards what would be researched. That is one end of the spectrum. The other end of the spectrum consists of collaborations that are scientifically driven. I do not mean driven just by scientific curiosity; they may be driven by a need to solve scientific problems. A good example is the Medical Research Council's collaborative research programmes on AIDS research with the French and Germans where we get together because we know what problems we want to solve and then define the problem, identify the workers, evaluate progress and so on. I dare say that some of Professor Mitchell's large installations would fall into that same sort of category. Another distinction one can make which is not quite the same is to distinguish those collaborations which involve donating money to somebody else out there who runs a collaboration for you. Brussels again is an example of that. It correlates with the politically driven type. However, it does not always co-ordinate. Another example might be the human genome organisation—HUGO—of which the Committee might have heard. That is an international organisation aimed to promote collaboration in human genome research. It started off for scientific reasons but is not linked in any official way to national scientific organisations. It is not accountable to anyone. The risk you take when donating to someone else to run a programme is that it can take off in any direction which may bear no relation to other activities in your patchwork of scientific programmes. If the quality is variable also one has no means of addressing that. Such programmes are to be contrasted with the programmes where we contribute to a joint exercise in which we are involved in monitoring, adjusting the objectives and controlling the quality with the ability of relating to our national programmes. An example of this might be the European Molecular Biology Laboratory which, although it started off for political reasons, has that relationship to us. Given that scientists are concerned about and indeed responsible for maximising the scientific output for the money that is put in, it will not surprise you that our preference is for collaborations that are driven by scientific need and run in such a way that we can contribute to the planning and monitoring processes so that development of the research fits with everything else that we are doing. We are also realists. We have to come to terms with the need to balance political requirements with scientific requirements. The balance is not easy to achieve, if some individuals are motivated entirely by the one consideration and others by others. The improvement that we would like to see in European developments is to move to a situation where scientific priorities have more relative importance as compared with political priorities, where there is better monitoring and where there are mechanisms for allowing us to adjust programmes in such a way that they can fit better with national activities. There is another area of improvement we would like to see. We have learnt to run a pretty tight ship financially in this country and we would like to see an equally tight ship run in Europe. This applies in various

[**Sir Gerard Vaughan** *Contd*]

areas of the framework programmes and to the European molecular biology laboratory. I know that SERC raised a similar issue with CERN a couple of years ago.

Chairman: I think that we will have to move on now. The preliminary remarks have taken rather a long time and it is important that the Committee gets to any questions it wishes to ask. We appreciate the importance of what you have to say, but I think there are some questions that the Committee feel they must put at this stage if I may interrupt you. I will ask Mr Flannery to start the questions.

Mr Flannery

251. Professor Mitchell, may I ask you a fundamental question which stems from your memorandum and I hope is applicable to all three Research Councils concerning resources. The reason we are dealing with this subject—and we have dealt with it before—is that it always comes down to the question of resources. I want to quote two paragraphs from the SERC memorandum numbered 16 and 22 because they embody what I and, I am sure, some of my colleagues want to ask about. if I may quote from paragraph 16, it says, "SERC believes that the central Government machinery for considering European science policy, as operated by the Cabinet Office Science and Technology Secretariat, is effective in drawing together the views of Departments to prepare a coherent line for UK Ministers to take at meetings of the Community Council of Research Ministers." You go on to mention two distinguished colleagues, M Curien and Herr Riesenhuber, who you say "head research ministries of much wider coverage of scientific activity than the UK Minister of State, DTI. As the Framework proposals extend into the area covered by the Science Budget we may well—from the nature of the topics—become disadvantaged". That is a very forthright and, I am sure, honest statement. Perhaps I may take up now the attribution paragraph numbered 22 and quote part of it. You know that we have been to Heidelberg and to Grenoble recently and to CERN trying to gather information for ourselves because we are not scientists, and I personally want more money for science. I was a teacher, and I want as much as is needed to keep us in these great organisations. If we take the figure of 25 per cent for CERN, for example, we did not know until a few years ago how much international bodies take.

(Professor Mitchell) No, CERN takes 12 per cent.

252. Indeed, but it is still a lot of money when it is needed for research and so on. The paragraph says, "Problems arise when SERC is asked to advise on the desirability of a Commission programme in a particular field without knowing whether resources for such a programme would come from the Science Budget, or from its own budget, and if so to what extent. This uncertainty makes planning difficult for the Council and puts a financial premium on joining a collaborative programme against initially unquantifiable gains. Phasing of attribution as a result of programme evaluation is the type of flexibility that would help." The two quotations that I have given seem to dovetail to some degree and are applicable to all Research Councils. Perhaps whoever wishes to do so could expand on what I am asking?

(Professor Mitchell) May I start, Chairman. On the first point what we were trying to get across is the mechanism by which views are fed into the research council of Ministers in the EC. What is new in this situation compared with former years is that there is in the Framework Three programmes a small move into basic science. The two guiding principles—if I go on too long I am sure you will stop me, Chairman—that give the Commission its locus are, first, the expressed statement in (I forget which) the treaty which refers to enhancing the international competitiveness of European industry. This gives the focus for all the work of enabling technologies, the IT, energy and so on, and that includes underlying research. The other as far as I can make out, relates to the statement about quality of life and so on, which I think would include the curiosity science and the base science, which is relatively small but it is a new thing. The question is, how are our reactions from the United Kingdom fed in in comparison with, let us say, Western Germany and France where there are Ministers involved largely with all science, though not entirely, and they differ. Our view is that where we are responding to things that the Commission is putting out the system works reasonably well, although as Research Councils we feel a bit remote from Brussels in that. The system is quite clear and operates not too badly. We feed into the DES, the Cabinet Office convenes meetings of all departments chaired by Sir John Fairclough, a line is produced and that line forms the brief that Mr Hogg at the present time takes to Brussels. In the recent discussions since there was a basic science involved the basic science was fed in as part of that brief. I think I know what lies behind your question. I believe it is the case that no single departmental Minister in the United Kingdom is going to cover, as far as I can see at least, all the range of things that are in the Framework Programme; it is just never going to be the case because of the wide range of those things and, indeed, neither does Curien or Riesenhuber although they perhaps cover more than us. The responsive issue, therefore, I think will be one of feeding in the interactions from all the bodies, getting the brief formed and getting it well presented. That goes on not too badly, I think. Where we do not have things properly together yet is taking initiatives to get some of the things in which we might be interested independently into the Commission programme initially.

Mr Flannery: If I may interrupt you, perhaps I can ask you the very point of the question. Do you feel disadvantaged due to lack of resources. With reference to paragraph 22, for instance, do you feel that you do not know what resources you have for a particular programme and how you can join in that programme not knowing whether the resources are there?

Sir Gerard Vaughan

253. Professor Mitchell, before you answer that, may I say that what we really want to know—this is part of Mr Flannery's question—is whether the situation is satisfactory. Is it reasonably satisfactory or do you think that there is real reason for concern? For example, you have mentioned in your own paper that two other countries have a Minister for Science. We really do want to know: should we have a Minister for Science. Should we have the ABRC as our main negotiator?

(Professor Mitchell) In relation to the whole Framework Programme I think the ABRC is not the right body. The things that are in the Framework Programme include energy, the materials programme, the IT programme and the basic science. The DES in a sense and the ABRC therefore represent the basic science bit with other Departments representing other bits. The important thing to do is to make sure that all those get fed in and that is done through the Cabinet Office and Sir John Fairclough and that forms the basis of the brief, whoever goes. Perhaps I may answer on the second point, if I may. There was a second question which I was treating as a separate question from the first—related but separate. This is the issue of how we are to respond when we do not know whether it will cost us money or not. This is the whole question of the attribution of the Brussels money. This is an issue that has only just come into the basic science area because the underlying science has only just become part of the framework programme. I do not have any misunderstanding about the objective of attribution. If it is a political wish to control public expenditure I can see the logic—whether I agree or disagree is another matter—of saying that that should include such expenditure as goes out from the EC from the VAT or the internal. I can see the logic of that. If that is not applied flexibly however it has an effect of inhibiting people's reactions because as soon as the framework programme is announced there is to be an immediate decrease in the base line of the science programme and, of course, we do not know how that will be allocated. I argue that this is an unsatisfactory state of affairs and there needs to be some flexibility in the way that is done. Therefore, I see this as a difficulty, the detailed consequences of which we do not know yet because the question of the level of attribution is currently one under discussion with Ministers.

(Dr Rees) I should like to come back to the point about the importance of balancing the political considerations and the scientific considerations. The present system in the country may or may not work well for optimising the political influence on the development of programmes, but I do not believe it works well for optimising the scientific contribution. In the present chain of relationships from Research Councils to DES, from Cabinet Office to CREST and from DTI to Mr Hogg there is dilution of the scientific solutions at every stage. I think we need a focus for scientific input into the European programme.

Mr Greenway

254. But why is there dilution of the scientific interest at every stage?

(Dr Rees) Because the considerations become wider and wider and those for whom the scientific consideration are primary are at the beginning of the process and not continually present.

255. I do not understand that. Why is science lost simply by being taken into a broader context?

(Dr Rees) I would simply say that the nature of the discussion and the end of the chain does not focus as much as I would like to see on what science should be done and how the scientists are appraised.

Sir Gerard Vaughan

256. Do you mean that the scientists, who know what they are talking about, are not actually on the committees that later on discuss this?

(Dr Rees) Only much later when the whole shape of the thing has been decided.

Mr Greenway

257. But they do not go through at each stage that you have described?

(Dr Rees) No.

258. Why not?

(Dr Rees) We are consulted, we are outside the process, we are only on call.

Sir Gerard Vaughan

259. Have you said that it is unsatisfactory?

(Dr Rees) Oh, yes.

260. And what has happened?

(Dr Rees) The situation is still the same, is it not?

Mr Greenway

261. Have you banged the table?

(Dr Rees) I was trying to come on to the point raised by Sir Gerard about a Minister for Science. That raises such wide issues that I do not feel I should comment on that, but I do think that a focus is required whether or not it is a Minister for Science. Unlike Professor Mitchell I think that a model based on the ABRC raised to a higher level of input could provide that perhaps along

[**Mr Greenway** *Contd*]
the lines of the model of the interagency committee for global environment research which has been set up involving research councils and government departments with an interest. Perhaps I should stop there.

Mr Evennett

262. You said you would not comment on a Minister for Science. Surely this is just the sort of forum where you should be saying whether you think it would be useful to advance science or whether you think a separate ministry of science would not be powerful enough to achieve the aims that you want?

(Dr Rees) I do not see why it should not be powerful enough. My hesitation or my reluctance to comment was simply that in any reorganisation if you pool activities of one sort together you remove them from something else and so create different interfaces. The consequent disadvantages might in the broader context outweigh the advantages—I lack the competence to judge. I am saying that there certainly should be some focus created somehow, maybe not necessarily by such a drastic mechanism as a Minister for Science, but maybe so.

Mr Evennett: One way of looking at it, of course, is how to overcome the problems of finance and effectiveness of finance for science for advance, not politically—although political considerations are important—but for the scientific advance. That is what we are looking at and therefore we have to look at all these aspects. I was very interested by what you said and I think we will certainly take on board your comments about how scientists are not involved in each stage of the process. It is a great weakness that we have noted.

Sir Gerard Vaughan

263. What do you mean when you say, the ABRC raised to a higher level?

(Dr Rees) It could not be the ABRC as such because the ABRC exists to advise the Secretary of State for Education and Science on certain matters. But the functions represented in the ABRC could be put together with other relevant interests. In the Inter-Agency Committee I mentioned as a model, this is with the chief scientist from the Met Office, the chief scientist from the Department of the Environment and so on: everybody who has something technical to say about what should be done in global environment research is there and represented and charged with the remit of hammering out a national position. There ought I think to be some similar mechanism for hammering out a national position in relation to European programmes.

Chairman

264. How much time do the Research Council officers spend in Brussels?

(Professor Mitchell) Dr Worsnip could give an example in relation to HEI.

(Dr Worsnip) It averages out about a day a fortnight, I should think.

(Professor Mitchell) That would be true, I think, for the major programmes.

265. How much influence do you think you have while you are there?

(Professor Mitchell) I think quite significant. The record in IT as to what has come back is very satisfactory for the United Kingdom. Two things contribute to that. One is the fact that Dr Worsnip has been and is frequently involved, is known and so on. The other thing is that the UK on the whole has its act nationally together in relation to IT so that there is a focus of the kind in that sub-area that I was talking about.

(Dr Rees) I would have to agree that there are particular sub-areas and, indeed, there are parts of medical and health research where we have a very satisfactory input and we are involved. I was talking in the wider context.

Mr Greenway

266. Is it possible for the UK to exercise proper management controls over international projects to ensure that we get good value for our money? Are you satisfied with that?

(Professor Mitchell) One is never satisfied, but, yes, the ability is there and I think the UK has a good record of taking advantage of those abilities. The Abragam review of CERN was pushed and set up by pressure of the UK. That was not questioning the quality of science, in which I think CERN leads the world. There is however the associated question, are the management structures the most effective, not having been changed for 25 years, and so on. At ESA, the space agency, we were instrumental in setting up the Pinkau review. We are always on the lookout therefore to be aware of that because in the end the money comes through us and it is in our interests to get the best out of it.

(Dr Buttle) I think all of us have one objective in common, that is, to win the most from the EC for the best UK science. I believe that NERC recognised as far back as 1984 that one way to do that would be to set up an office in Brussels and establish very close working links with the Commission. We are happy that we extended that in later years to the higher education institutions and other Research Council colleagues joined us in 1987 to have the Brussels office as a focus for research council activities. The number of days we spend travelling backwards and forwards is not, perhaps, the best judge of our influence in the sense that we have a continuing influence through that mechanism, principally in receiving information. The important thing is that UK scientists are aware of the opportunities. So far as we are concerned the crucial thing is that they are aware of the priorities that we set for the spend nationally in our various programmes so

[Mr Greenway *Contd*]

that they can, we hope—we try to educate them in this—go into the Brussels forum saying the same priority line. That is the way to gain added value and make sure that resources do not leak to maverick scientists who manage through their influence in Brussels to obtain support for a scientific area or project that nationally we would not consider to be very important.

267. Do you think that we gain more than we put in?

(Professor Mitchell) We could not do particle physics or space if we were not in so the answer is yes because we want to do those things.

268. But why has Juno collapsed?

(Professor Mitchell) Because the Navrodny bank withdrew financing.

269. Could nothing be done through the European Space Agency, in which you are collaborating?

(Professor Mitchell) The ESA has a programme. There is a very good process for setting up that programme. There is a scientific committee, on which we are represented. It has a certain budget and it has decided on its priorities.These priorities did not necessarily match with those that Juno was pushing.

270. There is no safety net for rescuing anything that you happen to see falling by the wayside?

(Professor Mitchell) There is supposed to be, but their budget has been so pressed that the kind of safety net of small missions which could rescue—I mean, there has been a big argument between ourselves and ESA on this point. We certainly do not have any money that we could put into Juno.

271. We have stumbled on to a big point, have we? Should we be saying something about this in our report to Parliament as regards a safety net?

(Professor Mitchell) Let me express it in a slightly different way. I am talking about the Science programme of the Space Agency, not the Applications programme. The problem we have is that the lead times of the major programmes in the space agency programme are long. The programmes therefore, while they are very good scientific value, tend to be set and are there for five or six years because that is the time it takes so that there is not much scope for responding very quickly. It is that that I would equate with your safety net. There is no scope within a couple of years for doing a small launch. We have argued within the space agency that there should be provision for that and one way of doing it is to make optional programmes in the science programme. I could write to the Committee on this issue.

272. Why does that not happen then?

(Professor Mitchell) Because other countries yet do not have that view.

(Dr Rees) May I return to Mr Greenway's point about making commitments and then being stuck with them and being rather dissatisfied with them. I think there is more than a grain of truth in this. I am quite prepared to believe that Professor Mitchell now has a good deal with CERN, but it was after a bit of a battle some years ago.

273. A big battle.

(Dr Rees) May I mention a particular recurring problem when new European programmes are proposed. If we were setting them up at home we would look for things of less priority or less quality staff or work that could be cut to provide the means, before asking for extra funding. Somehow this seems to be an unfamiliar thought to our European colleagues. We come up against the problem repeatedly in the European Molecular Biology Laboratory. We come up against the problem in the medical and health research programme. We would like to see tighter scientific management of European collaboration. It is unfortunate that it is always us who seem to be in the position of requesting this. Another question to ask about Brussels programmes is whether we get out more than we put in. We do—but in fact it isn't clear that the best science that could be funded from European sources in the UK is funded. Due to the complexity and obscurity of the processes we often feel that the money goes to those scientists who are most "street-wise" and expert at getting it out rather than those who really merit it.

Sir Gerard Vaughan

274. We have in front of us a note we have been given of some of the criticisms about the EC science programmes numbering three: that they are of poor scientific quality, that many are not focused in priority areas and that they do not take full account of the needs or capabilities of UK scientists.

(Dr Rees) We need the mechanisms in place to correct those.

(Professor Mitchell) I would dispute those points. The EC has certainly been going through a learning sequence. That first point might have been said of some programmes earlier on, but the competitiveness now is such that I believe the programmes in the things with which I deal at least are first class programmes. I do not think there is any doubt about that. It is true in IT; after a shaky start I believe it to be true in biotechnology. The SCIENCE programme has not really settled down, but I think the way I have seen that going in respect of its competitiveness that that is true. I do not have Dr Rees' trouble about the international organisations. CERN runs by stopping other machines to make its further ones. It turns its stuff over and throws out the lower priority things. It is forced to do that because it is kept on a tight budget, and the

[**Sir Gerard Vaughan** *Contd*]

science in the end pushes it to the thing it really wants to do for the frontier work. One has to keep at it. I believe in the European things that I have described in relation to CERN, ILL and ESA we have considerable influence, certainly as much influence as other comparable countries on the policy. In the EC I think the pattern of that is variable. In some areas we do and I think we are all working hard to achieve that throughout. It is not perfect. As regards the focusing I cannot understand the remark. With the exception of the SCIENCE programme, which is relatively small, all the EC programmes are focused, and their focusing is in topics that are important to this country—the materials topic, the IT, the biotechnology and so on—so I do not understand the statement that they are not focused. I think that they are focused in a reasonably broad way.

275. The statement that I read to you was a criticism of the priority areas on which they are focused. You however are saying that they are focused on the right areas?

(Professor Mitchell) Yes, certainly.

Sir Michael McNair-Wilson

276. May I ask you whether the high cost of our contributions to international centres has upset the balance of scientific research in this country and many alpha-rated research projects do not get funded because of a shortage of funds?

(Professor Mitchell) The latter statement I think is certainly partly true. Regarding the subscription to CERN, it seems an easy solution; you chop up the subscription to CERN and everything is wonderful. I believe that the proportional cost of the CERN subscription is no greater in relation to GDP in the UK than it is in France, Germany and so on because that is the way it is calculated. I think the problem comes in that the rest of the funding in the SERC and the Councils generally is behind that level of funding which occurs in France and Germany so, if you like, the same proportion of CERN in the three countries puts a greater pressure on our other funds. It would be a very sad day for the country, I think, with its particular resources if it did not have the will and the wherewithal to pursue subjects of that kind. To say the UK—not France, not Germany, not Italy—will abandon certain areas of science of that kind I think would be a terrible situation to be in. It leads to problems. The way I would like to argue the problem is not in terms of an unfunded alpha ratio, which I believe to be a false argument, but rather that there are specific bits of science which should be funded which are not being funded. There is certainly that problem, about which we put cases to Government. Indeed, there was some response in each of the last two years.

277. In an earlier answer you talked of comparable movements with other members. Is that related to the financial contributions that have been provided or is it to the scientific input?

(Professor Mitchell) I do not know of any European collaboration in which we are involved in which our influence has in any way been inhibited by the funding situation in the United Kingdom. I believe that is because the formulation of scientific policy is an open matter where the ability to contribute scientifically is the determining factor. We have the ability to do that, I think, and it is recognised as such.

(Dr Evered) In relation to the medical and health research programme our experience is perhaps a little different from Professor Mitchell's. Sir Gerard Vaughan's earlier comments about quality I think are true at least in part. One problem with which we struggle is a problem to which Dr Rees alluded: it is the dilution of the scientific inputs to the advice we provide through the DES through the chain that Dr Rees described. Additional targets have been attached to the medical and health research programme as a result of this process. A very good example of that in the current programme is that cancer, for instance, has been given high priority. I am not arguing that cancer is not a high priority but there is relatively little in cancer that cannot be done at least as well within individual member states of the European Community as can be done by collaborative activities. Such collaborative activities as are necessary by and large are covered by other international bodies like the International Agency for Research on Cancer, the UK subscription for which our Council pays. We also have some problems with respect to the management and the reshaping of the medical and health research programmes. There are matters, particularly in relation to selection, the operation of the peer review process and, above all, evaluation, upon which we have been pressing the Commission to improve their practices. For the first time—this is the fourth medical and health research programme—we now have an effective evaluation mechanism which has just been put in place for this programme whereas the other evaluations have been badly lacking in a number of respects. I should say that I think we also have one advantage in the medical and health research programme. Because there are fewer outside influences in some other respects we have a greater influence on the shaping of the programme. In relation to the new programme under the new framework, which is to be known as Biomed I, on the basis of being proactive and developing better intelligence we have been able at least to formulate a coherent strategy, which we have put to the Commission. This is very much based on identifying areas in which we see that there will be both Community and national value from the topics we have identified.

Mr Turner

278. Can you comment—and we have heard some different comments, which is very healthy—on whether you believe that the United Kingdom is missing out on any opportunities to

[**Mr Turner** *Contd*]

bid for EC funds. Secondly, do you have any instances of Research Council budgets being cut back because of overspending on EC science?

(Professor Mitchell) On the second point the answer is, no, we do not have any instances of that. Such instances would follow from any decided level of attribution and decrease of our funds, and that exercise is only now starting. There are not any instances therefore. It is a worry that we have.

(Dr Rees) It is a fact that it will happen though, is it not?

(Professor Mitchell) Yes, it will happen, I suppose.

(Dr Rees) Next year contributions to the Community programmes will be the first claim on our budget.

(Professor Mitchell) It is even worse on the flexibility fund.

Chairman

279. The question must then flow from that: do we let the EC become dominant in the European science system or do we protect bilateral arrangements, for argument's sake, the ESF?

(Dr Rees) I was going to mention ESF when you asked for examples of where we would spend more money on collaborations if we had more money. I think we would like to work more through the ESF mode. Unfortunately with most of the money going to Brussels and now a large amount of that being attributed to the DES and therefore cut off our budget there is less room for development down the ESF road than we would like.

(Professor Mitchell) Unless one could transfer some money from the EC to ESF. To keep it in perspective, Chairman, I do not believe, as I have been saying, that everything is perfect in relation to the EC, but it represents something like 4 per cent of the integrated R&D or research spend in the countries involved in Europe. It is not the major activity in research activity in Europe. The major players are the individual countries and the collaborations in small groups or in larger ones that they come together to do. Since you ask for this kind of comment, there is certainly a merit in that. We are currently discussing with France, Germany, Italy and Spain, for example, the building of a particular laser for civil research in Europe because a number of us feel we have fallen behind Japan and the United States. This is being done by these countries and representatives of organisations like mine coming together of their own accord not involving Brussels because we directly then control the discussion and move forward. I do not see therefore that everything has to be done through the EC. I think that the influence through this kind of discussion and others that the EC gets and the discussion it gives rise to for its 4 per cent is a high factor. It should not be getting all this discussion at the level of 4 per cent, if you see what I mean.

(Dr Rees) I am relatively happy, like Professor Mitchell, with those European ventures which are being set up for scientific reasons in a scientific setting. There are certainly problems of management but we can control those. You asked whether we should do more from Brussels, whether we should hand over more scientific planning and control to the European Community. My answer to that is no. We are not against having a European co-ordination in principle. It is simply that the mechanisms in place for choosing, monitoring, quality control and so on are inadequate to take on more responsibility. If—as we probably need to—we are going to a more integrated pattern of scientific activity in Europe, it has to be done through an ESF type mechanism which involves the national scientific organisations more in the development of programmes.

280. You want to see it enhanced?

(Dr Buttle) Perhaps I may give you NERC's experience of international science, which I think is different from the other research councils. We are approaching environmental issues that span international barriers. There is an iteration that goes on between the scientific community which meets and plans its science and discusses its science and goes into detailed planning; then that community, so to speak, brings those plans to the funding agencies in their home countries, and to the EC which is a funding agency. The ESF is a forum in which that scientific discussion can go on with the planning of science taking place in that forum. Planning of science can go on bilaterally and multilaterally. Those scientists planning in those various fora have to come to their national governments or the EC, if they are EC members, for the funding. It is, I think, important for us to make sure that the decisions on which science is done and the framework planning rest on the quality of the scientific proposal. In the UK and internationally it is agreed the peer review mechanism is the one we use for that. The problem for us in EC, of course, is that the decisions about which projects should be funded are not solely based on peer review mechanism. They have other considerations to take into account which is where our influence through the national governments management committee has to be made. It is a complicated process. The crucial thing is that the scientific community has the opportunity to participate in planning the programmes and that the best scientific proposals, and the most timely bubble up through that process and are brought to the funding agencies nationally, internationally or, in this case, through the EC. There is then a response, and where possible from our position as scientific funders the best science is funded.

Mr Greenway

281. But do things bubble up like that? It sounds too slack a procedure to me.

(Dr Buttle) It is not slack, Mr Chairman, if I may say so; far from it. There is rigorous debate when the scientists get together. I have witnessed some of these debates and they are certainly not slack.

282. Satisfactory, is it?

(Dr Buttle) It is a clashing of brain power to decide which is the best scientific approach to take.

(Dr Findlay) If I may, Chairman, I want to come back to Mr Turner's comments about whether the UK is missing out on opportunities. The few statistics we have from the Community SCIENCE programme—let me just remind you that this is the one which is very responsive and deliberately unfocused and gives grants for collaboration and twinning of laboratories—are that in 1988 the United Kingdom was involved in more projects in that programme that any other country in Europe, 72, as opposed to the French, 69, Germany, 47, and Italy, 34. As regards applications, the UK put in more than any other country. In 1989—the latest figures that we have—the French were just ahead of us with 68, the UK second with 66, Germany, 58 and Italy, 38.

Sir Gerard Vaughan

283. If I may interrupt you, on CERN, for example, we have 22 universities that have collaborated and our return from CERN is 6 per cent of the total returns from CERN—only 6.7 per cent.

(Professor Mitchell) I think you are talking about a different issue there, if I may say so with respect. In this case I think Dr Findlay is answering the question: in going to the EC is one getting back for research activity a reasonable share of the funds from essentially VAT; and the answer I think is, yes, we are. In relation to CERN the issue is: do contracts for the activities that we help to fund in CERN come to British industry. In the case of the space agency they have got to because it was built into the treaty.

284. I quoted CERN because that was the organisation on which I could give an exact figure.

(Professor Mitchell) I agree that our industrial record in relation to CERN is bad, there is no doubt about that. It is a different point, however; that is all I am saying.

Sir Gerard Vaughan: Yes, I appreciate that.

Sir Michael McNair-Wilson

285. May I ask what influences other than peer review would come into play?

(Dr Buttle) In the EC forum they would be considering subsidiarity, which is added value. They would be considering *juste retour* and what they call cohesion, which is the advantage of groupings of EC member states.

286. Who are "they" in these terms?

(Dr Buttle) The EC Commission and then the Council of Ministers.

Sir Gerard Vaughan

287. I suspect that we are about to finish, Chairman, but perhaps I may take Professor Mitchell back to two words in the paper, "become disadvantaged". You are, I think, referring to the lack of a particular Department or minister to speak on our behalf, is that right?

(Professor Mitchell) I really do think it is more complicated than that, Chairman. If the structure of the Research Council of Ministers remains as it is and covers this wide range of disciplines I do not see that one could argue for the basic science representative to be the sole representative of the United Kingdom in that wide range of science just as I would argue that I do not think you could see the man whose department dealt with energy being the sole speaker. As long as that remains such a wide spread "becoming disadvantaged" I think is in that sense not serious provided that the process goes ahead as I have described, the briefing is good and so on. However, if the basic science programme extended considerably I think that there could well be a disadvantage. That is the point I was trying to make. If for example the basic science programme, to take an arbitrary figure (it has probably never been the case) was 50 per cent of the vote, it would then be crazy that the Secretary of State for Education and Science was not there speaking for it. The fact is at the moment that the Research Council of Ministers does cover a wide range of things. We are a bit remote from it—we can always criticise for that reason—but in principle I think it works. If the basic science part extends then I think we could become disadvantaged.

288. The logic of that is that we should not extend?

(Professor Mitchell) Or that we should deal with extension in a different way.

289. But we do not know what way, you see? This is what we are trying to find?

(Dr Rees) I think we are set on the path of extending.

(Professor Mitchell) You could argue that the research Council of Ministers could be arranged differently: it could have one bit dealing with enabling technologies and another dealing with basic science.

(Dr Worsnip) Chairman, I just wanted to follow up what Dr Buttle was saying about the Brussels office and the influence that we have in Brussels. I said I was across here about one day a fortnight. The important part about it is getting one's face known in Brussels, going into the office of the officials who deal, in my case, with the ESPRIT programme so that you get the credibility; and when you say to them, "I think you should have these two people involved in your assessment of

[**Sir Gerard Vaughan** *Contd*]

proposals" they believe you and they will invite those people across to Brussels to help in the evaluation of proposals that they receive against the ESPRIT programme. We have in fact built up a pretty high level of UK involvement in that assessment process. The important thing is getting your face known in Brussels, and they believe you when you start providing them with names of people who can help them.

Mr Greenway

290. All credit to you, but it does sound dangerously haphazard!

Professor Mitchell) Chairman, may I inject a different point which I hope you may be willing to consider when you discuss. It seems to me there could be a case—undoubtedly it would have to be started politically within the EC—for some independent review at some point of the way the Commission has handled its science and technology, not a wise men commission, as it were, appointed by the Commissioner but some independent review. We say we must have reviews of CERN and we must have reviews of space; why do we not think of a review of the way the EC has handled science and technology matters—has it been the most effective?—and this should be done on a European basis. It seems to me that that is something that as a participating country we should be willing to do just as we have insisted on trying to get reviews independently in CERN and ESA.

Chairman: We are very grateful to you all for coming along this afternoon. We have discovered one thing this afternoon, I think: the difficulty of getting hard proposals. We shall have to consider all the evidence that has been put before us. When we come to review the evidence that we have received today it may well be that other questions will come to us, in which case we would like to write to you to get your opinions. Thank you very much for coming along.

ANNEX

Supplementary Memorandum by the Medical Research Council (ES42)

The Medical Research Council is committed to developing international research collaborations where these can be seen to achieve objectives which cannot be met at national level alone. The Council has already identified a number of areas where European collaboration in medical and health research would be fruitful, and these are set out in our earlier evidence. The purpose of this memorandum is to expand on two points raised in oral evidence concerning the problems arising from initiatives which are not primarily science-led, and the need for more focused scientific input into the national policy-making process.

1. *Political vs scientific driving forces*

In judging the adequacy and appropriateness of international scientific collaboration, it is necessary to distinguish between politically-driven and scientifically-driven collaborations.

Scientific research is inherently international, and informal science-led collaborations between scientists in different countries has existed long before the advent of organisations such as the EC and the European Science Foundation (ESF).

The MRC prefers to see science-led initiatives as the basis for international collaboration, because this ensures that proposals are based on particular scientific needs, and are also more likely to be made in the knowledge of existing informal international collaborations.

Science-led organisations, such as the ESF, the International Agency for Research on Cancer, and the European Molecular Biology Organisation and Laboratory should and do aim to enhance and complement this existing framework of international collaborations rather than seek to duplicate them.

Furthermore, the management arrangements allow those organisations contributing to the budget to play a direct part in the formulation, implementation and review of scientific policy. This satisfies the need for accountability, and also ensures coordination with national priorities. The ESF, in particular, is attractive in having a small administrative machine and therefore being relatively inexpensive.

While the MRC recognises the important role of politically-driven initiatives, it is our experience that where political objectives have a high priority in the establishment and implementation of new collaborative ventures these can be flawed in a number of ways. Firstly there may be insufficient preparation, with little or no review in advance of the area(s) to be developed, and of the ways in which the new venture will interact with existing national activities and programmes. The consequences of failure adequately to involve national scientific organisations in the planning and implementation of new collaborations are that programmes may develop in ways that run counter to, or even to the detriment of, national needs and priorities. A good example of a European programme set up to satisfy political imperatives is the cancer component of the current EC Medical and Health Research

Programme (MHR) which receives earmarked funds from the MHR budget as a direct result of the setting up of the "Europe against Cancer" initiative. Research on cancer is already well funded nationally and would not have been a UK priority for European funding on the basis of scientific criteria alone since needs for international collaborative activities are already largely met through the International Agency for Research on Cancer, the European Organisation for Research and Treatment of Cancer and the International Union against Cancer, and through many informal scientific collaborations.

Secondly there is a need to ensure that adequate management mechanisms are in place which allow for national representation and ensure accountability. Such mechanisms should operate transparently and include proper evaluation procedures and the ability to terminate activities which have fulfilled or are no longer fulfilling their objectives. A failure to evaluate can, over time, result in the continued support of research which does not adapt to the changing needs and questions of science.

2. *Chain of relationships from the Research Councils to Cabinet Office and EC*

The MRC's input to the Government machinery for determining European science policy is through the Cabinet Office, via the DES. Using the EC system to illustrate a system which has parallels for other international collaborations, the existing flow of information is satisfactory where the MRC (together with the DH) has representation on the management committee for the Medical and Health Research programme (equivalent to representation on Governing Council and Scientific Council of the International Agency for Research on Cancer and the European Molecular Biology Laboratory respectively).

However, at higher committee level, such as the EC Research Council which decides upon the Framework Programme as a whole, the system is rather less satisfactory. Whilst the briefing arrangements at this higher level may satisfy political objectives, they cannot be guaranteed to convey adequately the scientific messages, which tend to be diluted at each stage in the passage through the Government machine, nor to address the wider issues of national scientific research priorities in the international context.

Solutions which might improve this situation include the creation of a Ministry of Science, or the appointment of a Minister for Science, with responsibilities which cross existing Departmental boundaries, although a case for the creation of a new ministry could not rest solely or even largely upon the need to address these concerns. Clearly the issues involved in any such reorganisations are manifold, and would have considerable implications for national activities. It is not appropriate to attempt to describe these in the present context, and therefore this memorandum considers the international policy implications.

For the communication of Research Council input on international matters, we would approach the notion of a re-organisation of existing structures in order to create a Ministry of Science with caution. The new Ministry would doubtless be formed by taking elements of the existing departmental structures and placing them together in a new format with different interfaces. Whilst in the long term this may work to the advantage of the international scientific activities, it is also conceivable that the gaps left in existing Departments may create needs which cannot be satisfied by the new Ministry.

A Science Minster with transdepartmental responsibility would satisfy the need for more focused representation on science issues. However, this arrangement is potentially administratively cumbersome, and could well result in duplication of existing effort since none of the existing representations are likely to be replaced.

A third alternative would seem to offer the same advantages as promised by a Minister or Ministry of Science, but without the potential disruption and disadvantages that would inevitably follow from such reorganisation, that is an interagency committee, such as the Interagency Committee for Global Environment Research.

In this option the relevant representatives from national organisations would be drawn together in a body which has appropriate expertise and resources to discuss the scientific issues, together with the status necessary to present the national view. This would seem to be a better alternative for the provision of a focused representation on science issues using existing expertise.

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THE EDUCATION, SCIENCE AND ARTS COMMITTEE

SCIENCE POLICY AND THE EUROPEAN DIMENSION

MINUTES OF EVIDENCE

Wednesday 23 May 1990

COMMISSION OF THE EUROPEAN COMMUNITIES

Professor P Fasella

ADVISORY BOARD FOR THE RESEARCH COUNCILS

Professor Sir David Phillips, FRS

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WEDNESDAY 23 MAY 1990

Members present:

Mr Malcolm Thornton, in the Chair

Mr Gerald Bowden
Mr David Evennett
Mr David Greenway
Mr Win Griffiths
Sir Gerard Vaughan

Examination of Witnesses

PROFESSOR P FASELLA, Director-General of Directorate-General XII of the Commission of the European Communities, was examined.

Chairman

291. Good afternoon, Professor Fasella. May I give you a very warm welcome to the Committee this afternoon. I think you will have had explained to you the purpose of our inquiry into European Science. We are extremely grateful to you for coming along to participate this afternoon and to answer our questions. Do feel free to comment as freely and openly as you can because, clearly, we are trying to get some answers. We are towards the end of our inquiry now and we hope that this afternoon's session will enable us to formulate the ideas we need for the preparation of our Report. May I start the questioning by asking you if you would be kind enough briefly to describe your role and that of DG XII in relation to the EC science policy. And can you also tell us for what areas of scientific research you are responsible?

(Professor Fasella) The role of DG XII is two-fold. One is to serve as the centre for collecting information, elaborating it and then coming up with proposals which concern the science and research policy of the Community. So that we are very much like a pot of gold. We try to collect as much information as we can from outside the Commission itself, from scientists, students, industry and social sources, to get information as to what the Community should do that is useful. We have extensive consultation with all the other specific services, so that if we do research on the environment we do not do it out of our own heads but in close collaboration with the DG which is responsible for environment. Very often, therefore, we create multi-disciplinary and multi-service groups which sometimes find in research the common element. A typical example would be biotechnology which interests DGI, which is responsible for foreign relations; because in the GATT system the Americans are quite sensitive to what the Community decides. It is also of interest to DG II which is interested in economic forecasting because it is trying to see what technology will really mean in the years to come. It also interests DG III (for industry), DG V (for health), DG VI (for agriculture), DG XI (for the environment) and DG XVII. Sometimes, the approaches of the other services, as one could expect, are divergent. And we sit in the middle and try to use this scientific approach to bring things together. And this type of work eventually expresses itself in the preparation of the proposals that the Commission makes to the Council and to the Parliament as to specific actions. And, of course, we, the services, make the preparations for this; and then it is up to the Commissioners to form the political judgment over this and to make the proposal. So that one of our roles is that of having this job of being somewhat the focus of preparing the role of science and technology in Community policies. And this we do in close collaboration especially with DG XIII which is responsible for all communications and information technology. They cover the whole stream from the fundamental oriented research down to the regulations when needed. So that DG XIII is by far our closest contact and we work very closely together on most problems. Our second role, or responsibility, is that of preparing for the sending to the Council and the Parliament of the research proposals and the implementation of them. DG XII is responsible for all research except that for information technology. When the research is closely connected with the interests of another DG (that of, say, agriculture) we have joint committees in which we represent the research part and they represent the users' part. The type of research we carry out is now expressed in the Framework Programme according to the Single Act which first recognised research as one of the tools which the Community must use in developing its policies. And I think this makes sense. Research is so connected with economic developments or with environment that normally the Community will have something to contribute. So that we are responsible for preparing those programmes and for the implementation of them. The areas in the Framework Programme are selected on the basis of an analysis of the situation made by us. We make surveys of the need for research and of the opportunities for research. We receive very many

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[**Chairman** Cont]

inputs from Parliament down to industries and to scientists themselves. We try to put them together so as to present a plan for activity which is guided by what we call "subsidiarity"—namely, proposing that there be done together only such actions as can best be done at Community level rather than at a national level. Particularly in science, if something can be done at reasonable cost by individuals or companies or single universities, it is much better that they do it. However, there are sets of actions in research which certainly present a case for that research being carried out at Community level. Sometimes, it is a question of size in the case of very expensive projects. There are some projects which are of common interest but which may be too expensive even for the wealthiest to fund. A typical case would be research on controlled nuclear fusion. Sometimes, it is the need to connect the research to a large demand market so that the costs of the research may be recovered. The research itself or the offer of research is aimed at the broad market. If you take the case of information technologies or biotechnologies, they require a very broad spectrum of different competences which have to be put together whenever you want to achieve something either in research or in production. You need very many skills; and you do not find all of these skills available even in the largest European countries. The large ESPRIT programme of DG XII provides the required European dimension in the key area of advanced research in information technology. In other cases—and this is becoming more and more important—it is the size of the problem that is continental rather than national. Some aspects of environmental control are now, indeed, global. But between the national level and the global level there is the continental level and there are a number of activities which can very well be done at the Community level as a sort of intermediate size between the national and the global. And in other cases, which are now becoming more important with the approach of the Single Market in 1992, we must see to it when regulations are needed that (one) they are based on sound knowledge and reasonable technologies and (two) that they are homogeneous all through the Community. Otherwise one could fragment the market through different norms or standards.

292. May I ask you, Professor Fasella, what role is played by scientists in formulating the policy?

(Professor Fasella) A quite important role. Scientists intervene in three ways. They intervene as advisers to the Commission; and we have a body which is called CODEST (Committee on the Development of European Science and Technology) which is made up of 22 people who are very distinguished scientists and science managers. They represent very much the voice of the scientists which, in some respects, they lead. From Germany, we have in that Committee, Hubert Markl who is the chairman of the Deutsche Forschungsgemeinschaft and Benno Hess who is the vice-president of the Max Planck Gesellschaft and Professor Syrbe who is the president of the Fraunhofer Gesellschaft. Persons like Markl are not appointed by their governments but, as is the case for the Max Planck Gesellschaft they are elected by the scientists themselves. So they are people who are knowledgeable in what happens in their country and in the world and they bring in the direct voice of scientists. Also, sector by sector, in preparing the programmes we have meetings in which we discuss the needs for research and the opportunities which exist in a certain field. This involves both the learned societies or larger organisations such as the European Science Foundation. We sit in their council. We have contacts with the large installations like CERN, where we are observers, and the EMBL in Heidelberg—we have been for many years in the Scientific Council of the EMBL. And we, ourselves, make many visits to meetings of the learned societies, sector specific meetings and the institutions themselves. Very often, it is the scientists themselves who write to us.

Sir Gerard Vaughan

293. If I were a scientist and I wanted to put something to you for a grant, what should I do? Should I come direct to you? Or do I have to go through the national bodies?

(Professor Fasella) You can write directly to DG XII or you can write to our office in London. They will ask what you are interested in and will give you a little booklet which has no glossy pictures but summarises all the programmes we have, how much money they give, what are the rules of the game——

294. Could I ask for a 100 per cent grant? Or would that not be allowed?

(Professor Fasella) As of now, we have 100 per cent payment only for relatively small, *ad hoc* studies which are authorised under the budget as means to obtain the information on which to prepare a programme.[1]

Chairman

295. Could you give us an example of that?

(Professor Fasella) For instance, we had been interested—I must say before the discovery was publicised—in the prospects of high-temperature superconductivity and we had asked some persons including some who eventually got the Nobel Prize for it (but we had asked them before they got the Nobel Prize) to make us a report on what was the trend. "Was there really something there", we asked. But this is for relatively small sums of money—generally less, I would say, than 100,000 Ecus.[2] If you are a university person or a non-profit organisation, you can apply to that programme which is called (and we have funny acronyms) SCIENCE which is the only

[1]See Annex 1.

[2]Note by Witness: For this type of intervention, which in this specific case involved a workshop, we pay the whole cost.

[**Chairman** Cont]

programme that is not targeted. We thought that we had to have at least 3 per cent or 4 per cent (and it is now approaching 7 per cent to 8 per cent of all our budgets which are not earmarked *a priori*; because we may try to do our job well, we have advice from the scientists, from industrialists and from everybody; but the chances that I could have good ideas are, unfortunately, not very likely. It is more likely that somebody in a laboratory has the ideas. And sometimes the good ideas come at the border line between disciplines and sometimes between nations.

296. Are you saying, Professor Fasella, that 92 per cent of the funds are commissioned by you; that you select those; and that it is the remaining 8 per cent for which people may apply?

(Professor Fasella) Well, it is neither. It is one thing for us to say, "We want a programme on informatics". It does not tell the scientist everything he has to do; but it selects some areas. It might select software, micro-electronics or, say, architecture of informatic systems. So, in this sense, it is top-down. But then, of course, it calls for proposals and not for detail; so that there is plenty of freedom for the scientist, himself. You could say that most of the programmes are oriented but we have this one—the one which I mentioned in answer to your question—which is open to anything in solid science, from mathematics to plant biology. Then we have a few who are interested in that, who send in an application for SCIENCE. Then, if you were a non-profit organisation, you could get what is now called "100 per cent of additional costs". This means that if it is a university we would not pay for the salary of the professor who has tenure and his own salary; but we would pay if, in order to carry out that research, he went to, say, Guy's Hospital and, being a bright young person who has just got his degree, he could work there. Then his salary could be paid fully by us if he works full-time on the project. Similarly, we would not pay for renting the premises of Guy's Hospital. But if you have to buy a new high-resolution, three-dimensional electrophoresic block or, better still, if the bright young person needs money to build his own instruments, for that we would pay fully.

Mr Greenway

297. It all sounds very haphazard—at the bottom end, anyhow. And fairly haphazard at the top. Are you satisfied that it is not all down to chance that you make any progress at all?

(Professor Fasella) It would be very interesting to see what is the role of chance; and there is the excellent concept of serendipity which you invented in your country. So chance is quite respectable. But what I was trying to say is that we try perhaps to encourage chance so that you have a set of programmes—and you can have examples—so that you can directly see what is the degree of precision in the course of proposals. This is what you could call partly top-downwards and partly bottom-up. And we try to encourage chance so that bright young persons may be interested in going into micro-electronics or into some areas of biotechnology or the material sciences or, now, into something in which I think there should be a revival—something called molecular engineering in organic chemistry; or new approaches to toxicology as applied to food. There are many such areas. So we are interested in this.

298. Chance seems to have two aspects, does it not? There are (a) the people who by chance apply to you; and (b) these people having applied, somebody within your organisation by chance filters out the right——

(Professor Fasella) It does not work that way. Can we follow an example? You come to us and say, "I am interested in a new approach to, perhaps, toxicology".—or perhaps you say that the old way of testing for the long-term toxic effects of drugs to be given eventually to chronically sick people is not significant if you do the chronic work on a normal animal. Suppose that you give an anti-hypertensive drug to a normal animal for all its life and suppose that is very effective, it will make the animal sick. Suppose, then, you come to us and say, "I have used genetic engineering to make animals which reproduce some disease and which I can use as better models for testing something. I am not certain that this will be a good idea but that is not for me to say". Suppose you come with that! And let us suppose that you also say, "To do this, I have groups in place working at Guy's but I also found out that I want to do live monitoring with a suitable animal device for the squirrel monkey they have developed in Hannover. The developer is ready to work with me so we have put to him a joint proposal". Then that proposal comes to me and I send it to a system of peer reviews. For the programme which I mentioned earlier (and which is an open one) we have now put together a group of 3,000 specific experts. Britain has about 480 of them. And I have a list of their names so that, if you wish, you can see who they are. You will find some pretty good persons among them. We could do that because the Royal Society or the Max Planck or CNRS have all given their referees; and then we double check; so when the proposal comes in, it would be sent (depending upon how large is the request) to at least two and up to four independent referees in different countries.

Sir Gerard Vaughan

299. If I came to you in connection with mad cow disease (BSE), and said that I wanted an urgent investigation, you would put it to your advisory panel. Is that right?

(Professor Fasella) Yes. We send it to the referees. The referees send in their report and there is a group of scientists, chosen by CODEST, who look at the referees' reports and eventually make the selection of——

Mr Greenway

300. How long does it take to process?
(Professor Fasella) It depends upon the importance of the request. If it is for a scholarship on what you would call an urgent case and it may cost £10,000 to send very rapidly somebody from your laboratory to Heidelberg because you want to check something, then it can be done even within a fortnight if the cost is £10,000. If it is a very expensive project of several millions of pounds, then generally (although there are no deadlines in the SCIENCE programme) every three months the committees look at all the proposals that come in. So that, if you are lucky, it gets looked at after the time taken by the referees to reply—which is 40 days—and then the selection is made. It takes about one week from the end of the referees meeting which decides to the time when you, sir, would get your letter. Then, generally, it takes the university itself—and universities are much slower than industry—about 50 days. That is the average. The minimum is about one month. Some universities, even in Britain, take much longer; they take as long as three months before they answer. Then, when they answer, having filled in the application form, it takes us about 40 days to process it, to check with the legal people. This is certainly one of the sore points.

301. You mean that it needs shaking out, the whole thing? And what are you doing to shake it out?
(Professor Fasella) We get these proposals from all over the Community and sometimes—and I shall mention things now just from my own country, which is Italy, so that I do not impinge upon anybody else—we get proposals from universities that did not exist.
302. In Italy?
(Professor Fasella) Yes; and there were also some from other countries. But I prefer to mention my own so that I do not turn it into a nationality problem. We have data here to show how this has been steadily improving and I can leave all this material with you.

Sir Gerard Vaughan

303. Does it all work satisfactorily?
(Professor Fasella) Really, it does.
304. That is what we are getting at.
(Professor Fasella) May I finish my story?

Chairman

305. Of course, Professor Fasella.
(Professor Fasella) When the programme started we were at three months.[1] We are now down to 40 days. As we learned how to operate it, as contracts became standardised, the time involved became shorter. To come back to my answer, it goes back to the university for the final signature and then, when the final signature is in, they generally get the money between one week and (it might be) one month later. This depends upon what is the banking system in the respective country. Britain does pretty well at that stage. There are other parts of the Community where the transfer of the money through the banking system is very slow. We even proposed to them to leave their money in Brussels and have checking accounts. But in some countries, notably Greece, this is now being solved. The government wants the sums to go in and not to come out again. But, with 1992, this will change. Again, it is not a yes-or-no answer. You asked me the question, "Does it all work? Am I satisfied?"—No. But at least I am sufficiently happy in the sense that I think I know, and I think my people know, which are the steps to be taken to improve. And in doing this we are being helped by a system which I think we were encouraged to introduce by the United Kingdom Government. I did not like it very much, but now I must admit that it is very useful. It is called the "independent evaluation". If, again, you take the SCIENCE programme that we were mentioning, we appointed a group of independent experts. It is chaired by Sir Sam Edwards who is Cavendish Professor of Physics in Cambridge and quite a notable man. But you have people from Sweden, you have one American. They have all to be outstanding personalities who have had nothing to do with the programme but who are knowledgable. They are asked on their own responsibility to sign the report which is published; and if they make mistakes they are responsible for them. All these reports are available. The most recent one about SCIENCE has just been sent to me by Sir Sam Edwards last week. These people look at the programme and say, for example, "This works; this does not work. Improve this!" This is very useful and I think there has been in this administrative part a very distinct improvement; so that I am more satisfied than dissatisfied—satisfied because I do not think we have stopped improving. So, as I say, although in a sense, I am dissatisfied, I am also satisfied because I think that on each occasion I know what has to be improved and, indeed, we have been improving considerably. For instance, in this specific case what we shall do is to produce a simpler, more standardised contract; because we now know which parts of the contract people want to see changed. So we have learned from experience. The other change we will make so as to improve the timing is this. Because the programme has expanded, we will introduce between the individual referees (and their total is 3,000) and the group of 22, some intermediate groups of experts who will look at bunches of proposals. In that way, we can speed up the process of comparing the various proposals that we have.

[1] Note by witness: The selection and contract preparation procedure under the experimental phase of the SCIENCE programme took around three months. In the interests of objective assessment the selection procedure (circulating to referees etc) itself now takes a little longer, due to the increased number of applications. Following selection, projects can now be launched and all contract procedures completed within about 40 days. Contracts are now on average larger, more costly and have more partners than during the pilot phase.

[**Chairman** Cont]

306. May I put to you another point, Professor Fasella. I am conscious of the time and I should like to move on and to broaden the subject slightly.

(Professor Fasella) The greatest difficulty is that we have on average ten times more good requests than we can support. The really inefficient part of the system which is frustrating to everybody is that we have many good requests than we can satisfy. This is bad for the people who make an effort, it is bad for us who feel very dissatisfied; but it also shows that there is a clear need for this type of action. And we have all these data which were obtained not by us but by this group of independent experts chaired by Sir Sam Edwards. I can leave this material with your secretariat.

Mr Win Griffiths

307. Professor Fasella, can we go back to the actual Framework Programme under which all that you have been describing takes place? You have already said that you get a tremendous amount of advice from scientists about how to develop your Framework Programme for them, about what to put in and so on. But, at the end of the day, those programmes are approved by the Council of Ministers. Do you find that you are subject to any political pressures; and, in that sense, do countries such as Germany, with a highly organised and well defined Ministry of Science, have any particular advantage over a country like Britain where we do not have a very strong Science Ministry in that it is rather fragmented?

(Professor Fasella) I have my doubts about that. For us, especially in the beginning, it was easier to deal with BMFT in Germany or with the Ministry of Research in France. However, I really have my doubts about your question. I love England—for I started life with an English nurse; and fell in love with her—I was very small! But the more I know about England, the less I understand you because you have a strange, mysterious way your wonders to perform. On paper, by Continental standards, there should be chaos among your various Ministries. In reality, maybe there is, but I do not see it. So that I would be very cautious and I understand it is very much an internal problem. But I can look at the results—and I take once again this SCIENCE programme because we have been discussing it; and again I have the data here if you want it, since the programme started we have had two pilot years and five years of full operation. I mentioned the concept of "just return", which I hate. But if Britain altogether pays about 18 per cent of the programme, you get back, with oscillations in various years, from that programme between 23 per cent and 26 per cent. This is not because you are favoured; the choice is made on the basis of scientific merit by experts who are not British only. It just means that, altogether, the number and quality of the proposals that come from Britain are judged to be better by the peers of the system, which involves everybody. France started very low and is now doing much better. It is improving. Britain certainly affects very much the shaping of the programme because at the time when other proposals are discussed Britain generally sends in very good experts who make good proposals and who, up to a point, lead the others. So I think you have an important role in shaping this. There is one trend which worries me a little. There is a tendency from all governments to increase the weight in the final selection of the programme, to increase the weight of the nationally-appointed *fonctionnaire*. Here I establish a pure correlation. I do not know if it is the cycle of cause and effect. But if you look at the programmes, if you take the SCIENCE programme where the committee, the only one, is made up entirely of scientists who are not appointed by governments, their constituents are scientists themselves. So that they do not get orders from the Government. There, the British participation is between 23 per cent and 26 per cent. Then you go to programmes which are run by what we call (in our jargon) "Comitology Three"[1] which (from your experience as part of it) you know is very tight and you know that those member-States represented who eventually vote there approach the "juste" structure. Maybe it is a random case. But my worry is that it may become more politicised. I can understand that governments which have a budget increase are more concerned and that they respect a coherence; but the danger is that if you eventually take a vote which is politically inspired in deciding which programme is scientifically best, this is the worry.

308. You mean that you would like to see more of the approach based on the science factors. The other message that you seem to be giving us is that the European research budget could be increased dramatically and a lot of worthwhile research would be done.

(Professor Fasella) Yes. I think that even this must be done progressively. In a way, we are very young in doing all this. We are learning all the time and we are still in a learning curve. I told you that we took three months to process, that it then went to two months and that it has now been cut further. We are learning. But if we increase too suddenly that would be bad because we would not have the time to learn and adjust. But, as of now, I still think we have too little for what is needed. In absolute terms, even though the 1991 budget will be more than 2-billion Ecu (so it is not negligible) it represents 3.5 per cent of what national governments spend at home. So that it is a very small part relative to what each public

[1] Note by witness: The so-called "comitology" committees are statutory committees provided for in the Council Decisions on Community R&D programmes which assist the Commission in the implementation of the programmes. These committees have powers which are defined in the Council Decision of 13 July 1987 laying down the procedures for the exercise of implementing powers conferred on the Commission. They range from committees of a purely advisory nature ("type I") to regulatory committees ("type III").

[**Mr Win Griffiths** Cont]

authority is spending. I think the pure fact that we have so many good projects which have to be turned back because of lack of funds shows that there should be an increase. In fact, that would be useful but I do not think it should be too fast.

309. Do you know what happens to the projects which you cannot finance?

(Professor Fasella) Some, I think, are lost. But something new has happened. I am almost afraid to say it because I wish I had had that idea myself. But somebody else had it and I feel stupid because I should have thought about it. But it is interesting. Banks came to ask us—and this was not in the SCIENCE programme but in programmes like biotechnology—this sort of question. "Could you give us a list of the projects which your referees found good but which you did not support because you did not have enough money?" What we do then is to call back the persons who had made the proposals (because we cannot reveal their name without their authorisation) and, if they agree, we tell the bank that there was a joint proposal by this small company in Manchester and this other company in Bruges, a proposal which rated very high but which could not be supported because of lack of funds. So all this is happening. And I think that some, indeed, have obtained facilities or a loan from industry. But I do not know how successful they have been. We tried to trace them. But all these projects are at an early stage so that for many of them we do not know yet whether we are doing the right thing or not.

Mr Bowden

310. I should like to prove the point which was raised earlier about the relative strength of an application which comes from a country which has a defined and dedicated Minister and Ministry of Science and that which comes from a country like Great Britain where it seems to be slightly a gamble for whoever cares to put their case forward to you. Also, I should like to take that further slightly to say that in the latter case, in the British situation, it gives you a great deal more power as DG XII in deciding what is done centrally in Europe and what is done individually in the country. Do you think that Great Britain is at a disadvantage in this particular arrangement? How do you see this developing politically?

(Professor Fasella) If you look at the facts we have, in many programmes Britain does better than average. I think that the *juste retour,* if Britain puts in 18 per cent and gets 22 or 25 out, is, to me, above average.[1] It means that some other countries will get less, inevitably. So, if you take those parameters, Britain altogether is above average especially in some programmes. So in that sense, you could say that Britain has much to say—it is generally the most vociferous delegation in Council—and it gets quite a lot out of the programmes themselves. But why it is so? Is it because the present system works better? Or could you argue that you would get even more if you had a Ministry? This I do not know. Also, you may take into consideration that if you compare the British situation with the situation in other highly advanced and large countries like Germany or France, altogether (and especially in Germany) the public funding for civil research is much higher. So the Germans have much less reason to come to the Community while your scientists and industry are much more interested, and especially so in the basic research part. Again, this is how I read the data with the figures. But I cannot answer your question because I could not know if you would do better with a central Ministry. How could I know?

311. The second part of the question dealt with the power that lies with DG XII to decide what is better dealt with within Britain and what is better dealt with within Europe.

(Professor Fasella) I think I know Britain enough not to venture an explanation; I think I know you well enough to know that it would be futile. It is really an internal——

312. Then let me put it this way. Where there is a dedicated Ministry of Science in a country, they would have made a judgment first of all (and before they put it to you) as to whether something they could do within their own national framework. And, having made the decision that they could not, they would then put it to DG XII. Whereas, where things spring from all over the place, as you have suggested—from the United Kingdom and elsewhere—it rests with you to make that decision.

(Professor Fasella) I think that there must be within the United Kingdom Government a very good internal correlation. I do not know how you do it or whether you have internal committee meetings. But what I have said is that, from the outside I would have expected it to be chaotic; but, in reality, it is not. I even keep a score, a record—and this is for my own amusement; Brussels is not always fun. Well, not always, but most of the time!—of the degree of inconsistency which we think each of the various representatives of each national administration has. And sometimes in the countries which do have a centralised Ministry, you find less internal coherence than is the case with Great Britain. I do not know what happens in London but by the time you get to Brussels you are pretty well co-ordinated.

Mr Griffiths

313. On the number of projects that you consider, is there a great deal of difference in what we might call the rejection rate because of the lack of money? In other words, do you get many more projects from the United Kingdom compared with other countries and therefore more rejections?

[1] Note by witness: For the years 1986–1988, the UK share of Community R&D funding through its programmes has been fairly constant at just over 21%. The gross UK contribution to Community funds over the same period was between 18% and 20%. The net UK contribution is currently around 15%.

[**Mr Griffiths** Cont]

(Professor Fasella) Relatively so, yes. We have more projects from the United Kingdom.

314. Do you think our scientists are coming with the begging bowl because we lack money?

(Professor Fasella) You generally have a higher total number of acceptances. There is a higher number of requests and therefore also a higher number of rejections. The final result is that you have above average participation.

315. Do you think that our higher participation is because we have got more bright people looking for research funding? Or is it because we have got more bright people who cannot get the funding at home and have got to go to Europe to get it?

(Professor Fasella) I do not know.

316. The latter is probably the reason; because there was not enough money in Britain as compared with Germany.

(Professor Fasella) I do not know. Sometimes, perhaps. But here is a joke which was made to me and I quote it as a joke. I had a German colleague whom I had known for many years. He was making fun of me; and he said, "You know, we like Brussels because every time you have a programme we go to Bonn and say, 'Brussels put in "X" amount so then Bonn puts in "2x". The civil servants go to Brussels and we increase the money we have at home as a result." But this was a joke on his part and I quote it as a joke.

Chairman

317. May I ask you, Professor Fasella, to clarify a point which I did not think we had got to earlier when you were talking about additional costs. You spoke of "100 per cent of additional costs". If 100 per cent of additional cost is equivalent to 50 per cent of full costs, including the overheads, from where would you expect universities to get the other 50 per cent?

(Professor Fasella) Essentially, from, their own resources. In this sense, you could consider our action as an action which induces increased support for research. If, on average, the other 50 per cent comes from some other source, you could say that the Community programme induced more spending on research. This is a deliberate policy in the situation where, in the majority of programmes, the other 50 per cent comes from companies. In all programmes that involve companies this is very good; because the best way to make certain that companies are serious when they participate in research is to make certain that they put their own money into it. There is now another idea-and again, unfortunately, it is not my idea; it came from the independent evaluators. In the BRITE programme, the independent evaluation panel said—and we have now followed their recommendation and it works—"Ask that the industrial contract be signed by the president of the company; because if it is signed by the head of research then, if things go badly he hides it. But if it is the president of the company and he knows that he has put in half of the cost, he will feel obliged to use it." So for universities involved in industrial projects it could be a way of inducing more funding from home sources. In reality, especially if one considers the way that universities work—and I would go back to the first example—let us suppose that you had sent in an application from Guy's, you could say that you have contributed some of your time to the projects for free; because you would receive your salary from your administration and you do not charge it to the Community programme. But, in a way, you would have received your salary in any case; so that it is really the scientist himself who is being exploited because he does a little extra work because he would be supervising the young person whom we pay who could not work if you did not contribute your guidance for free. Also, in making comparisons, you know the reason why the Committee of the Vice-Chancellors and Principals of Universities, chaired by Professor Hanham from Lancaster.

318. He came here, did he not?

(Professor Fasella) Ah, good. So you know him. He wrote a report on our grants and they are now going to give us advice exactly on this point. But when you say that the British system gives 70 per cent, you cannot really completely compare that with it because their 70 per cent assumes that it goes to as, I think, is your expression, "well-founded universities or institutes" while our 100 per cent pays all the additional costs. So that in the long run the difference is not very large. But the system of calculating things in various countries is very different. For Britain, we are actually expecting a suggestion from the Hanham Committee and in Germany we have a very good report from the West Deutsche Rektorenkonferenz, where this has been cleared. But the situation is different.

Sir Gerard Vaughan

319. Professor Fasella, may I put this to you? We have been talking mainly about the present. Will major changes need to be made in 1992, do you think?

(Professor Fasella) I think so.

320. Could I link with that this question? Would you like to see a move to the position where all European science was done through you, through the Commission?

(Professor Fasella) No. I do not think it should all be done through us. I give you another quotation from Klaus Pinkau who is a very distinguished German physicist and head of the laboratory in Garching. He is connected with our fusion programme and is chairman of the JET Council here in England. He runs a laboratory of a few thousand persons which, by the way, is one where Russians, Japanese and Americans work on European territory on the next step in fusion. Klaus Pinkau is very involved in our programme. He is very outspoken. Once he told me, "You know, Paolo, if I could do everything in Garching (which is his lab) without ever going to Munich, I would be very happy. But the Max Planck head

[**Sir Gerard Vaughan** Cont]

is in Munich and now and then I have to go there because we are not big enough to do it alone. Then I found out I even had to go to Bonn and now I even have to come to Brussels; because we are a world-wide project—it has reached the scope. If, therefore, for the type of thing that interests me, I find that I have to come to Brussels, I do so seriously because, if I participate, you will do less stupid things than if I keep aloof." He is very active and he is a very good friend; so I may even take what he says as a compliment—for, as we know, there are infinite ways of deluding oneself. But you can see the point. So I think we should increase; I think we should increase at a certain rate but allow the system to adapt and to learn from our mistakes without being given tasks before we are prepared for them. So I would say that by 1993–94 we should have a budget of about 3-billion Ecu per year. And then it depends upon how successful we have been. Maybe I sound uncertain. I am not uncertain within myself. I see very clearly where we have to go. But it is just like when you are driving a car. You look ahead and if there is a curve you had better steer along it.

321. You do not think you need a new car for 1992, do you?

(Professor Fasella) Well, not a very fancy one. I would not go up to a Rolls-Royce. Also I think there are very good institutions which do excellent research work—institutions like CERN or the Grenoble lab or EMBO or the research part of ESA. We have very good relations with them and I think it is good to interact with them. But when you have something that works, let it alone? Do not try to put it in a bigger straitjacket.

Chairman

322. Professor Fasella, thank you very much, indeed. May I just say, using your analogy of the motorcar, that we drive on the left in this country and you drive on the right on the Continent. It may be that that is something we should also consider. But we thank you very much, indeed, for coming here this afternoon. We have been interested to hear what you had to say and would certainly welcome sight of some of the Papers if you would like to leave them with our Clerk.

(Professor Fasella) Thank you very much. It is a great honour. I had planned to be very disciplined—not to move my hands and to be very British! Well, I have not been; but it has been a great opportunity and I think that in spite of all the "I don't knows", we have a certain idea as to where we are going.

Chairman: Thank you very much.

Examination of Witness

PROFESSOR SIR DAVID PHILLIPS, FRS, Chairman of the Advisory Board for the Research Councils, was examined.

Chairman

323. Sir David, can I give you a very cordial welcome to our Committee this afternoon. It seems a very long time since we first had our preliminary chat together and, obviously, the Committee have received quite a lot in the way of evidence and scrutiny sessions since then. So we are very much looking forward to our session with you which, as you have probably been told is more or less in the last part of the evidence that we shall be receiving. We hope to use you as a bit of a sounding board this afternoon. May I start by asking you whether you can tell us what benefits the United Kingdom derives from being involved in international science activity and what sort of costs are incurred?

(Sir David Phillips) Well, Chairman, perhaps I should not say so at the beginning, but I do not think I can quite match the performance that you have just been enjoying; but I listened to it with great interest and I hope during the course of our discussion that I shall be able to come back to some of the points that Professor Fasella and you were discussing. Science really has been always international and I would imagine that it is bound to remain international in character if only because there is, I believe, a natural limit to the number of people who can be engaged in the scientific activity in any country; whereas there does not seem to be a very natural limit at the moment to the number of scientific opportunities that might be explored. That is one point. Secondly scientists perhaps have the image of working in a solitary way in their own laboratories and emerging only to announce spectacular results. But, in fact, a great deal of communication goes on the whole time both within and between countries; and that is an extremely important element of the whole activity. And a lot of that, as I have said, of necessity is international. But then there are other factors that have come into play as science has developed—with which, by now, you will be very much aware. Some scientific activities such as the study of high energy particle physics has become, even in the opinions of the scientists in that field, too expensive an activity to be pursued in a single country, and certainly a single European country. And it begins to appear to be too expensive an activity at its present state of development even for a country like the United States. So that I would expect this activity to become a truly global activity if it is going to be taken any further. As it happens, I hope it will. There are other examples of that sort of science. Astronomy is much in that category. The Science & Engineering Research Council maintains observatories in Hawaii, in the Canary Islands and in Australia. All of these are run jointly with other countries; and we benefit a great deal from that collaboration, both from the scale of the apparatus that we are able to build and share and

[**Chairman** Cont]

from the scientific communication between the people that are using it and doing cognate experiments with it. So that is one category, the essential nature of large-scale international work. There are then some issues which are inherently international and some of those are impinging a great deal on work which is now in progress: for example, the whole concern about the global environment and about particular issues within the global environment. The Royal Society reported recently a study that it had conducted with the Academies of Norway and Sweden on acid rain in Scandinavia, its relationship with how it might conceivably be generated and what were its effects. That sort of thing by its very nature is international and was, I think, a very happy example of collaboration between those three countries. The whole activity on the depletion of the ozone and the ozone hole also was an example which began with a British observation in the Antartic, which quickly led to confirmation by other people, and then to international activity on an economic and industrial scale rather than a purely scientific scale. So there are some things which are bound to be international. I could pursue other examples of that; but then there are things which begin to impinge potentially quite severely if I now bring myself down to the European scene. One of these is the question of bio-ethics and the different attitudes that different members of the Community have to different sorts of research work. You will all remember, I am sure, having taken part in what —if I may say so—was a model debate on embryo research in the House just a few weeks ago arriving at—and I do not know what were your individual positions—a very proper result, that work could be continued up to a point under proper control. That, I think, in the view of most scientists, is what was needed. That is a view which is not shared by your legislative colleagues, for example, in the Federal Republic and was not shared originally in Denmark. And there are other issues which seem less sensitive, issues such as the use of genetically-engineered oganisms in producing biochemicals. In Germany, it has not been possible for Hoechst, the chemical company, to produce human insulin from genetically engineered bacteria because there is strong public opposition to that sort of interference with nature, which arises from rather complex social, historic or religious attitudes which, I think, are understandable. But I am just bringing it up as an illustration of differences in the attitudes towards what sort of science it is acceptable to do that arise even within as coherent a community as the European Community. It is necessary—since, for example, if one modifies plants one cannot expect pollen to abide by national boundaries—to arrive at national agreements about what can be done. And that sort of science, again, needs to be done internationally and by international agreement. So there is really no way of avoiding on any of these fronts the necessity to take an international view of science. And, just to conclude for the moment, Chairman, I think that what we need to do and what, to a degree, we have been successful in doing (as Professor Fasella, in effect, pointed out) is to create, in the context of the international view which British scientists have always taken, a particular European view of science which leads on sometimes to a wider international view.

324. As far as internationalism is concerned, is this just in "Big Science"; or is it happening in all fields?

(Sir David Phillips) It happens really in all fields. One reads all the time in a scientific journal like *Nature* of some new experimental discovery or some development of technique that has taken place in some laboratory in some country and, within days, you will find the same technique, the same experiments, being done and improved everywhere, including in this country; and a constant interplay between the originator and the developers of the technique. It is a very international business—combined I may say, and rather curiously of course, with an element of competition.

Mr Greenway: Do you resent, Sir David, the limitations put on scientific investigation by some parliaments? I do not in the least share the view that you have expressed about embryonic research. I am wholly opposed to what you have said on that; and if we could secure a majority in this Parliament (and we may yet do so) and reverse the position of some weeks ago, would you resent that? You would regret it, obviously; but would you resent it? We do not have a common view on this Committee but I would——

Chairman

325. If I may intervene at this stage, this is not something which is particularly relevant to this Committee's inquiry. It is a separate point of view which I think is being used——

(Sir David Phillips) I said, Chairman, in a speech at a meeting organised by the Parliamentary and Scientific Committee last October, that I wonder what will be the attitude of German doctors to developments in in-vitro fertilisation techniques that are made necessarily in other countries by other scientists because the work cannot be done in Germany; and what will the German population say about their access to such advances. It cannot be supposed that a prohibition in one small country will actually prevent the work going on somewhere else.

Sir Gerard Vaughan

326. We are discussing international research, European research and national research and this is very complicated. Now, somebody has to make the decisions both in financial resources and in skill resources; and we are very concerned to know whether the arrangements in this country are satisfactory for allocating the priorities. Is the machinery right? Is it right now; and will it still be right when, for example, 1992 comes? Should

[**Sir Gerard Vaughan** Cont]

we be changing in this country? Or can we carry on as we are? Do you not agree that this is a very complicated matter?

(Sir David Phillips) I have to confess, Chairman, that I am somewhat ambivalent about this; and for these reasons. I strongly subscribe to the view that virtually all Government Departments nowadays are necessarily engaged in science and technology and, therefore, need to have within those Departments expertise in these subjects to advise their Ministers and inform policy decisions and so on. And these Departments, therefore, need to be supporting research work that supports this in-house knowledge. That is more true of some Departments than others, perfectly obviously. It is more true of the Department of Trade and Industry, of the Ministry of Agriculture, Fisheries and Food, of the Department of Health and, of course, of the Department of Education and Science as things are now organised. On that score, what I would worry about would be that the in-house expertise in science was not strong enough. If I can take you back to the Rothschild Report of 1972, one of the proposals in that report with which I strongly agreed, since I did not agree with all of it, was that the scientific capability of Government Departments ought to be very much strengthened. I think that is now again a fashionable thing to say and I hope it is happening. Having said that, one is left with the problem of how one brings the scientific views and policies of all these different baronial Departments together in a coherent view when one wants to express a United Kingdom view in, for example, a European debate. And that is the sort of thing that Professor Fasella was finding very mysterious and which I—and this is part of my ambivalence—find at the moment a little less than 100 per cent satisfactory. As things stand, because the DTI is associated with more of the Framework Programme than any other Department, the DTI is regarded as the lead Department and the Junior Minister, Mr Hogg at this stage, is the person who represents the United Kingdom on the Council of Ministers. When he does that, he is not always discussing only DTI issues; he is, from time to time, discussing other issues and particularly those affecting the science base. And, of course, on those issues, he is very thoroughly briefed. The Department of Education and Science, in association with the research councils, makes a very strong and, in the main, I think, successful, effort to give him that briefing; and I would not want to say that I am aware that things have often, if ever, gone terribly wrong. But I am still left a little uneasy. If we look at other areas of Community policy and how governments interact with them; if we look at agriculture, for example, since (as it happens) the present Secretary of State for Education and Science used to be the Minister for Agriculture, Fisheries and Food and knows all about this, there is a Committee of Ministers of Agriculture which meets in Brussels from time to time. And that becomes a sort of club because they all know one another and they can communicate before the meeting as between, if not friends, at least close acquaintances; and they develop, I think, to a degree, a common ethos. Now, when it comes to the Council of Ministers discussing basic science then the French Minister, M. Curien and the German Minister, Herr (Riesenhuber) are, again, in that close relationship. But our representative is not. And I fear that something may be lost there. But I do not quite see how to resolve the dilemma.

Chairman

327. As far as the actual presentation of a United Kingdom case and the making of policy in this country is concerned—and you talk now about this cross-departmental involvement with matters scientific—do you think they would be weakened or strengthened by having an overall Ministry in charge of science.

(Sir David Phillips) Well, that is where I stumble. As I have said, I believe that most Departments really need a strong scientific capability themselves. Now, if they retain that, what is actually left for the Minister of Science? That is the question that I find very hard to answer.

Mr Win Griffiths

328. On the other hand, your were mentioning the "club" that exists for the Agriculture Minister and you seem to imply that there was a certain benefit in that.

(Sir David Phillips) Yes.

329. Surely, therefore, even if you have a strong scientific base within each Ministry or within most Ministries, there would still be a value in having a strong lead Minister for Research and Science along, say, the German pattern to develop the European Community dimension in a way in which Britain would be fully involved.

(Sir David Phillips) You, Mr Griffiths, will know a great deal more about this than I do; but in general I am very suspicious of Ministers having (if you like) responsibility without the money.

330. Well, they have got that in Germany, have they not? They have the responsibility and the money.

(Sir David Phillips) I am afraid that I do not know the detail but, of course, the organisations of governments differ in different countries in quite strange ways. Herr Hiesenhuber yes, has some over-riding responsibility for science and technology but I do not know how that puts him, for example, in relation to the German Minister of Agriculture who also needs strong scientific capability.

Mr Evennett

331. We are obviously looking at a very difficult subject here and we do not seem to be getting to the root of the problem. Like you, we find it very vague and very difficult. The question

[**Mr Evennett** Cont]

as I see it is the choice or the balance in scientific research and development between national, European or international resources and responsibilities and how we divide or split them. I, personally, have a horror of Europe and the EC bureaucracy and was most concerned at what Professor Fasella had to say. If one accepts that we want that certain national base in our scientific development and scientific research that we have always had in this country and would want to continue and you mentioned earlier that certain aspects of science had to be international because of the cost and the difficulties involved. Do you fear, as I do and perhaps you could expand a little on how you think it could develop between Europe, national and international, that Europe itself may not be big enough for many of these things; that if we looked towards Europe we could be at a disadvantage? The Americans and the Japanese and we, ourselves, could find ourselves competing in certain areas of scientific development. And from our visit to certain centres in Europe, we have seen that the competition element is still very much there in certain fields while, in other fields, because, as you have mentioned, the costs involved are so vast, competition is not possible because we would all need to pool our resources. What I am concerned about is a kind of Fortress Europe on science: "This is us and we are looking just inward to ourselves in development with a bureaucracy." As a scientist, and a British scientist, does this worry you?

(Sir David Phillips) At this instant, I can think of only two areas of science which are getting out of scale for regional development. By that, I mean independent development, say, in Europe, in the United States or in Japan. They are highly-energy particle physics and possibly fusion research. It does no concern me at all, I think, as a scientist that these two subjects may have to be developed on a global scale by collaboration between scientists from those three areas—and, indeed, I would have to say, since one of the leading figures in the field came from Pakistan, from whichever country people with the necessary talent emerge. That does not worry me at all. If I come on to your fear about the Brussels bureaucracy, I do not entirely share that fear. I should explain that quite a lot of the time when Professor Fasella was talking about the "SCIENCE" programme he was talking, in effect, about almost a European research council programme. Now, you have to think about how that came about and how it runs in two stages. And it was that which I did not think emerged terribly clearly from Professor Fasella's account. Stage One is that governments have to agree that there should be such a programme; they have to agree what resources should be allocated to it; and they have to agree what areas of science it should cover. In the old "SCIENCE" programme—which is now being transmogrified into Line 6 of the new Framework Programme called "Human Mobility"—there were really very few constraints on the areas of science which were allowed to be supported within that programme. That was the level of government interest or interference or, if you like, control. Those resources then go to the Commission, to DG XII. And DG XII, as the Professor was explaining, set up a committee of science advisers which is known as the Committee on the Development of European Science and Technology—of which at the moment I am a member, Sir Peter Swinnerton-Dyer, the Chief Executive of the Universities Funding Council is actually the chairman; and there is one other United Kingdom member, Sir Charles Reece, until recently the research director of ICI. That is a committee of scientists. At this point we have come to something which is science-driven; it is not government-driven, it is science-driven. And that extends a little to the questions that were asked. The people who apply for grants from that committee do so of their own volition. And they do that in this country and they do it also in countries where there is a Minister for Science. The Minister of Science in France does not say to individual scientists in French laboratories, "You must apply for funds from this committee." It is science-driven by the participating scientists. Governments, at that point, are not involved. That point, I thought, did not come out absolutely clearly in the discussions with Professor Fasella. It is also science-moderated; that is, all the applications are looked at by independent scientific referees and they are judged at this instant solely on the basis of their scientific quality and the age-old criteria of timeliness and promise—where promise, to some extent, perhaps, has to be seen here in a European context.

Mr Bowden: I fear that this question may be thought to be below the belt but, since it is unlikely that we are going to have a Minister for Science or a dedicated Ministry of Science, do you feel that the present arrangement of research councils and the ABRC is able to represent British scientific interests on a European front and on an international front in the best possible way? Or do you think there is some other arrangement which might effectively serve that role?

Sir Gerard Vaughan

332. May I interject at this point? One of our groups of witnesses suggested that the ABRC be reformed, slightly changed, and not remain in its present——

(Sir David Phillips) Thank you. I believe that to have been the CVCP, but I may be wrong. The ABRC, as you will all know, has recently been reconstituted and is now a smaller body with, as I like to think of it, five executive directors who are the heads of the research councils, six non-executive directors who are representatives of academia, commerce and industry, myself as an independent chairman, and two other members who are, in effect, assessors since they are not necessarily bound by what the committee concludes. One, the deputy secretary from the

[**Sir Gerard Vaughan** Cont]

Department of Education is there to represent the Secretary of State and to report to him, and the other is the Chief Scientific Adviser from the Cabinet Office, who also has other responsibilities and connections. The committee, however, remains advisory to the Secretary of State and although I confidently expect that in the main our advice will be accepted, it would be a mistake to suppose that at this instant we are at all executive. We are, if you like, becoming quasi-executive. Given that and my insistence that the Board is actually a committee of independent scientists and technologists chaired by an independent scientist and technologist, I do not see how the Board or its chairman can act abroad as though it were, or he were, a member of the Government or a representative of the Government. There would have to be a radical change. One can imagine, for example, that the Board could be chaired by the Junior Minister in the DES. That would make it a radically different body and, at this instance, I would want very long notice of a proposal to move in that direction.

Mr Win Griffiths

333. May I get back directly to the European scene? Given, Sir David, that you heard most of what was said by Professor Fasella: that in the science field there is a high degree of concentration and a great deal of effort made to make sure that the right projects are funded and that it is done through a peer-review based decision-making process, do you believe that all this effort is effective in terms of the projects funded and the amount of money spent? Or could it be done better in some other way? And, if this were disbanded, would the work be done somewhere else anyway? And then, given what Professor Fasella had to say about the way in which the other fields of activity and research worked; that, in other words, they were peer-reviewed based, do you think that the European Community should continue this role in science and research? Or should it move over to the science mode of doing things?

(Sir David Phillips) Well, Mr Griffiths, I do not know whether I can remember all those questions. To start with peer review, it is a matter for concern that the peer-review system, which has developed in this country and in the United States, in particular, and is now being used in Brussels, very largely on our recommendation, is a very labour-intensive, time-consuming thing which takes up the time of a very large number of scientists. We are much concerned about this in this country and, indeed, the ABRC has in process a study of the peer-review system which is being chaired by Professor Margaret Boden of the University of Sussex—and I hope the study will report before the end of the year—to see whether there are any improvements that we can think of making to it. I hope that they may think of some things to suggest. But no one as yet has thought of any seriously different way of ensuring fairness in the assessment of scientific quality of this kind. As to whether the Community should be doing this sort of science, well, there are certain constraints which I have not mentioned—and which I do not recollect Professor Fasella mentioning explicitly—on the sort of scientific programmes which are supported by the Community under their "SCIENCE" programme. They are, in essence, that the science has to involve collaboration between universities or industrial companies or both, in a number (at least two) different European countries. That, I think, is an essential and extremely important element in this programme and one which I think makes it very worth while. Going back to my point about the need for United Kingdom scientists to develop a European ethos, if you like, instead of just a United Kingdom ethos, we are of course in this country extremely proud of our scientific tradition and I believe, as we probably believe in respect of football, that we really do it better than anybody else. But the fact is, if you look around Europe, that, as you would expect, there are exceedingly good scientists and exceedingly good research laboratories in most European countries. It is important that we should know them and collaborate with them and benefit from their skills as well as from our own skill. I think this programme is aimed particularly at bringing that about. Now, when you get out of basic science programmes into programmes with a more industrial content, then the first step in that, which again is something you discussed with Professor Fasella, is the selection—by, for example, a research council in this country or by the Commission in Brussels—of an area that needs special attention: let us say, information technology. We have often called these "directed programmes" and I think it creates a false impression. They are "selected programmes". What is done top-down is this. On the basis of scientific and industrial advice, an area of science and technology is selected for special emphasis. But what is actually done in that area depends upon what scientists and technologists suggest should be done. They, again, apply for funds to Brussels so that they can do what they want to do. It is, admittedly, within a defined area but it is not directed in the sense that anybody centrally tells them what to do; it shifts to being a responsive support scheme like all the rest. Now, in information technology, that operated to a degree with the Alvey programme but you can see that is all too easy to move towards a much more top-down system where centrally, but again on scientific advice, it is decided, "Yes, Europe needs, for example, to be able to manufacture a modern chip. Can we get the electronic industries of Europe, the Thompsons, Siemens, Philips and so on, actually to collaborate so that we are in that business and are not dependent upon the United States or Japan:" That does become a more strictly directed sort of way of running a programme. So that there is a whole gradation from purely responsive, reacting to "what scientists want to do", through "what they want

[Mr Win Griffiths Cont]

to do, but in defined areas" to "what they are willing to do" in order to achieve particular, identified, generally economic, objectives. All of those, I think, are important.

334. So that you think it is worthwhile the European Commission continuing to be involved and probably just slowly expanding its involvement?

(Sir David Phillips) Yes.

Chairman

335. We have still some time to run yet; but before we do run out of time, I should like to give you the opportunity at this stage to pick up on what you said before in relation to a couple of points that Professor Fasella raised which you felt you might want to touch upon.

(Sir David Phillips) Actually, Chairman, I think I have touched on those. They were particularly the distinction between the stage in programmes at which governments or industrialists are identifying areas which need support and the point at which scientists and technologists are actually driving the programme by deciding what to do. In that context, I do not see any organisation of Ministers of Science and so forth playing a part successfully in driving the scientists to do things that they do not want to do.

Mr Win Griffiths

336. May I just follow that up? You were speaking of the review currently being undertaken of the peer-review system. Whatever the outcome of that review, would you expect (whatever changes might be recommended) that the system itself would more or less remain intact? And do you believe that approach should also be taken in all the other fields where there is research being done through the Commission?

(Sir David Phillips) I think it is necessary to make judgments as far as one can of quality, and the people who are able to do that are experts in the field. You do run into some difficulties that have been often discussed, such as grant committees getting into the hands of old-established scientists like me who keep on wanting to support what they did in their youth so that young scientists do not get a fair chance to do that radical, exciting thing that is going to change the face of the world. That is something that one has to be aware of and which can be moderated by officials of research councils saying, for example, "All right. That's what these peer-review people say and what the grant committee says; but I think that should be supported." I would say a second thing, however, about that. What I have been implying in that statement is that all of this needs to be done by some central grant-giving body. And it is natural that we should have been talking about that because we are talking about how they do things in the Community. I should like to interpolate this. I am actually a believer in what I call local patronage. I believe that there needs to be money available in research laboratories so that when a young person—or even an old person—turns up with a bizarre idea which might actually be all right and lead to a significant advance, there should be somebody locally who knows the person, who knows the track record, who has control of resources and who can decide there and then whether it should be done. Obviously, that cannot be done for something that costs millions of pounds; but for up to tens of thousands of pounds I believe that that should be possible.

Chairman

337. Perhaps I may pursue a question that I put to Professor Fasella, the question of the position of United Kingdom universities and the feeling that they lose out financially when they obtain EC funding because of the top-up grant. Do you think that a special fund would help in this to set it up? Or whether, perhaps, the ABRC could consider this.

(Sir David Phillips) The ABRC is just getting into its stride, I think: and one of its likely steps may be to set up a sub-group which will particularly look at international issues of this kind; so we may very well pursue it. However, I think I would say this. As Professor Fasella described it, the Commission would provide, say, 100 per cent of the marginal costs. That does not sound terribly different from at least the old way in which the research councils supported research in universities—relying on the existence of the dual support system; that is, that universities had some money which they could dispose of as they thought best to support research by themselves or in association with somebody else. Here, I think, we are in the area of—and I introduce the term without apology—"university management". Universities have to judge whether they can afford to take on research projects at marginal cost or not. If they cannnot, then they should not take them on.

Mr Win Griffiths

338. Do you think that the universities in Britain have sufficient funds to do their scientific research?

(Sir David Phillips) My short answer to that, in general, would be, No; because I think the universities have been squeezed quite hard over recent years and the money that used to be used for the free support of scientific research, to a degree at least, has been swallowed up in salary settlements and so on that have not been covered totally by additional money. So, in my experience (and, until six weeks ago, I was running a university laboratory) there is definitely less readily available money in universities for research of a free kind; that is to say, money which, as head of laboratory, I could decide to use to buy a bit of equipment or to buy consumables or to send a young man to a conference or a young woman to another laboratory to get some experience, and so on. On the other hand, the amount of money supporting research in universities from the research

[**Mr Win Griffiths** Cont]

councils, from the medical charities, from Government Departments and from industry has very significantly risen. The question is this. Has the work that that money is intended to support been fully funded? Or have the universities had to dig into their own pockets to such an extent that is actually embarrasses them? Some of them, I think, have got into that position. It is very hard to say, "No!" to a research grant, even if it does not provide the full costs.

Chairman

339. Are you worried about the United Kingdom's policy of attribution? Do you think it will have a distorting effect upon United Kingdoms scientific activity?

(Sir David Phillips) Chairman, I must say that I have been over this ground—not that question, but "attribution" and what it means—and the ABRC has been around the track many times; and I have to confess that, even now, I do not fully understand all the implications of it. But I think some things are clear. The impression it gives is that if you get involved in Brussels programmes and persuade the Commission and other countries to set up programmes in some area of enormous importance such as—and I was about to say "transgenic animals" but since Mr Greenway has now come back—

Mr Greenway

340. Perhaps I should apologise for that!

(Sir David Phillips) —I will say instead, "warm superconductors" as a trivial example beyond controversy, then people fear that, in doing that, in encouraging the development of European programmes, in some way they will lose money at home. I think that the realities behind that really have to be made as clear as possible to the scientific community; because it is extremely important that whatever programmes the European Community decides to initiate should be very strongly influenced by the United Kingdom scientific community. We should be making sure, in the development of programmes at the beginning in Brussels, that they are the programmes that we want to see done. And I think the impression of the effects of attribution is that it has an inhibiting effect upon scientists getting as involved in that process as they otherwise might have been.

Chairman

341. Going back and posing what is perhaps a slightly unfair question and because I want to be slightly provocative at this stage, when we had our preliminary discussion some months ago, we discussed then the sort of areas that we might well look at. We have received a great deal of evidence during the course of the Inquiry and I am bound to say that there has been a degree of equivocation from many of the witnesses that have come before us. We were looking for very firm answers, for suggestions from them, for statements about where they felt things were wrong and suggestions as to how they could be put right. And I think I would be speaking for more than one or two of my colleagues here when I say that we have felt that perhaps some of those answers have not been forthcoming. Is there anything to which you would like to see this Committee address itself particularly when it comes to our deliberating the evidence we have had? No doubt, you have had an opportunity to reflect on some of the evidence that has been reported as having come through the Committee. Is there anything else that you would like to say to us at this stage?—anything from your own experience now that you have this newly-constituted role with ABRC.

(Sir David Phillips) Like all your other witnesses at this stage, Chairman, I find that a quite difficult question. But I shall have a go and I shall start with the question that you asked me previously about attribution. I think that if this Committee could clarify to the scientific community what is implied in "attribution" and how, given that that is the way the United Kingdom system works, the scientific community here ought to react to it—to what extent they should get involved in initiating Brussels programmes and so on—I think that would be a very useful service. My own view is that they should not be inhibited by that particular mechanism but should forget about it and let it be worked out. But I think that some clear statements about that are really needed. I was a little sad and disappointed to have heard Mr Evennett place so clear an emphasis on the "Brussels bureaucracy". I think, Chairman, that if you could be clear about the nature of that, again that would be an extremely useful service. Let me try to make clear what I mean by that. There are, I believe, two elements to what is perceived as the Brussels bureaucracy. On the one hand, there are the officials of the various Commission directorates. There is Professor Fasella and all his staff in DG II. They, if you like, are the Brussels bureaucracy. But alongside that, and in some respects over that, there is the whole Committee structure in Brussels made up of representatives of the member-countries of the Community who are often, even on issues concerned with science, not only scientists and technologists but often officials of various kinds who are there not to ensure that the best science is done but that each country gets a fair share of whatever is going. To me, that is a part of the Brussels bureaucracy and the Commission is often in conflict with that part of the bureaucracy; to that when people talk about the "Brussels bureaucracy", I think they need to be clear about just where the problems lie. They do not always lie in exactly the same place. We ought also to range beyond Europe. I think you went to CERN and that is an example. Even at this stage, although CERN is a European institution of which European scientists are extremely proud, there is very fierce international competition and people are proud that Europe is now ahead of the Americans in the high-energy particle physics game. The paradox is that, if you like, is that if

[**Chairman** Cont]

you go to CERN, as you did, you will find lots of extremely good American scientists actually working there and you will find American funds going into the detector systems there. I think you might mention that in passing, and go to to say something about the essential full internationalisation of some areas of science, of which CERN is the prime example. I think you will find that the Americans with their great plans for the superconducting supercollider are now, beginning to appreciate that that is beyond the range of even the United States in present circumstances. And I think that if on those few issues—fusion, high-energy particle physics, perhaps astronomy to some extent and, certainly, global environmental research—we could think in a truly international way, then that would be a very important message to put across.

Mr Win Griffiths

342. Do you think there would be any value, especially in relation to the issue of the global environment, to have an input from the members of the European Community through the Community rather than through individual countries acting separately?

(Sir David Phillips) In some respects, that is already happening. For example, the European programme for satellite observation, in the main, is run through the European Space Agency, of which we are members. That will produce a great deal of information, of raw data, which will have to be analysed while, at the same time, the Americans and probably the Japanese will also be producing satellite data of a comparable kind. One of the issues which is current is to what extent those data will be freely available to everybody working in global environmental research, and to what extent some of the participants will attempt to take commercial advantage of what they know that others do not yet know. I think there are problems of that sort in global environmental research. But the Community also participates in the ocean-drilling programme which, oddly enough, is related to global environmental research, as well. So that there is a developing regional effort in global environmental research alongside a developing worldwide effort; and getting it all right and getting all the data brought together consistently and freely is going to involve quite a lot of diplomatic activity.

Chairman

343. Sir David, thank you very much indeed for coming to see us this afternoon. If there are any points which occur to you as a result of reflection on either this afternoon's discussion or anything else, I shall be very grateful if you will get in touch with the Clerk so that we can take these points on board when we come to consider the report itself. On behalf of my colleagues, may I thank you once again for coming along this afternoon.

(Sir David Phillips) Thank you very much Chairman.

ANNEX 1

Supplementary memorandum from Directorate General XII of the Commission of the European Communities

See Qs 294–296

The Commission normally provides up to 50% of the total cost of research projects carried out under Community programmes. Organisations such as universities, public research establishments and similar non-commercial bodies may, instead, receive up to 100% of their additional costs associated with a project. This arrangement frequently applies to the projects in the SCIENCE programme, which is aimed at stimulating transnational scientific and technical cooperation on highly original research projects in areas not covered by other programmes. While other Community research programmes are clearly targeted (for example on informatics, environment, biotechnology etc.) the SCIENCE programme is open to any new ideas within the broad field of exact and natural sciences and related technologies. Although SCIENCE accounts for only around 8% of the Community research budget, it is important since it offers the possibility of supporting very innovative approaches in new and emerging areas. Such approaches, because of their novelty, would not fit easily into the targeted programmes, although these are drawn up after extensive consultation with the relevant scientists, industrialists and "research users". A scientist would generally only apply for a grant under the SCIENCE programme if the scope of the project fell outside that of the targeted programmes.

Researchers may reply to calls for proposals for any of the Community programmes if they are interested (and competent) in the subject matter covered by the programme (for example, informatics in the case of the ESPRIT programme). Each programme is comprised of a number of broad areas, which are specified in the calls for proposals. However, these calls for proposals are not highly detailed, allowing interested scientists as much freedom as possible in the formulation of the research projects and in the scientific approach to the issues under investigation.

20 July 1990.

ANNEX 2

Letter to the Chairman of the Committee from the Chairman of the Advisory Board for the Research Councils [ES 39]

At the end of my evidence on 23 May, you invited me to let you have any further comments on the issues covered by the enquiry which might help the Committee in the preparation of its report. I have been reflecting on this and offer the following thoughts—most of which repeat points I made orally, but with a few additions.

UK Government Machinery

The present UK policy of each Government Department having responsibility for scientific issues in its field of interest, and of having its own sources of scientific advice for the purpose, seems to me right. Science is not a separate activity to be isolated; it needs to inform and underpin policy making and implementation in all areas of the Government's concern. This does, however, put a large premium on ensuring that there is effective co-ordination across Government Departments—including for the purpose of representing UK interests in the EC context.

Frankly, I doubt whether we can ever be satisfied with such co-ordination arrangements. They need constantly working at: refining them and improving them to meet new circumstances and new purposes. Our arrangements vis-a-vis the EC seem to work tolerably well at present, but I have no doubt that they could be improved in some respects. Radical change is probably unnecessary. As Professor Fasella told you, the UK position seems (surprisingly) coherent and focussed from the Brussels perspective; and there is no doubt that the UK has had a relatively large influence on the shape of EC science programmes and that our scientists have been relatively successful in winning funds from these programmes. Moreover, we must remember that, although they are growing, EC monies fund a relatively small proportion (perhaps 4%) of UK scientific research; and it is more important, therefore, that our governmental arrangements are right for our domestically financed programmes.

Having said all that, however, I remain a little uneasy on two fronts:

- first, because of the balance of EC research programmes, the UK representatives in discussions on the Framework Programme are normally DTI Ministers and officials. I have no complaint about this and am not aware of particular problems; but I do wonder how easy it is for them to transact business about basic and strategic research (mainly the responsibility of DES) with their counterparts from other countries who are used to dealing with such matters at first hand and who are in regular contact with each other in the process;
- second, whilst being generally satisfied with UK co-ordination at the top levels, I am very conscious that the bulk of science policy-making needs to be in the hands of the scientific community itself. By "science policy" here I mean decisions about what science is undertaken, where and by whom—decisions from which Governments should properly be at arms length. I have little hard evidence, but I suspect that UK scientists interact with the EC Commission rather less than some of their continental counterparts. This may mean that we have less influence at the early formative stages of thinking about future EC research programmes than would be desirable.

I do not have any particular organisational improvements to suggest which might help with these difficulties. But having thought hard about the problem, I wonder if there might be some small gain from raising the profile of the co-ordination process, both within Government and with the scientific community. At present it is rather buried within the Cabinet Office machinery, and thus the need for co-ordination with others does not always spring instantly into the minds of those who become involved with EC research programmes.

UK Government Accounting

The other aspect of UK Government arrangements which has attracted particular attention during your enquiry is the EuroPES regime by which EC research spending is taken into account as part of the Government's annual public expenditure review. Here the main problem is getting straightforward information on how the system works. Too many of us, myself included, are too readily led into confusing "additionality" with "attribution" and are bemused by the relationship between the two. If the Committee were able to persuade HM Treasury to produce a "plain-man's guide" to how the system works and to its likely impact on domestic programmes, you would do a signal service to us all. Too many UK scientists are currently discouraged from applying for EC support by the (I believe) mistaken belief that any grants they win will be offset by EuroPES reductions in corresponding domestic programmes.

Scientific Networks

Co-operative research programmes—in Europe and elsewhere—depend substantially on informal scientific networks. It is not easy to plan a major new joint research programme with scientists you have not previously met and whose research resources and expertise you know of only at second or

third hand. Most significant collaborations are thus between scientists who have already had previous contacts. Over time a large number of intersecting networks of scientific contracts have developed in Europe. Some are the result of particular initiatives—such as the Royal Society exchange schemes, the European Molecular Biology Organisation, and the European Science Foundation—in which UK scientists have played leading roles. The EC's collaborative research programmes will, incidentally, help sustain and develop these networks. But it will also be important for national and EC monies to be spent specifically in nurturing existing and new networks, as the seedbeds for future collaboration.

EC "Bureaucracy"

Some of your witnesses have, I understand, raised concerns about the degree of "bureaucracy" associated with EC research programmes. This is not something that worries me greatly, but I would make two comments:

a. it is important to distinguish between the activities of the EC Commission and of the Committees of national representatives involved in EC decision-making. These two parts of the system are sometimes in conflict and those who lump them together will not easily understand the decision processes affecting the Framework Programme;

b. applications and contracts for EC research projects take a different form from those normally used in the UK. Inevitably, the first few times that university scientists and administrators encounter them, they will seem more complex and difficult than the familiar UK equivalents. That does not, however, mean that they are worse. Indeed, I believe that the standard EC contract is distinctly better as regards arrangements for intellectual property rights.

As in dealings with all large organisations, it is important for our Research Councils and universities to have a clear grasp of how EC processes operate as regards the Framework Programme, and to have a means of ready access at working levels within the Commission. The Research Councils' joint office in Brussels is proving invaluable in these regards; it is an asset which could be further developed.

Resourcing of UK Science Base

The ABRC has repeatedly stressed the importance of effective management in our Research Councils and universities, to ensure that maximum value for money is achieved with the public funds allocated for scientific research. Considerable progress has been made to this over the last decade and I have no doubt that the UK science base is very well placed to make good use of research grants from the EC.

I am, however, aware that in some instances the opportunities for UK universities to take advantage of EC support will be constrained by a shortage of nationally funded resources—primarily, limits on the extent to which research infrastructure generally can be redeployed to support part of the costs of EC sponsored projects, and sometimes specific constraints because of deficiencies in available research equipment. It is also true, of course, that potential collaborators abroad will not consider UK universities to be attractive partners if they appear relatively under-resourced for prospective joint research programmes. Ensuring that the UK's investment in research is adequate and that there is a satisfactory disposition of research resources will thus continue to be prerequisities for this country to take full advantage of EC research funding possibilities.

Wider International Collaboration

As I remarked on 23 May, there are a number of good reasons why UK researchers should collaborate with scientists in other countries. One concerns those areas of science where the resources needed to further advance the frontiers of knowledge are beyond the capacity of a single nation. Collaboration within Europe has been an effective way forward in several of these fields, and this approach will probably extend into new areas (for instance, discussions are currently in train about possible collaboration in provision new high-power laser facilities). But the stage is being reached in some fields which even a joint European effort is inadequate. Particle physics is a good example, and a wider internationalisation of CERN would be an important step towards facilitating further scientific progress in the late 1990s. Research on nuclear fusion also requires experimental facilities and instrumentation on a vast scale, and would benefit from worldwide collaboration. Concerns about global environmental change raise the same issue from a different angle: research here will be much dependent on the free availability of environmental monitoring data from all around the planet. Yet another example is the research which is rapidly gathering pace worldwide to map and sequence the human genome. Clearly, whilst co-operation on a European basis will often be sensible, we must not restrict ourselves to that where scientific needs point to broader international collaboration as being more appropriate.

I hope these comments are helpful.

Professor Sir David Phillips

7 June 1990.

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EDUCATION, SCIENCE AND ARTS COMMITTEE

SCIENCE POLICY AND THE EUROPEAN DIMENSION

MINUTES OF EVIDENCE

Wednesday 12 December 1990

Science and Engineering Research Council

Professor Sir Mark Richmond, FRS
and Dr J Wand

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Members present:

Mr Malcolm Thornton, in the Chair

Mr David Evennett
Mr Harry Greenway
Mr Gerry Steinberg
Sir Gerard Vaughan

Memorandum by Sir Mark Richmond, FRS, Chairman, Science and Engineering Research Council

I would like to focus on three issues, not necessarily in order of importance.

1. It is vital that the UK plays a full and meaningful part in international science. This is partly because certain important types of science are so expensive that they can only realistically be prosecuted internationally; but it is also vital for the nation's self esteem to be making a positive contribution to *some* science of this kind. I feel the importance of the self-esteem/national image dimension needs expressing strongly; and in particular that it is a concept that needs embracing positively by HMG.

At a more mundane level one can certainly argue that parochial advantage comes from such international participation, particularly if the facilities concerned are located in the UK. The Swiss are said to gain six times the income they pay in costs in relation to the CERN operation in Geneva.

Overall the UK will not win the agreement of our partners to host international facilities until a more positive attitude to international science is transmitted.

2. Many of the international projects that the UK participates in are subject to intergovernmental agreements. For SERC the CERN agreement is perhaps of most significance, but there are others. Programmes within the EC may be thought of as intergovernmental agreements of a kind.

One of the serious consequences of such agreements is the impact they may have on the resourcing of the domestic science programme since they may face the UK with escalating costs that are basically outside the UK's control, let alone that of SERC. The CERN agreement, for example, faces SERC directly with the consequence of fluctuating exchange rates, and of cost inflation in other countries. SERC will be faced with the need to find £9m to £10m in extra subscription for CERN in 1991—an outcome arising *inter alia* out of salary increases at CERN, itself a result of Swiss inflation.

In parallel there is the whole matter of attribution/additionally in respect of EC programmes. Again the effect can be to debit SERC, and other agencies with costs resulting from the decisions of others and for the support of programmes we would not choose to highlight.

Obscurity tends to reign over the rules for attribution and additionality. It is even claimed by some that the way HMG applies the rules of additionality may be *ultra vires* European law. This needs clarifying.

Whatever the situation, the agencies who are ultimately faced with the attributions arising from the EC programmes should be more closely integrated in the process by which the programmes are agreed.

One concedes that it is not realistic for funding bodies such as SERC to be fully protected against the costs of EC programmes but where costs arise through intergovernmental agreement, there should be devices available under the PES/Euro PES procedures for some degree of indexation to international, rather than domestic costs. Unless that is the case the domestic science base inevitably suffers; since a ratchet tends to operate in that re-charging of the domestic programme is extremely difficult once the funding has been removed to pay for the international programmes.

3. SERC's lead Department is the DES, and financial allocations to SERC are made by that Department as a result of advice to the Secretary of State for Education and Science by the Advisory Board for the Research Councils. However, many other government departments have legitimate interest in SERC's research and particularly that carried out under international agreements. Primary examples are DTI and FCO.

There is a serious worry that the ABRC—even in its new form—may take little notice of the international dimension, and may give advice not in the national interest from the international perspective. In that event the Secretary of State for Education and Science, may not accept the advice, but where do the decisions lie then? It is unclear, and SERC has relatively little input. This matter needs investigation with a view to a clearer process being instituted.

Similar issues arise with respect to bids under the PES arrangements. The Department of Education and Science is in the lead, but it is unclear that the proper concerns of departments such as DTI and FCO are injected into the PES process.

Although SERC has a central place in the work of the ABRC, we have no access to the work of ACOST. I believe this is a serious shortcoming and should be remedied, if only by the formal availability of agendas and minutes.

12 December 1990

Examination of Witnesses

PROFESSOR SIR MARK RICHMOND, FRS, Chairman, Science and Engineering Research Council, and DR J WAND, Science and Engineering Research Council, were examined.

Chairman

344. Sir Mark, welcome. May I just say that my colleagues with whom I have just discussed your presence here this afternoon are very grateful to you for coming along at such short notice. We are, as you know, in the final throes of determining this report but we are very anxious, as we have been from the outset, to ensure that it accurately reflects the state of play today. There has been some disquiet expressed on both sides of the Committee that we have not had as accurate a picture as we would have wished in order to give the report the strength we believe it needs. So we very much welcome your presence here this afternoon. I hope you will bear with us in that we will need to make this a fairly short evidence session as we want to try and make some progress this afternoon. Perhaps to start off you might like to make one or two general comments.

(Sir Mark Richmond) Thank you, Chairman.

Sir Gerard Vaughan: We are very thin on the ground.

Mr. Steinberg: Nobody knew this was happening.

Chairman

345. We have total agreement on the report as it is, so we are hopeful that what we will hear this afternoon will enable us to strengthen it without losing any time.

(Sir Mark Richmond) Thank you very much indeed. I will be succinct, I realise you are short of time. I have prepared a two-page note here which will basically summarise what I say. I deal with three issues. The first issue is the question of international agreements in big science undertaken under international agreements and the need for them. A point which I think is frequently understressed, is the very considerable sense of national esteem and national kudos that can come from prosecuting international science projects. I think that is very important. I think it is something that is under-esteemed by government, if I may say so, and I would hope that your report could encourage people to be a bit more bullish about it. The subsidiary point is, I believe, that it is easy to show that many of these international facilities do indeed produce significant economic advantage to the people who have the main facilities. The Swiss admit to making about six times as much in income as they put out in relation to CERN and that is something which I think is really rarely stressed, but it is important. The second area I would like to talk about—and I think I really should leave it to you to ask questions as the most effective way forward— is the whole question of international collaborations; the way in which intergovernmental programmes are agreed. That is both internationally and also within the European Community where the intergovernmental agreements tend to come out in the form of EC programmes, and the consequences of those agreements for the funding of science, domestic science, in the United Kingdom seems to me to have very strong knock-on consequences which I do not think are recognised fully enough. The third area that my note deals with is the question of the way in which decisions relating to science policy are generated in this country; and the role of various government departments; and the co-ordinating role of the Cabinet Office; and changes which I think may well be necessary in how that is all managed. Those are the three areas.

346. Thank you very much indeed. Can I ask the first question on the matter of international agreements. Do you think too much of the funding of UK basic science is locked up in these international agreements? Do you think the country has its scientific priorities wrong and would SERC come to a very different balance of funding between subjects if it were not restricted by these international agreements?

(Sir Mark Richmond) I think the problem arises over the flexibility or lack of flexibility that comes from the international agreements. We are continuously hoisted by the escalation of costs in these international agreements. For example, SERC is likely next year to be faced with paying really about £9 or £10 million more than we had anticipated as a result of events that are absolutely outside our control. That £9 or £10 million will have to be found at the expense of the domestic budget. In the long term we can unravel it to a degree. Even with the CERN budget—a big cost of £50-60 million a year —the terms of the agreement are so constraining that manoeuvre is very limited.

Mr Steinberg

347. The problem I have had all the way along in this investigation has been the fact that so much money has got to be used to fund the international or European dimension. Would you say that because of the amount of money we actually have to fund on the European dimension, it does actually affect the domestic budget and that science in this country, even particularly perhaps in schools, is suffering because of the amount of money that has to be spent European-wise?

(Sir Mark Richmond) The problem as to what proportion of spend the SERC or any other agency spends on science in Europe or internationally is in a sense its concern; it makes that agreement with

[**Mr Steinberg** *Contd*]

government departments, then relies on it. The problem arises when costs internationally escalate faster than thought so that the proportion of the SERC spend or agency spend on international agreements tends to increase because we get no extra money; then the rest of the budget, the domestic budget, has to take the strain.

Sir Gerard Vaughan

348. So that if, for example, in Switzerland where they have inflation for, I think, probably the first time in——

(Sir Mark Richmond) —— in ten or fifteen years ——

349. ——this means the international agreement costs more and you then have to find the extra money?

(Sir Mark Richmond) Out of our total budget. The only thing that will give is the domestic budget.

Mr Steinberg

350. Let us just assume that inflation had not increased in Switzerland and we were still going along in the same way as we had done before for x number of years: do you still feel that the amount of money that is paid into the European budget has a detrimental effect on domestic science?

(Sir Mark Richmond) You see, domestic science can consume almost inexhaustible amounts of money. What I am sure about in light of the agreements we have at the moment is that the amount we could spend on our domestic budget is constrained—that is for sure—and as the international work escalates in cost so the domestic has to take that in front of it. If you want to ask a political question, I am not in a position to answer that.

Mr Evennett

351. I think we all agree that more money is necessary for scientific research and development, but there are three points I would like to address with you, if I may, which you have somewhat covered in your memorandum. First of all, would you agree that scientists themselves need to sell science rather better—the vital importance of science, the exciting and relevant opportunities that there are for people studying science? Secondly, would you agree that scientists should be less woolly and vague when it comes to determining where they want the resources to be channelled? Thirdly, we have come across a fear of Europe and the bureaucracy whereby the control of expenditure on scientific research, if more money were channelled that way, could be lacking and that there would not be worthwhile investigative research if one channelled the money into a bureaucratic organisation like Europe. Now, the conclusion of all these things that comes to us is, where do we go from here? Do we go more to the domestic? Do we go more to Europe? Or do we say really science is now so big it should be much more international? To date we have not had answers really to any of these points in definite terms. I wonder if you might be able to help a little?

(Sir Mark Richmond) On the question of excitement, I think undoubtedly the scientific community has a much more effective job to do in transmitting the excitement of science, and I think we have failed. That is something everyone has to do really. Part of the job of SERC is to do its bit. We have to try to do something about that. On the question of clarity of the scientists' vision as to where they want to go, it is very difficult for such a big and incoherent community as science which has a million and one odd things to do, which I touch on in the memorandum. The feeling I have is that there is not actually enough coalescence of a view in the country at the moment as to what are important directions or what are not so important directions. The last thing one wants is that the national effort in science should be co-ordinated by some great gauleiter in the centre. On the other hand I think some priorities, some directions, some shape are useful and I feel they are to a degree lacking. On the question of European control, I think there is a great feeling amongst the universities that Europe is an enormous bureaucracy and it is possible to see the whole European business as bureaucracy piled on bureaucracy—the European bureaucracy piled on the British bureaucracy. However, people I know who have gone to Brussels, and have taken the trouble to go there and learn the system and actually get their personalities stuck into it, find it a rewarding place to go looking for support. I think a lot of messages we get from UK science are that the system is different from the UK one, the system is not known as well and poeple are hesitant about plunging in. So that is one thing. If you ask should we be "little Englanders"—which is more than you are saying—or profound Europeans, it seems to me there must be horses for courses; there are bits of science you can only pursue, I think, on a European or international scale, there are other types of science which you can only, or I think should only, pursue on a national level. When you come to the question of clarity of thinking as to where we want to go, I think there should be a clear review as to what sort of things we want to do internationally, what sort of things we do in Europe, and what sort of things we do domestically.

Sir Gerard Vaughan

352. Who actually makes the decisions at the end of the day? My impression is that there is a sort of roundabout between departments and there is almost a chance at the end as to who makes the final decision, yes, or no, how much?

(Sir Mark Richmond) As far as we are concerned, our lead department is the Department of Education and Science. The Secretary of State for Education and Science is guided in making his allocations, which of course reflect science, by the Advisory Board on Research Councils. As far as we are concerned, other departments of government which

[**Sir Gerard Vaughan** *Contd*]

I mention in the note—the DTI and FCO—have a very real interest in what we do because of the international and commercial impacts of what we are supporting. I am not happy at the moment—I think I would not say that too strongly; nevertheless I use those words—that, although the DES is in the lead and a strong ABRC view is being injected, there is, as it were, a sister committee, ACOST, which operates and we really know very, very little about what goes on in ACOST. We do not see the papers, we do not see the agenda. I think that actually is something I want to see changed because I think that this side of the house—basically the DTI/Cabinet Office—in relation to the pursuit of research and technology has to say something to the SERC and *vice versa*. You asked where our questions are settled?

353. It sounds to me like a recipe for confusion and overlapping and uncertainty and, at the end of the day, the wrong decisions.

(Sir Mark Richmond) The position with ABRC and DES is clear enough. We have relationships with DTI at departmental level, with the FCO and other departments of government. There is the Chief Science Advisor at the Cabinet Office who has an important role to play. As far as I am concerned with SERC, if it goes beyond the DES, in terms of policy and in terms of funding, it goes to an area where we really have no access. I understand that, though I am sure there are Cabinet committees at which certain decisions are made. But as to the coalescence of these views, whether or not it be under the public expenditure round for allocating science funds and perhaps for recognising the increasing cost of arrangements made under intergovernmental agreements—whether we will become heavily committed in the AIDS programme, for example—not SERC but MRC—how those decisions are taken, how they are arrived at, that is in the mist.

Chairman

354. In your memorandum, Sir Mark, you make reference to EC programmes. Could I just ask what influence you think SERC has on those programmes? Is there any way you can actually try harder to influence them?

(Sir Mark Richmond) As far as we are concerned, the lead department is the DES. You realise under the existing Framework Programme in Europe the lead is taken by DTI. We have a new Framework Programme, the third programme, in which for the first time under Line 6 the DES will have a substantial role to play. I think, if I may say so, a thing I would very much like to see is the DES having a much more prominent role in discussions in Brussels with the DES Minister being directly involved and, as a consequence, for SERC to be more tightly coupled into it. We cannot, of course, say in Brussels "let there be light" and it be the colour we want it to be, but the fact is we feel very much distanced, and yet under the attribution rules we feel the price tag might be attached to us.

Sir Gerard Vaughan: It does not sound very satisfactory.

Chairman

355. A couple of questions that have been suggested, can you answer this: what about the balance of effort in summary, I suppose, as between national and international programmes, for example? Is the quality of research funded by the Community up to our standards? Is it directed towards objectives we would approve and has it any influence on these objectives?

(Sir Mark Richmond) Can I say something about "big" and "small science" because a lot of big science is big facilities used by lots and lots of small scientists and that is not often understood. Leaving that point to one side, I think that in the EC, inevitably the decisions are subject to EC political and national considerations and some of the programmes suggested are not ones that we might choose, or may not be so high on our agenda, and therefore it comes back to the point I was saying, that we are concerned we will be lumbered with the need to pay for programmes we would not ourselves choose to put in as a top priority. There may have been another part of that question, I have forgotten.

356. Is it because it is research into the wrong things?

(Sir Mark Richmond) I have to rely very much on my personal view and I think a lot of excellent science is supported by the European Community. I think at the moment the best British scientists tend to seek their support from the research councils because it is the route they know and the system they know. I think if the best British scientists were to use the EC route, and I do not see why they should not, the best science will be done under the EC. I think the feeling in the universities is it will be the second route you follow and since the research councils can fund the best science they can it is the second order science that goes ahead in Europe, except in specific programmes like BRITE and information technology where there are really good people. I do not think it is inherent in the system, it is the way Europe funds.

Sir Gerard Vaughan

357. Would you want to see a Minister for Science in this country as in Germany?

(Sir Mark Richmond) You want to get on, I could talk about that for hours. The problem of a Minister for Science is that it follows that to have any use he has to have an impact; and to have the impact he may wish he must be in the cabinet; and to be in the cabinet with a strong voice you have to have a budget. The worry will be unless the Minister for Science is a very rare individual that is listened to in the Cabinet without a portfolio, if I can put it that way, I do not think he will carry the clout. I am rather doubtful a Minister for Science is what we want and I do think we will want as great a co-ordination of the way science has evolved, which

[**Sir Gerard Vaughan** *Contd*]

is not to say there should be a dictat from above as to the basis upon which these issues are discussed and the decisions are made on them.

Chairman

358. That seems a very approrpiate note, Sir Mark, on which to end.

(Sir Mark Richmond) To send me away!

359. Can I thank you very much indeed for coming along. I hope you feel your extra input is reflected in the quality of our report.

(Sir Mark Richmond) Might I just say I have prepared this memorandum very quickly. Could I have an opportunity to check it through your secretary, before you actually print it?

Chairman: Please do. Thank you very much indeed, Sir Mark.

APPENDIX 1

Memorandum by the Agricultural and Food Research Council (ES 23)

1. *Introduction*

The Agricultural and Food Research Council (AFRC) was founded by Royal Charter to undertake research into agricultural sciences and related disciplines. The AFRC receives funds from the Science Budget, from MAFF and from other sources with which it conducts research in eight institutes and in University based groups. The total funding available to AFRC in 1988–89 was £122 million, which amounts to about 2 per cent of the total of the publicly funded research budget.

AFRC's research programme is primarily basic and strategic work in the biological sciences, from which knowledge is gained:

to increase the efficiency of agriculture, food and other biologically based industries

to improve the quality and safety of food

to conserve the environment and lessen the ecological and social consequences of change, following altered patterns of agriculture.

The need to attract and train bright young people in the biological sciences is a key function of AFRC. The funding to Universities (£9 million in 1988–89) provides resources for this. AFRC's eight major interdisciplinary institutes provide facilities unique to the UK for short term and long term training of post graduate and post doctoral research workers in the biological sciences (130 in 1985–86).

AFRC, as a matter of policy, is actively seeking more involvement in EC programmes and bilateral collaboration with European research institutions and organisations. The institutes of AFRC, well equipped and staffed, provide centres of excellence in their respective scientific areas, outstandingly able to act as lead or co-ordinating centres in the management of multi-institute European programmes. Good links have been established between AFRC and the EC permanent officials, in part through the Brussels office of the Research Councils, which also plays an important role in providing early warning of new EC scientific programmes.

2. *EC role*

(i) "EC role in relation to the domestic science programmes of the Member States".

The EC does not have any direct role in determining UK national R&D programmes although domestic activities are of course planned in the knowledge of EC programmes.

Article 130H of the Single European Act states that Member States shall, in liaison with the Commission, co-ordinate among themselves the policies and programmes carried out at national level, and that the Commission may take any useful initiative to promote such collaboration. AFRC regularly provides information to the Commission on its objectives, priorities and research programmes. Common problems, the escalating costs of science, and the benefits of more rapid exchange of information and results, all point to the potential benefits which can be derived from co-ordination and collaboration within Europe. The EC also has a significant role in fostering the exchange of scientists.

The best basis from which collaborations—in Europe or elsewhere—can develop is from strong bi-lateral programmes. The Council has a five year agreement with the French Institut National de la Recherche Agronomique (INRA) to promote joint programmes, especially in transgenic plant and animal molecular biology, physiology and in agricultural engineering. Discussions on collaboration are currently in train with the Netherlands, Spain and Germany.

(ii) "EC involvement in the development of collaborative projects between Member States and other non-EC countries".

There is scope for non-EC European countries to take part in Community 'concerted actions', on payment of an appropriate contribution, through the scheme for Co-operation in the field of Science and Technical Research (COST). This is generally regarded to be an effective mechanism.

But the development of collaborative projects between member states and non-EC countries should be for the two countries involved, decisions being made in the light of a knowledge of EC activities.

The approach of 1992 and the emergence of the Single European Market have increased the interest in the USA and Japan both in seeking industrial entry to the European market and accessing, or even supporting, R&D in Europe. Glasnost and perestroika have also an influence on scientific boundaries between Western Europe and the Eastern bloc. The EC could have a role to play, but in practice aspects of trade and economic development, rather than science, will tend to dominate discussions.

The EC could also have a role to play in ensuring better targeting of development projects in less-developed countries. Currently each Community country attempts to cover too many aid recipients.

(iii) "Scale of EC programmes that Member States should support".

There are areas within the life sciences where increased resources could be used to good effect. There is scope for more concerted European action in research on aspects of plant molecular biology and neurobiology, for instance. EC funds could help to bring this about. This need not necessarily imply an overall increase in the size of the EC R&D budget, but rather the redirection of funds from other areas as work terminates, or is found on evaluation to have a limited pay-off. However a major disincentive to putting forward proposals for new EC programmes is that—instead of their being funded by the redirection of existing EC resources—the result could be a net increase in EC R&D expenditure. If the cost of expanded EC programmes had to be met from the Science Budget, and if no allowance were made for this in the Public Expenditure Survey, UK Research Councils would have to cut support for domestic programmes in order to fund them.

With regard to the Commission's proposals for a new Framework Programme, the sums requested under the lines 'life sciences and technology' and 'human capital and mobility' seem too large, and have not been justified by adequate detail on the objectives and content of the programme.

3. *Priorities and Mechanisms for European Research*

"Are existing EC priorities, types of programmes funded and conditions on funding appropriate?"

AFRC's priorities would be for an increased emphasis on biological sciences, the environment, food safety and quality, independent scientist exchange schemes and co-ordination through seminars and workshops at policy, programme and project levels. But as stated above the Council could not advocate increased EC activity if the result were that national programmes had to be sacrificed.

The AFRC would like the opportunity to provide an input when the EC is first considering proposals for new programmes, and forming a view on the priority to be attached to such proposals. The Commission does not at present draw sufficiently on the expertise available within the UK Research Councils. The Councils could at the very least advise on a suitable range of UK scientists for the Commission to consult, in order to obtain an expert and more balanced input, when new programmes are at a formative stage.

On mechanisms, concerted action—whereby EC funds are provided for such things as meetings, short exchange visits and exchange of materials, by scientists within the Community whose research is already funded from national sources—is a mode of support which has attractions. As it funds only the co-ordination of research projects, concerted action clearly requires a smaller national contribution to the Community than shared cost and direct action programmes. Also decisions on the participation in, and funding of, research projects, as opposed to their co-ordination, continue to be taken at national level, allowing each member state a large measure of flexibility in its participation in particular concerted actions.

The feature which makes concerted action attractive from one view point makes it less attractive, however, to individual research workers who may look to EC research schemes as an additional source of funds for their work, and to those who seek evidence of a juste retour to the UK in terms of EC funds awarded to UK scientists for research projects. And concerted action may not be necessary where good informal links already exist between European scientists.

4. *HE/Research Councils*

"What effect is the EC research programme having on the priorities and approaches of higher education institutions and research councils? Are UK Institutions successful in obtaining EC support for research?"

It is probably fair to say that the existence of EC research programmes has made UK research councils more outward looking and has accelerated the development of Europe-wide research. Broad EC programme areas are frequently similar to UK national priorities, though it is likely that national views affect the content of the EC programme rather than vice versa. Priorities of scientists in HEIs and research councils are of course influenced to the extent that, within their own area of competence, they tailor applications to meet the terms of the EC programmes.

The view is that while the UK as a whole may be obtaining its juste retour from EC funds AFRC institutes could be more successful, particularly in the Agricultural Programme. This programme has a marked bias to the southern countries; the AFRC has succeeded in participating in co-ordinated research in these Mediterranean projects through exchange of scientific expertise, but contracts (eg. in research on white clover seed production) have been few, through reasons of geography. In many other EC programmes the AFRC institutes and university based groups have been active participants, but with cost-shared contracts the financial returns (with some notable exceptions) have not been

substantial. Income received from the EC in 1988/89 was £1 million for projects in areas ranging from genetic engineering and other aspects of biotechnology, to effects of climate on crop productivity, to tropical agriculture. One of the Council's objectives, as stated in its Corporate Plan, is to treble this figure by 1993.

5. *Government machinery*

"How effective is Government policy machinery for considering European science policy".

The AFRC's input to the Government machinery for determining European science policy is mainly through the Cabinet Office committee on international S&T, through DES Science Branch and through some direct contact with MAFF, DOE, DTI and other Councils in commenting on programme proposals of mutal interest.

These arrangements are generally satisfactory, though there are occasions when Departments do not draw on the Council's expertise to the extent that they might. There is a case for having scientific as well as official representatives at some Brussels advisory committee meetings.

1 December 1989

APPENDIX 2

Memoradum by the Economic and Social Research Council (ES 33)

1. *Introduction*

For the social sciences the EC role in the development of collaborative projects has hardly begun. We therefore concentrate on the EC role as it has or rather has not developed instead of the effectiveness of existing mechanisms of which we have relatively little direct experience.

2. *The EC Role*

2.1 In principle, ESRC accepts the value of a collaborative European research effort in a wide range of applied social science subjects that are of central concern to the Commission's activities: industrial, economic and regional policies, health and welfare systems, agriculture, the environment and relations with other nations.

2.2 In practice the Commission's R&D Framework Programmes have been characterised by an overwhelmingly technological orientation divorced from human resource issues. Although the objectives of the Programmes—improving the quality of life, improving competitiveness—appear to imply a wide scope for the application of economic and social science knowledge, the Commission has promoted an almost exclusively technical interpretation of its remit. The ESRC has sought to increase the social scientific element included in the new Framework Programme, but with a few welcome exceptions eg a socio-economic element in the new environment line, there has been little change from previous programmes.

2.3 This technical orientation stems from the narrow remit of the sponsoring departments (DG12 and DG13). Many of the important questions that could usefully be tackled by social and economic analysis in fields such as demographic change, information and communications technologies, management behaviour, agriculture, health and regional policies, are considered to be the responsibility of other Directorate-Generals. ESRC considers that a parallel Framework Programme of social and economic research could usefully be undertaken to support the Commission's activities in other areas of its competence. At the moment, the Commission spend large sums of money on social and economic research contracts that receive little scrutiny from the member states, with respect to both subject matter and results. Nor is there any attempt, in the spirit of the Single European Act, to co-ordinate national research efforts between member states in the social and economic sciences. Consequently, a lot of research effort across Europe is duplicated or pursued at a sub-optimal, usually national level.

2.4 One very clear example is the inadequate capacity of DG2 to undertake the scale of economic and industrial policy analysis desirable to carry through the Single European Act, and the parallel inadequacy of the resources made available to the existing SPES (Stimulation Programme in Economic Science) programme in supporting the work of DG2. Another example is the absence of an integrated research effort in exploring the common problems of European nations in the face of the demographic changes that will occur in the next two decades.

2.5 The Commission also has a potentially unique role to play in the development of a genuinely European research community through support for Europe-wide networks of research teams ("centres of excellence"), and schemes to encourage mobility of researchers. National research councils inevitably face difficulties in pursuing collaborative work. Their funds are, by definition, geared to national requirements, and cannot be used to fund researchers in other countries on any major scale. Additionally, it is often difficult to co-ordinate programmes and financial arrangments across national boundaries. ESRC is pursuing a policy of co-ordinating research priorities with the CNRS in France and the DFG in the Federal Republic, but the scale of such co-ordination is likely to remain relatively small. In this context, centrally-funded responsive or initiative mode programmes on a European scale, which involve researchers from a number of countries, could have an important and beneficial effect.

2.6 The New Framework Programme is far from a satisfactory response to these concerns as a whole. The lack of detail, both substantive and financial, in the Commission's proposal is a reflection of the weaknesses in its decision-making processes. The Single Act requires the Commission to respect the principle of "subsidiarity", and empowers it to co-ordinate national research programmes. The mechanisms for achieving co-ordination are weak, and the management of programmes, while variable, appears to be generally poor. These criticisms were also made in the so-called Report of the Five Wise Men. It is not surprising, therefore, that the Commission is unable to put very much detail into the scope of the new programme, or to justify the scale of the resources required, since the objectives of the Commission's R&D policy are very broadly specified, and do not arise out of a tightly controlled and well managed rolling programme of research.

2.7 With respect to the social sciences and the new Programme in particular, ESRC is particularly disappointed at the lack of detail in the Human Capital and Mobility (line 6) proposals, and their apparent bias towards the natural sciences and technology. The quality of applications received under the Stimulation Programme in Economic Science which was launched in 1989, suggests that there is

enormous scope for extending the integration of the European social science research community. While the proposed post-doctoral "mobility" scheme is attractive, we can see no valid reason why it should be restricted to the natural sciences.

3. *Priorities*

3.1 We would wish to stress the value of a European involvement in social and economic research on the environment. This is an area of research that is currently underdeveloped and where research resources are surprisingly thin on the ground. The ESRC has initiated a number of large and medium-sized programmes on environmental issues, including one that will be conducted throughout the European Science Foundation. Nevertheless, the fact that the research issues involved are intrinsically international in character, and have very important international policy implications, suggests that a co-ordinated long-term programme of research on a European scale would be an appropriate supplement to national programmes, providing it can be designed in a complementary way. To their credit, the Commission has already shown a keen interest in our own proposals and they appear to be developing an apparently complementary European programme.

4. *Evaluation*

4.1 Finally, we would wish to draw attention to the Commission's procedures. It is widely and correctly held in our view that evaluation of projects undertaken by the Commission has been inadequate in the past and that there is little evidence that new procedures will be introduced in the future.

Adrian Alsop
Head of Policy and Co-ordination

2nd May 1990

APPENDIX 3

Memorandum by the Science Policy Research Unit (ES3)

The Select Committee on Education, Science and the Arts into UK Science Policy and Europe has asked for written comments from the CVCP and individual universities.

The Science Policy Research Unit (SPRU) has itself had only limited involvement with EC programmes, although, along with other university departments, we are now increasingly seeking funds from EC sources including programmes such as SPES and SPRINT which form part of the Stimulation Programme under the Science Initiative. We have over the years been extensively involved in the evaluation of UK programmes, and are now also becoming involved in similar evaluations of EC programmes.

The Director of SPRU currently chairs an ACOST committee reviewing international collaborations, and one of our senior researchers, Margaret Sharp, co-authored the 1987 Chatham House study on European Technological Collaboration. Although, therefore, we have little direct experience, we have some expertise within the Unit and would like to make the following comments on the issues raised by the Committee in its press release:

(i) The UK contributes only some 5 per cent of the world's output of science and technology (as measured by publication, patents etc). 95 per cent therefore comes from other countries, and closer involvement and understanding of that 95 per cent must be of advantage to the UK. In principle, therefore, we would suggest that any programmes which seek to extend interaction among scholars will be of benefit and should be supported.

(ii) The EC Framework Programme which comprehends the EC Science and Technology policies amounts to some 5.6 billions ECUS over its four year life (1987-91). This amounts to approximately £3.5 billion, or rather less than £1 billion a year of which the UK's 'share' amounts to some £200 million. Compared to the UK government expenditures of over £4 billion on supporting various types of R&D, including military R&D, this is relatively marginal. A good part of the £200 million goes to support firm involvement in ESPRIT and similar programmes. Only a very small part actually ends up in the universities, research institutes and polytechnics.

(iii) Besides programmes which encourage the exchange of scholars, attendance at conferences, etc, we would also suggest that programmes aiming:

(a) at research on environmental issues such as acid rain;

(b) at research backing efforts to arrive at internationally accepted standards;

are justifiably now being run at a European level. These issues cut across traditional boundaries and it makes little sense to run them as a national programme.

(iv) The case for supporting programmes on grounds of size (too big for *one* nation state to deal with) justifies *international* collaboration, but not necessarily *European* collaboration. The major European programme that falls into this category is the nuclear energy programme which takes 1.6 MECUS of the Framework Programme's 5.6 MECUS—in fact slightly more than the ESPRIT Programme. The Programme supports the four joint European research centres at Geel (Belgium), Karlsruhe (FRG), Ispra (Italy) and Petten (Netherlands) which concentrate mainly on fission research, whereas Culham at Oxford houses the European fusion research programme. There has been a long history of dissatisfaction with the four joint research centres and attempts at diversification into eg metals research, but the latter have not really been successful. The lessons to be learned from establishments such as CERN (not EC, but which two SPRU researchers, John Irvine and Ben Martin, investigated in detail) is that programmes that are built up slowly over the course of years and that respond to external demand rather than internal empire building are more likely to be successful and highly regarded by their appropriate communities. A prime example of this is EMBL (European Molecular Biology Laboratory), another non-Community European intergovernmental collaboration which is held in high esteem by the life sciences community.

(v) Another reason frequently put forward to justify a European role in collaboration is the need to make the most of 'complementaries' in the development of new technologies on the grounds that no one country can be expected to be expert in everything. While this is, of course, true, this argument again justifies *international* collaboration as much as European collaboration, and often the skills needed to complement domestic capabilities are to be found in the US or Japan. The case for supporting some bias towards European collaboration, and for that matter European programmes such as ESPRIT and JESSI which promote European electronics, stems from the increasing technological protectionism of the US in the face of the Japanese challenge. Japan has always been highly chauvinistic about its own technology (although making efforts to be more open), but if Europe finds itself excluded from access to US technology, it is important to build up European competences in new technologies because of the importance of such competence to long term competitiveness.

Our interests lie in trying to keep international exchange as open as possible. Therefore, while supporting the European programmes, it is important not to exclude other linkages, and to encourage the European programmes to be relatively open (eg to membership from countries such as Sweden or Austria). Ultimately decisions as to how wide to open membership, whether to allow foreign-based multinationals etc to participate, and so on, have to be political decisions.

(vi) The increased range of European programmes makes it difficult to comment on priorities and appropriateness. At present, the Framework budget priorities, judged in terms of expenditures, are in this order: information technology, including telecommunications; energy (mostly nuclear); industrial technologies including new materials, robotics, etc; health and the environment; biotechnology. Most questionable is the emphasis given to nuclear energy. Other comments culled from SPRU researchers which are relevant to this issue are:

(a) applicants appreciate the relatively straightforward application forms and clear cut-off dates, etc, but find the Brussels bureaucracy slow and inflexible on contract details and, above all, payment;

(b) ESPRIT was the pioneer of the new style programme and has been a major catalyst to the restructuring of the European electronics industry, but is in danger of becoming a self-perpetuating empire. In particular the army of 'consultants' now spawned by this and similar programmes, together with the number and size of firms supported, creates a large constituency pressing for its continuation;

(c) most of the money goes at present to so-called 'pre-competitive' research. In IT most of this ends up supporting company research; in biotechnology most has gone to universities with little company involvement. In the UK the successes of Alvey and the SERC Biotechnology Directorate indicate that programmes that do succeed in bringing university and industry together in a working relationship can have many spin-offs, and there could be more emphasis on this type of programme.

(d) to date the EC has put very little money into the support of basic research, yet this would seem to be an area where Europe lags behind the US (eg in the life sciences). There might be something to be said for switching support from some of the 'near market' projects supported under some programmes, towards more support for basic research;

(e) in biotechnology there is urgent need for the Community to take the lead in promoting and developing infrastructure facilities, in particular, the development of data bases.

(vii) Our impression is that UK universities and polytechnics have been relatively slow to wake up to the potential of EC research programmes, but are rapidly making up ground now. Many universities have appointed liaison officers to keep departments informed of new funding opportunities; many departments have established their own links with Brussels. Although the priorities established in Brussels have some influence on research undertaken, to a considerable degree, Brussels is seen merely as an alternative source of funding for the research which a group wants to undertake, and research proposals will be doctored accordingly. Academics are becoming good entrepreneurs when it comes to funding.

(viii) UK universities and polytechnics are well represented in the IT areas, thanks largely to their involvement in Alvey and the publicity given to European programmes via that network. UK firms are also very well represented in the IT area, with GEC topping the list of collaborators. This is less true of other areas. In particular, the UK is poorly represented in the health and biotechnology initiatives. On the latter, where most involvement is academic but not industrial, the relatively poor liaison between the DTI's Biotechnology Unit, which provides the link to Brussels, and the respective Research Councils on these European issues helps to explain the lack of representation. Only universities/departments that have made their own liaison with Brussels have much knowledge of the programmes being promoted by the EC.

(ix) There is considerable resentment in the academic community about the lack of 'additionality' which derives from the Government's methods of allocating and cash limiting the European R&D expenditures. While many would welcome more funding at the European level, they would not welcome it if this were at the cost of funding from UK government sources. In general the perception among academics is that the quality of research funded under the European programmes is lower than that funded by the UK research councils. Given the already high level of 'unfunded alphas' in the UK, if the opportunity cost of more European funding is less UK Research Council funding, then most UK academics would likely opt for UK not European programmes.

(x) The experience in biotechnology raises serious questions over the effectiveness of the UK government machine in relation to the European research programmes. Given that the DTI is the lead department in most of the programmes, it would be worth discovering how far the DES itself is involved in programmes where there is a major higher education input, and whether the DTI is tapping adequately the policy input from the higher education sector.

5 October 1989

APPENDIX 4

Memorandum by the Institution of Professionals, Managers and Specialists (ES 20)

Summary and Main Conclusions

1. The Institution of Professionals, Managers and Specialists, which represents scientific staff engaged in public research and development, is concerned that the ability of scientists within the Research Councils and other government-funded research bodies to maximise the opportunities afforded by European Community research and development programmes is being severely circumscribed by a number of factors.

2. These include:

- reduced Government support for science—particularly relative to our major EC competitors—resulting in sub-standard equipment and the loss of qualified staff;
- the application by the Government of 'attribution' and 'non-additionality' in certain areas, both acting as disincentives to European involvement;
- the excessive use of short term appointments for scientific staff;
- the inevitable, but daunting, bureaucracy of the European Commission;
- the partial failure of UK organisations to assist scientists to overcome this bureaucracy and make successful bids for funding.

3. If the UK's Research Councils are to improve their level of participation in EC programmes, the following action is required:

- increased Government funding of civil R&D;
- the non-extension of attribution and non-additionality practices to the Research Councils and higher education institutions, and their abolition in other areas;
- much reduced use of short term appointments for scientific staff, and longer term action to reverse the contraction of the scientific community;
- a higher priority to be given to EC involvement by the Research Councils;
- the development of an improved system for the dissemination of information on available funds and the formulation of proposals to scientists.

Introduction

1. The Institution of Professionals, Managers and Specialists (IPMS) is the trade union which represents 90,000 scientific, technical and specialist staff in the Civil Service, related public organisations and an increasing number of private sector companies. Over 4,000 of our members work in the Research Councils and, in compiling this evidence, we have drawn on their experiences of participation in projects funded by the Commission of the European Communities (CEC) and their opinions on how the level and quality of this participation might be improved.

2. As the Institution is not in a position to forward informed comment on some of the broader questions to be examined by the Committee (the EC role vis-à-vis that of Member States and the appropriateness of individual programmes, for example), our evidence will concentrate on our members' observations—the views of active researchers, rather than Research Council managers. In this way, we would hope to give the Committee an insight into the experiences of those looking at the process 'from the coal-face'.

3. Our evidence is, to some extent, based on two simple premises: that, on balance, UK membership of the European Community (EC) is beneficial; and that the EC is increasingly becoming a major source of research funds and UK research establishments should attempt to maximise this country's 'share' of those funds. Even where there is a view that a given programme is mis-directed, maximum UK involvement means maximum influence over future developments.

4. Our evidence is structured as follows:

- a brief look at trends in civil R&D in the UK and abroad. Here, the basic question is whether or not the last decade's run-down of the UK's public R&D effort is now prejudicing our ability to participate fully in the European effort;
- a discussion of the pros and cons—from the point of view of the active researcher—of being involved in EC programmes;
- a look at some of the criticisms of the CEC bureaucracy in Brussels—again seen from the position of active researchers—and the support the Research Councils and the Government provide to help people deal with it;
- an examination of some of the apparent failings of the Research Councils in providing sufficient encouragement, information and support to scientists who do or might like to submit proposals to the CEC;

— A look at the key questions that we would like the Committee to ask the Research Councils and their masters in the Department of Education and Science, presented in the positive form of an agenda for action in improving the UK's share of the European scientific effort.

Civil R&D in the UK and Abroad

5. Throughout the 1980s, civil R&D has been consistently cut back by the government. Although government R&D spending has broadly kept pace with inflation, it has been cut in real terms when the higher inflation rates for scientific costs are taken into account. The high rates of economic growth experienced in the latter half of the decade have not benefited science; its share of gross domestic product has actually declined—a quite remarkable trend in an advanced economy. Similarly, the proportion of government expenditure allocated to science and other R&D efforts has fallen over this period from 3.3 per cent in 1981 to 2.8 per cent in 1989. The Government's latest Review of R&D suggests that, far from being reversed, this decline is to be intensified.

6. These cuts have been traumatic for the Universities and the Research Councils. Of the Councils in which IPMS has a direct interest, the loss of staff will accelerate in the next few years. Between now and 1992, AFRC is projected to lose 750 (19 per cent) of its 4,000 staff, 240 of them graduates (this comes on top of the 24 per cent loss since 1986); NERC will lose 300 (12 per cent) of its 2,500 staff, including 150 graduates; and SERC will lose 60 (2 per cent) of its 2,700 staff, 24 of them graduates.

7. The problems that this decline in the overall numbers of active researchers presents are compounded by the increasing use of short term appointments (STAs). This practice—where staff spend the first year of their appointment getting to know the subejct and their colleagues, the second year doing research and the third looking for their next appointment—prohibits the development of stable and effective research teams. The efficacy of such widespread use of STAs was questioned by the House of Lords' Science and Technology Committee in their recent report on Agricultural and Food Research.

8. When the reductions in opportunities for scientists are taken together with this increasing use of STAs and the relatively low pay of scientists (highlighted by the Science and Technology Committee's recent Report on Civil R&D), it is not surprising that young people are increasingly turning their backs on a scientific career.

9. The general deterioration in the infrastructure of the Research Councils and Universities has been another result of the cuts. In its recent report "Science and Public Expenditure 1989", the ABRC drew attention to the desperate need for re-equipment. Total equipment needs amount to a cost of some £460 million (ABRC, para 54), and the Board said:

> ". . . these results suggest that the UK is not as well provided for as some other advanced countries, with worrying implications for our international competitiveness in research and scientific training."

10. The lastest OECD Science and Technology Indicators Report confirms this view with disturbing evidence of the UK's relative decline in the international R&D league table. In the first half of the decade, we were the only OECD country in which the percentage of GDP devoted to R&D declined. Whilst the UK remains in the big league of R&D spenders, we are rapidly being caught up by others.

11. Taking total R&D expenditure as a proportion of gross domestic product (GDP), France caught up the UK in 1987 with 2.3 per cent and is on its way to a target of 3 per cent. Even Member States without our history of R&D effort are increasing their investment—Spain being second in the OECD league table of R&D growth, the UK bottom. Removing defence R&D from the picture, the OECD found the clearest decline in government spending on civil R&D to be in the UK. We have thus been overtaken by other countries in this sphere—Italy's government-funded civil R&D is now greater as a percentage of gross domestic product than the UK's. In its advice to the Government referred to earlier, the ABRC suggested that the UK is spending between £150 million and £200 million a year less on academic and related research than our main European competitors.

12. The UK currently secures a greater share of CEC research funds than it contributes. Whilst we acknowledge and applaud this fact, in the opinion of the Institution this is to be expected in view of the UK's historically high level of scientific endeavour. Our concern is that this eminence may be short-lived. It is inevitable that the Government's attitude to R&D, as exhibited by the above, must seriously undermine the efforts of individual researchers to secure CEC funding for their work. A research community starved of funds, inadequately equipped and short of qualified scientists is unlikely to continue to be attractive to the project proposal assessors in Brussels.

13. It is not just the overall level of funding which hampers UK involvement. The Government employs two accounting practices which act as a disincentive to UK involvement in CEC programmes. Under 'attribution', Government contributions to EC expenditure are set against the budgets of one or more responsible Departments. Under 'non-additionality', any 'excess' income that a Department or public body derives from participation in CEC schemes is clawed back by the Government. At

present, the Research Councils and Higher Education Institutions are exempted from the latter, more obvious disincentive. However, this could change if CEC R&D programmes start to focus more on the 'basic' end of the research spectrum.

14. The Government's science policy prejudices UK research establishments in another way—concerning the manner in which CEC projects are structured. CEC programmes frequently involve the 'matching' of funds, where it is expected that the cost of a proposal will be shared by the CEC, the research contractor and at least one third party—ideally industial, but possibly government. Because UK industry is notoriously bad at financing external R&D, our researchers find that, in the absence of government support, there is generally no third party funding available.

15. Finally, and going beyond the immediate concern here with the UK's performance in winning CEC research grants, the above raises fundamental questions about the ability of UK research bodies to compete with their EC counterparts for public R&D contracts in general. Under the public procurement directives being drawn up by the Commission in the run-up to 1992, all government procurement of goods and services will be open to Europe-wide competition. Thus, UK contracts will be open to tenders from non-UK laboratories and institutes and other countries' projects will be open to bids from UK establishments. However, the ability of our researchers—hampered by poor infrastructure, out of date equipment and transient scientific staff—to bid successfully for contracts must be in doubt.

Why be involved in European Research?

16. There are abvious advantages to the UK from being involved in European R&D. Involvement offers influence over the direction of research programmes, prestige, the pooling of scientific resources and expertise and, of course, money. But what does such involvement offer the individual?

17. There would appear to be two extreme views of the utility of European involvement to the scientist as an individual. First, there are some scientists who enjoy travelling to endless workshops and being known in international circles. To others, the round of writing proposals, attending meetings and writing lengthy reports can relegate their scientific work to a minor activity. Although the views of most lie between these extremes, there is a tendency towards the latter, which is particularly keenly felt where cuts have left teams so understaffed that much of the practical work is done by the leading scientist.

18. That said, all are certain that there is great scientific benefit to be gained from participation in European and other international efforts. In particular, CEC programmes are seen as attractive, being—in the words of one of our members—"more inspired than most we see in the UK". The international objectives of the programmes means they are frequently breaking new ground and the wider contacts and new insights gained from meeting researchers from other Member Countries benefit UK scientists in a number of ways.

19. So, it would appear that, in addition to the resource problems discussed earlier, there are two main areas where scientists in some of the Research Councils feel disadvantaged in seeking European involvement: the bureaucracy of the CEC and the support they receive from the Government in general and their employers in particular.

The CEC Bureaucracy and the Bidding Process

20. The 'red tape' of the CEC has now passed into folklore and the size and complexity of the Directorates of Research makes a certain amount of bureaucracy inevitable. Thus, gaining a grant involves getting to know the system: when and where to apply, which topics are flavour of the year, who is in charge of the programme and whether the scale of the project is right.

21. The EEC Research Allocations Committee gives different sums of money for different sectors of research. Those putting proposals together for a given programme know the total sum available but not what might be allotted to its different elements. It is thus a matter of judgment whether to make a small bid or attempt to 'scoop the pool'. Added to this is the problem of finding one or more Continental bodies and/or industrial companies as partners so as to increase the chances of the bid being successful.

22. The formal procedures associated with funding applications are daunting and the failure rate is apparently high. The first hurdle, however, is one of the Research Councils' making, as they do not always allow bids to go forward. Of course, some sort of vetting procedure is vital to prevent frivolous or poor quality proposals from being submitted. Nevertheless some scientists have a suspicion that these decisions can be made for tactical reasons. These suspicions could be allayed and much time saved if the criteria controlling the Research Councils' decisions were clarified.

23. This uncertainty about the criteria by which projects are evaluated extends to the CEC's own evaluations. Researchers complain of apparently unwritten criteria of which their overseas counterparts are aware, but they are not. Although proposals are officially assessed on their scientific merits, there is a suspicion that the CEC might switch from one contractor to another for each stage of a programme in an attempt to spread the funds more evenly between countries. Such a scenario is not unlikely given the political pressures in Brussels.

The Research Councils and European R&D

24. It is not our intention to review here the success rates of the different Research Councils in winning CEC funds. We do not have access to complete information and the Councils themselves are in a better position to provide the Committee with this. Instead, we would like to present the views of some of the Institution's members in the Research Councils who have been actively involved in trying to secure and then carry out EC funded work. In particular, we concentrate here on the apparent failure of certain Councils to provide sufficient encouragement, information and material support to their researchers in this respect.

25. Whatever the efforts of UK institutions, they can only be truly assessed in comparison with those of their counterparts in other Member States. Some researchers expressed a concern that their Research Council is not perceived as a 'natural partner' by its counterparts in Europe. Within AFRC, for instance—a body which holds up its agreement with France's INRA (Institut National de la Recherche Agronomique) as an example of bilateral links—scientists cite the unwillingness of INRA to involve AFRC Institutes in its projects as evidence of its low opinion of AFRC. The AFRC's efforts are summarised in this statement from one of our members: their "approach to Europe is, in general, amateurish, second-rate and pathetic in comparison with other EEC countries". A similar level of disillusionment was expressed about the NERC. The SERC, on the other hand, appears to be considerably more effective, both in building international links and in supporting its researchers with information and in bids.

26. There is an obvious need for the Research Councils to actively publicise themselves within Europe and to build on the links that exist. Incidentally, this might also go some way towards mitigating the ill-feeling and mistrust engendered by the Prime Minister's somewhat jaundiced view of the EC's value.

27. One of the major forms of publicity and assistance to researchers provided by the Research Councils is a joint office in Brussels, until recently run by the NERC. Its main function is to ensure that UK scientists are made fully aware of opportunities to bid in good time. It produces a regular bulletin containing news of the latest developments in Brussels, details of proposed and agreed programmes, closing dates and budgets. Those scientists who have had contact with the office have found it 'user friendly'. Also, its facilities—in the form of meeting rooms etc are seen as highly valuable. However, researchers in AFRC and NERC feel that this is the limit of their Councils' active (and funded) commitment.

28. With the possible exception of the SERC, at the level of the individual Research Councils, the support system appears to be little more than a 'mail box'. Within AFRC, this was put down to the control exerted by MAFF, which regards EEC matters as 'political' and is therefore reluctant to explain the workings of the CEC or to pass on even basic information such as how projects are evaluated. MAFF also appears to be reluctant to appoint non-MAFF people as expert assessors. As such, individual researchers are left to draw up proposals without being able to draw on an organisational 'learning curve'.

29. Even more fundamentally, the AFRC and NERC secretariats—which our researchers feel should be assisting bids—frequently appear unaware of programmes and deadlines and unable to provide advice. There would appear to be a lack of any co-ordinated effort on the part of the central offices to draw attention to potential opportunities upon the announcement of new programmes. Such support, need not be a drain on scarce resources—all that is required is a team of two or three people acting as a point of contact between the Councils, their laboratories and Institutes and Brussels. Once again, SERC would appear to have considerably more sophisticated and better resourced support systems.

30. It would appear that, rather than generally encouraging staff to make applications to projects within their specialism, a Research Council makes a decision to bid when it feels it has to be part of a programme. In other words, choices about the extent and depth of our involvement are being made in a highly selective way, and a way which may have more to do with the prestige of the Research Council than science.

31. In some cases, scientists who are keen to participate in CEC programmes are forced to prepare proposals in their spare time.

32. On the question of the guidance and advice given to researchers drawing up proposals, the lack of clear policies on financial costs—marginal costings, etc—have led to delays in the completion of applications. Even advice on things as basic as the appropriate signatories to an application appears to be unforthcoming.

33. On a less formal level, seminars and workshops have an obvious role in enabling staff experienced in certain areas of Europe to pass on useful information to their colleagues. This would also provide a route by which the Research Councils themselves obtain regular feedback. SERC has run a few seminars, as has the Brussels office.

34. At the level of the individual Institute and Research Station, the degree of support offered to scientists is highly variable and appears to depend largely on the attitudes of Directors and the individuals appointed as EEC Representatives. Of course, these attitudes are conditioned by the individuals' workload in other areas of their work, and it would appear rare that sufficient time is allowed for EEC work. It is also questionable whether the Representatives have sufficient organisational influence to give priority to EEC-related efforts.

35. The competition which often exists between Institutes and even between Research Stations within Institutes is ultimately destructive. A result of the climate of cutbacks, this competition is preventing the formation of coordinated proposals involving scientists drawn from different areas.

36. All in all, the Institution's members wish to see a less ambivalent role being adopted by their Research Councils. Senior managers and Directors of Institutes and Laboratories should be left in no doubt that participation in CEC programmes is mandatory and that financial and administrative resources should be made available for those involved in CEC applications.

Improving UK Participation—An Agenda

37. The Institution feels that these observations from scientists active in attempting to secure CEC contracts suggest that the Research Councils are failing to maximise the opportunites afforded by the expansion of European R&D activity. The weaknesses we have identified suggest action is required in the following areas:

- *Government funding*—this needs to be increased, particularly for re-equipment but also to raise the morale of the scientific community and release researchers from excessive workloads. The target should be to match the levels of civil R&D funding (as a proportion of GDP) of our major EC competitors—ie France, Italy and the Federal Republic of Germany.
- *Accounting practices*—the application of 'attribution' and 'non-additionality' should preferably be abolished and, at least not extended to the Research Councils and higher education institutions.
- *Scientific staffing*—it is urgent that the present over-reliance on STAs is ended: it is an inefficient use of highly qualified people and, ultimately, deters young people from entering the profession. In the longer term, action on pay, education and training is required to resolve recruitment and retention problems.
- *Priorities*—it appears that some Research Councils give insufficient priority to involvement in CEC programmes. Their ambiguous attitude is reflected in the uncertainty scientists seem to have as to whether their individual efforts will be welcomed and in the lack of support the Councils give them in their bids for funding.
- *Information*—a centralised and well resourced system for the dissemination of information within each Research Council would greatly improve both individual scientists' awareness of relevant programmes and the coordinated formulation of proposals. Such offices within the Research Council secretariats would provide the vital link between the Councils' Brussels office and their research teams.
- *Support systems*—the support some of the Research Councils give to scientists formulating proposals and pursuing bids for funds appears to be woefully lacking. Researchers particularly require information on timetables and deadlines, the required format for proposals, costing and the criteria applied in Brussels' assessment of bids. At a very practical level, workshops could be instituted for scientists to exchange information and learn from each other.

November 1989

APPENDIX 5

Memorandum by the National Association of Teachers in Further and Higher Education (ES9)

The Association welcomes the present inquiry, which we believe is very timely. We are concerned that the trend of British government policy towards both the European Community and higher education could seriously undermine science policy in this country and disadvantage not only our higher education institutions and their students and teachers, but the broad range of industry which depends increasingly on the application of science. The already existing gap between Britain and our major European partners could continue to widen in this area as in others.

While Britain has been able to gain a significant share of EC collaborative projects to date, we believe that this situation is likely to deteriorate if the science base is allowed to continue to erode as it has in recent years. The introduction of the National Curriculum in schools is already highlighting the lack of properly qualified science teachers, and the continuing crisis in school teacher supply—whatever the Government may say to deny its existence—can only exacerbate this already bad situation at school level. This in turn affects entrance to science subjects at further, higher and teacher education—and so the cycle continues.

In higher education, the planned concentration of research capacity in fewer institutions will impair the British higher education system's capacity to take advantage of EC funding of collaborative ventures. The growing trend towards joint ventures between British institutions and between British and European institutions will be checked. This is a danger that present domestic policies will lock our scientific intitutions into a downward spiral from which they cannot recover, and which will take them further and further away from their EC counterparts.

If the number of institutions able to do large scale scientific research is seriously limited, it seems most likely that very few, if any, PCFC institutions will be included in the favoured group. For years, it has been argued that higher education students and teachers alike need to work in an environment in which active research is taking place. Any concentration of research could mean that the disadvantage faced by students and teachers who do not have such access is compounded, by also depriving them of increasingly important contacts with conterparts in EC institutions.

British official policy towards higher education for a number of years, has placed increased emphasis on the need for industry to fund higher education, particulary in fields like science. It is clear that, particularly after 1992, we will operate more and more in a European business environment, and our institutions will have to be relevant to, and compete for support in, that changing environment.

As far as the mechanics of institutional involvement in EC projects and links with scientific institutions in EC countries is concerned, there is a need for streamlining to ensure that information on EC programmes is channelled to our institutions as quickly as possible. More than this, it is desirable for the Government to promote institutional initiatives with the EC as vigorously as possible, and to enable as many institutions as possible to participate.

I hope that these comments are of assistance.

Paul Bennett
Education Officer

23 October 1989

APPENDIX 6

Memorandum by the Royal Society of Chemistry (ES 25)

1. *General*

The Royal Society of Chemistry, as a member of the European Communities Chemistry Committee (ECCC), has for some time been considering how the EC could better stimulate and support the real need for EC-coordinated research in chemistry. This culminated in a Report "Chemical Science and Technology—Needs for the 1990s" to which the Society made a major contribution.

The Society's response primarily relates to the second of the Select Committee's areas for examination (Priorities and mechanisms for European research). Our response takes the form of reproduction of material extracted from the ECCC Report. Copies of the complete Report can be made available if required.

The Society would be willing to supplement the evidence in this document by giving oral evidence at Committee sessions.

2. *Chemical science and technology; needs for the 1990s (extracts follow)*

2.1 *Executive Summary*

"The chemical industry, based in chemistry, is a major contributor to the economic health of the EC. It plays a lead role in developing new processes and new products and has a vital function to ensure that our environment is not harmed. Many other sectors of the EC economy, including transport, food, public health, energy, end environment require the results of basic research in chemistry and chemical technology. The Report emphasises the importance of fundamental research for the future of chemistry in the EC countries, and examples of special concern for Europe are included.

It is recommended that the EC should make a special effort to further stimulate European Research Cooperation in chemistry and Chemical Technology. This will uphold the leading position of EC countries in the field and help bring the European growth rate up to that of other comparable economic entities.

2.2 *Introduction*

"Modern society requires a very diversified manufacturing industry to produce electronics, pharmaceuticals, foodstuffs, plastics, textiles, automobiles and many other necessities. These industries all process raw materials that are frequently made by "chemical" industries. Other industries use chemical processes for converting natural materials into other products, for example those processing metals, or wood, as well as those making natural rubber, or refining and modifying oils and fats. Most materials used in the manufacturing industries are prepared by chemical methods. Chemistry and chemical technology thus form an essential basis for most sectors of industry.

The recent EC Report on the "State of Science and Technology in Europe" states[1] that:

> "The Chemical Industry has been one of the most important factors in economic development and social change that has taken place in Western Europe over the last 30 years. This is an intrinsically innovative sector characterised by the manufacture of new products and materials which integrate with and replace natural ones, calling for different processes and technologies from those known hitherto."

If plastics and pharmaceuticals are included with chemicals, but fuels such as coal, oil and gas and other forms of energy are excluded, the direct earnings of the EC chemicals industry are still very large. The total annual turnover (1988 figures) is some 311 Gecu ($1 = 10^9$ ECU)[2]. The industry has ca. two million employees, a 1988 capital investment of some 15 Gecu, and annual trade within the EC totalling 75 Gecu.

Most important, however, exports to non-EC countries amount to 51 Gecu, whereas imports from these countries are only 27 Gecu[2,3]. This gives an annual favourable balance of trade with the rest of the world of over 24 Gecu. In addition, there are also of course the turnover, profits and balance of trade deriving from industries which depend heavily, although indirectly, on the chemical industry.

Chemicals is an area where the EC is leading worldwide; for example, the annual turnover of the chemicals industry in the USA is 203 Gecu and in Japan 138 Gecu[2]. However, the growth of the EC chemicals industry of only 5 per cent over the period 1980–85 has been very much less than that of our competitors[4] and stimulation is needed to prevent further weakening of its relative position.

Chemistry is the basic discipline, chemicals are the starting products and chemical processes play a key role in the manufacturing of many high technology products, including advanced materials, agrochemicals, products of biotechnology and pharmaceuticals. It has been estimated that some 70 per cent of the total industrial production in EC countries depends, to some degree, on chemical

science and technology. Environmental problems and the scourge of pollution can only be solved with the help of chemists and chemical engineers. In short: Chemistry is essential for the quality of life.

The rapid growth of high technology will put greater demands on the chemical profession. This comes at a time when the chemical profession in many countries is under threat from declining student enrolment and a relatively poor image, and when fewer resources are being made available for basic research into the subject. If the European research impetus is allowed to fade, the EC will either have to import innovations from the USA or Japan, or the industry will go into decline.

The chemical industry is generally quite capable of undertaking the immense research and development required on the applied side. However, it leaves the more fundamental areas of research to non-industry institutions, such as universities, which have only modest, and in many instances even decreasing funds. This is a dangerous situation as basic research remains the source from which every innovation in society and industry is ultimately derived.

Our European basic research effort is, as a result of history, heavily fragmented. As such we are in a highly unfavourable position compared to our main competitors, the USA and Japan. There is an urgent need for further EC support of strategic risk-bearing chemical research (science and technology). The Report suggests priority areas based on EC economic, environmental and health needs. The costs may be substantial, but research in areas in which EC countries are relatively strong, compared with the USA and Japan, can be expected to bring a high return of money invested. So many opportunities for advancing our knowledge and strengthening our economy are waiting for discovery, that delay can hardly be tolerated. Moreover, the risks of not attracting sufficient of our brightest young people to become scientists are increasing every day."

2.3 *Existing European funding for chemistry*

"Considerable EC resources are already being put into expanding technology in various areas (for example, new materials, IT, biotechnology, energy) and many collaborative, short-term, applied programmes are available (BRITE, EURAM, STEP, EUREKA, SPRINT, ECLAIR, etc.)

By comparison, little funding is available for *basic sciences*, in particular chemistry. The total amount being spent on chemistry projects within the current SCIENCE programme is only about 6 Mecu per year[5]. This amount is derisory when one compares it to the benefits that the EC chemical industry brings, and to the needs of academic chemistry. It should be stressed that today's chemistry and chemical engineering students in universities and polytechnics will provide the scientists, engineers, technicians and managers who will run and guide the industry tomorrow. We should also remember that "Less and less can technologies develop without advances in the associated scientific disciplines . . .", as a recent Commission document has stated."

2.4 *The need for chemistry research*

"Chemistry is a central enabling discipline which is the basis of much of present-day technology. It provides the fundamental understanding to deal with many of the needs of the community. Its interactions with biology, biotechnology, toxicology, electronics, medicine and physics are all vital to those disciplines. Advances at the interfaces between chemistry and those sciences and technologies will be the source of new technology and this will have the potential to create new wealth, better living conditions, a clean environment, renewable materials and improved health.

However, growth of the interfaces cannot proceed without at least an equal increase of fundamental work in the core of chemistry itself. Thus new research must continuously be supported both in the main disciplines of chemistry and chemical technology, as well as in the interfaces.

While developmental work is often best carried out in large interdisciplinary groups (as in industry), a characteristic (and the strength) of European academic chemistry is the relatively small, highly motivated, and strongly entrepreneurial research group. Such groups often explore a small (risk-bearing) topic, and focus most of their attention on it. The combination of many such groups, each with its own specialism, creates a pool of expertise which industry can then tap into, as and when it requires.

This approach to working also allows methodical exploitation of an area, which in turn usually brings out new and unexpected results, which industry can then further capitalise on. Many profitable new ventures have originated in this way. It is, therefore, imperative that adequate facilities and adequate funding continue to be provided for strategic chemistry research, which is carried out by relatively small teams that can look beyond immediately perceived applications.

These groups often collaborate and interact with each other and with groups in other disciplines, such as physics and biology. Such communications are vital, therefore the European Community must actively encourage and promote supranational collaboration to optimise the use of resources. This has already started in a small way, for example in the SCIENCE programme and various forms of scientific exchange (such as ERAMUS and the "retraite" specialist conferences for "cross-fertilisation").

Within any area of science, one may distinguish between research of a more fundamental nature, and research of a more applied nature. There is a continuum from the most basic to the most applied types of research. Academic institutions focus on the more basic work, also problems areas. It is towards the basic end of this spectrum that extra resources are required, since it is there that bridges between academic and industrial research, or between one type of fundamental research and another are needed. Such basic research is pre-competitive and deserves greater Community support than near-market research, which is better carried out directly by the industry."

2.5 *Chemistry as a multisectoral activity*

"The chemical industry plays an important role in advances being made in other manufacturing industries and economic activities. Apart from its own activities in making products such as fertilisers, plastics and rubber, paints, pharmaceuticals, electronic materials, dyestuffs, adhesives, inks, detergents and photographic materials, its products are used in other major manufacturing industries, such as food and drink, paper and printing, cosmetics, textiles and leather, and the automotive industry (metals, plastics, ceramics, catalysts, coatings), and in areas such as agriculture, telecommunications, waste treatment, gas purification and drinking water supply.

Professional chemists in the European Community are employed in all of the above industrial activities, as well as in universities, colleges and schools in local government administration and in laboratories, research institutes, hospitals and consulting firms."

2.6 *The image of chemistry and chemical technology*

"Chemistry products are everywhere; including in our environment. Although the very positive effects of chemistry on society in undeniable, the chemical industry has also had an adverse effect. In the past cases of environmental pollution through human error or ignorance have led to a low-popular image of chemistry, chemical technology and chemists. Even though pollution has decreased significantly as a result of new insights, new technology and environmental regulations from national governments, and considerable efforts by chemists and chemical engineers, many unsolved problems remain. These problems contribute to this low image and provide a challenge to all chemists. Further, the many benefits of chemistry are not well understood by the general public and need to be better explained. At present the general public tends to ignore the positive and to emphasise the negative effects. There is an important need for a review of public relations for the chemical industry.

Chemists and chemistry also play a major role in improving health and safety in the home and at the work place and in providing a cleaner environment in which to live. Environment, safety and health will be the key issues in the public mind over the next decade. There is a need for new approaches to avoid and prevent pollution; they will require tremendous input from chemical reearch. Chemistry must play its major role well and the European chemcial industry must be adequately supported through adverse propaganda. The EC has a major responsibility to help."

2.7 *Priority areas for the next decade*

"Some priority areas for chemical research and technology projects (and their relations with the overall EC economy) are detailed below. Their choices are based upon consultation with experts from both inside and outside the ECCC, existing European programmes, activities outside Europe (such as the Japanese MITI programme and the Pimentel report) and earlier documents from member countries.

As described in the Executive Summary, the four proposed major *priority areas* are:

— Advanced materials, renewables
— A better environment; safety, hygiene and pollution control
— Efficient communication and transport
— Food and health"

The report is designed to assist European policy makers to take decisions based on the areas of European strength and to meet the challenges posed by rapid developments in other parts of the world. The proposals for future chemistry research areas (related to current economic, environmental and health, concerns) will also be of interest to national policy makers and research scientists (both academic and industrial) in the member countries.

Each of these topics has been further divided, and a number of topics are proposed where pre-competitive research should be fostered. This is in addition to the vital prenormative ("basic") research, covering much of the discipline, without which the subject will die.

Substantial additional funding by the EC will be needed to promote the European research cooperation in chemistry and chemical technology.

Attention is also drawn to recommendations dealing with advanced training and education, research conferences, and the regular updating of the present report."

2.8 *Recommendations to the European Commission*

2.8.1 "The report details a wide range of opportunities for the expansion of chemical research in the Community and the Commission is asked to take account of these when creating new or adjusting existing research programmes. It should be stressed that it is in basic and not in "near-market" research that this stimulation is required."

2.8.2 "It is suggested that EC member countries are encouraged by the Commission to stimulate national research programmes in the areas of opportunity outlined in the Report."

2.8.3 "The initiative of the Commission in providing funds to enable greater use to be made of existing major facilities in chemistry is welcomed. Such funds not only enable more efficient use to be made of these resources, but also should enable researchers from the less-developed countries of the EC to gain valuable experience. The Commission should encourage the further expansion of this kind of activity."

2.8.4 "To stimulate research exchange at the very early stage and to foster cross-fertilsation of ideas, it is recommended that funding should be made available to enable specialist meetings (European Chemistry Seminars), modelled on the Gordon Conferences, to be organised on a Community basis."

2.8.5 "The educational exchange programme, ERASMUS, is of special importance to young chemists and the expansion of this programme is recommended. Investment in human capital remains extremely important for the future of the EC."

2.8.6 "It seems that one of the problems of the SCIENCE programme relates to the whole system of refereeing projects. As far as chemistry is concerned, there would seem to be some advantage in the Commission contracting this job out to a specialist body set up by the ECCC."

2.8.7 "To help in the carrying out of new and increased programmes in chemistry, it might be necessary to set up a separate secretariat, probably in Brussels. The ECCC would be prepared to consider setting up and running such a secretariat, if financial assistance were made available. The Secretariat could be the focus for the administration of refereeing systems and the proposed European Chemistry Seminars."

2.8.8 "Finally, it is recommended that this Report should be updated every 2-3 years, to allow the EC to react adequately as new scientific discoveries emerge, or when new economic, political, or environmental developments require a change of strategy. Clearly it would be beneficial to have CEFIC involved in such updatings."

J S Gow

December 1989

APPENDIX 7

Memorandum by the Chemical Industries Association Limited (ES 13)

The Chemical Industries Association appreciates the opportunity to submit evidence for the above inquiry. The Association is the main trade/employer organisation in the UK chemical industry, with a membership of about 200 companies, many of which operate internationally.

The chemical industry is a prime wealth-creating sector of the UK economy. Almost every other industry and activity depends in some measure upon its products. It generates a positive trade surplus of about £2 billion annually.

The industry's strength has been, and will remain, closely dependent upon a high-quality science base. The flow of ideas and discoveries from fundamental academic research provides the seed-corn for industrial research and innovation; and—at least as important—the education system plays a vital role in the provision of intelligent, trained and enquiring science graduates for the industry.

We assume that two of the main objectives of a European dimension to science policy are to foster a European science base of at least equal standing to those in other leading countries (notably the USA and Japan), partly in order to support the development of competitive and innovative European industry; and to encourage exchanges and contacts between scientists in different member states, as part of the creation of a cohesive Europe.

Against this background, the CIA wishes to make the following points:

1. There is a real danger that current pre-occupation with "exploitability" of scientific research, especially in the UK, may be overdone, and that in the longer term industry as well as the universities may be disadvantaged by this. The chemical industry differs from most other industries in that it funds and carries out its own research to a very high extent and relies far less than other industries upon government funding of its research. Whilst the CIA went on record two years ago as accepting the general principle of greater concentration of academic funding into strategic areas, it pointed out then—and wishes to emphasise now—that basic research, which chemical companies look to the academic sector to provide, must not be squeezed out.
2. There is equally a danger that chemistry is being too much taken for granted. Funding for science at the European level is heavily-oriented towards highly-expensive areas such as particle physics. Though such research is—almost by definition—of fundamental importance and may lead to discoveries of major significance, the equal importance of chemistry must be recognised. Chemistry is a core science which underpins other areas of science and technology. Without advances in chemistry, many of the areas of research and technology covered by the EC's R&D Framework Programme—such as information technology and advanced materials—could not be developed. Whether through national funding or through some development of European funding programmes, fundamental science must be maintained.
3. The exact content of a European, compared with a national, funding programme for science is not easy to contemplate but a move towards some greater cohesion of European scientific efforts should be supported—provided that it does not entail the construction of a mammoth bureaucracy to administer it. Certainly, CIA supports exchange programmes and joint projects between academic researchers within Europe in order to stimulate the flow of ideas. Such interactions should be pervasive—including scope for contact between different disciplines—and should provide opportunites for "young blood' to participate.
4. Within the UK, many industries, not least our own, are making efforts to encourage more youngsters in schools to opt for science and engineering. Government, through its funding of all levels of education and through initiatives such as the National Curriculum, clearly has a vital part to play. We are conscious, however, that the problem is by no means confined to the UK and we suggest that its relevance to a European science policy should be considered. So far, such thinking at Community level appears to have been confined mainly to mutual acceptability of certificates and diplomas between member states.

In conclusion, the CIA believes that the relationship between UK and European science policy, and the UK Governmental policy machinery for considering this, are indeed topics deserving detailed attention, and it would like to compliment the Select Committee on its decision to address this subject.

We shall be pleased to attend and provide oral evidence if required.

T. D. Culpin
Director (Business Development)

3 November 1989

APPENDIX 8

Memorandum by the Institute of Physics (ES 19)

The European Community Role

(a) The EC role in relation to the domestic science programmes of member states

The European Community should:

1. continue to concentrate on collaboration between member states, thus widening the perspectives of domestic science programmes while leaving member states to decide which programmes they will support;
2. increase awareness amongst scientists in member states and encourage more interaction between research groups having common interests;
3. support research areas of mutual concern to all member states—such as those of the environment and of geophysical phenomena, which require central planning and resources;
4. be concerned with supporting large-scale pure research which would be impossible for individual member states to undertake;
5. promote chosen areas of curiosity-driven research which are not necessarily market oriented.

(b) The role of the European Community in the development of collaborative projects between member states and non-EC countries

The EC should be stimulating new collaborations likely to develop with Eastern Europe; but there is a need to find simpler mechanisms than those which are currently in use for inter-EC collaboration.

(c) The Scale of European Community programmes which members states should support

While it is difficult to make judgements as to the financial scale of programmes which deserve support from member states, it was felt that programmes such as EUREKA and ERASMUS should be strongly supported.

Priorities and Mechanisms for European Research

The appropriateness of existing priorities and types of funded programmes

It was generally felt that the existing priorities are largely appropriate. They allow coordination, financial support and harmonisation of activities in related areas: these are welcome and valuable. However the following recommendations are made.

1. Greater emphasis than exists at present should be placed on longer term basic science, in relation to short-term market-driven research.
2. The EC should allow more interchange, mobility and recruitment of young research workers across state boundaries.
3. There should be more grants for exploratory visits especially between small dispersed groups activating significant new initiatives, so that new links may be developed.
4. The risk that inadequate attention will be paid to intermediate-scale research facilities must be avoided.
5. There should be a substantial expansion of (much over-subscribed) programmes such as 'SCIENCE' and 'ESPRIT'.

The Appropriateness of Present Funding Conditions

Present funding conditions were not thought to be appropriate. The following improvements were suggested.

1. In the UK context, due to changes in the dual support system of research funding, the level of indirect costs needs to be made higher. The matter of the overheads charged by universities in relation to EC grants must be clarified.
2. The bureaucracy and the paperwork associated with applying for grants are excessive and cumbersome. Application forms and procedures must be simplified, and the amount of information sought must be reduced. Bids should be accepted or rejected more quickly, possibly through a system of short applications.
3. There is a need to feed back more information concerning the programmes into the science community—much as we have in the UK via the SERC for our domestic programmes.
4. Over narrow programme definitions need to be broadened to allow a greater range of programmes to be considered.
5. Funding conditions for European research must be more flexible and must be able to embrace large-scale as well as small-scale interactions between different member states.
6. The criteria for the choice of particular development programmes should be clearly spelt out to the wide scientific community within Europe.

Higher Education and the Research Councils

The effects of EC research programmes on priorities and approaches of higher education institutions and the Research Councils

It was not felt that EC programmes were as yet having a great effect on higher education institutions in this country, though institutions were, naturally enough, looking at strategies for maximising returns from European Community programmes—for example, by setting up new types of research groups, perhaps of an interdisciplinary nature.

The Success of UK Institutions in Obtaining EC Support for Research

1. The success rate is not perceived to be high in relation to the effort put in (see section on The Appropriateness of Present Funding Conditions).

2. Frequently the notice of proposal deadlines is too short.

3. In the UK efforts are also seen as being hampered by the partial collapse of the dual support system and a consequent depletion of technical support. In general UK institutions are not yet exploiting current EC funding to the full, though matters are improving.

Government Machinery

The effectiveness of Government Machinery for considering European science policy

1. It was felt that government policy has been largely lacking in this area. A stronger political commitment to science at national and EC level is required.

2. Government policy has insufficient input from scientists, and is thus insensitive to the needs of researchers, and is therefore not as effective as it might be in determining the best policy to advocate for collaborative European programmes.

3. The UK is not sufficiently well-represented in EC committees and thus does not take part in the drafting of programmes. More people with a wider range of research and academic backgrounds are needed to represent the UK—people who are not constrained, as officials often are, by government policy.

4. Hesitation and lack of commitment by government departments has weakened the UK's position in collaborative programmes with other European countries.

5. It is essential that any EC initiative should not be regarded in any respect as an alternative to a strong political commitment to funding at national level.

6. The Professional Institutes know the current situation at R&D level very well, and government officials should be enlisting their aid and obtaining their advice more often than at present. The Institute of Physics—the learned society and professional institute involved in *all* aspects of physics and the work of physicists in the United Kingdom—would welcome greater involvement in all decision-making processes at government level when issues such as those raised in this current exercise are being considered.

1 November 1989

APPENDIX 9

Memorandum by the Research Committee of the Chartered Institute of Building (ES 7)

I respond to your press notice concerning Science Policy and the European Dimension, in my capacity as chairman of the above committee. You request comment under four headings. Below you will find in brief the conclusions drawn from the experiences and deliberations of members of my committee, all of whom hold senior positions in major building and civil engineering contracting organisations, academic, or commercial research. Our interest is in two scientific engineering disciplines:

— Building Engineering and Technology
— Construction Project Management.

EC role

It is our view that the community role should be to stimulate and fund longer term research within, and collaboration projects between member states. Recent research of which we are aware would suggest that the six major Japanese contractors together with their government alone invest very considerably more in construction R&D than any single EC member state and industry together.

We do not believe that there should be collaborative projects with non-member states unless of an aid/humanitarian nature. More important than scale of project we believe that support should be given to developing internationally acknowledged EC wide research team centres of excellence.

Priorities and mechanisms for European research

We do not believe the concept of 'green' building and civil engineering industries is given sufficient priority within the EC.

HE/Research Councils

We have addressed ourselves to the last question only in this section. We recognise that Universities within the UK have recently been more successful in obtaining EC funding than hitherto. However, it is our firm view that in particular Dutch and French Universities are given far greater useful practical assistance in bidding for research funds than is currently available in the UK. As a result we are watching EC funded centres of research excellence forming in other member states despite a number of quite impressive UK bids.

Government machinery

We are of the clear and unanimous view that in this area there is a seriously inadequate level of funding by HMG. The allocation of adequate resources so as to at least equal the best of the other EC member states is the very minimum we believe to be acceptable. We believe that any increased allocation of resources by HMG would be very cost effective in both the short and the longer term. There may in our view be room for one or more UK private fee charging agencies in this area provided that this does not conflict with EC rules. We believe that for individual research teams to have to grapple with Brussels, often with rarely more than 'token' UK civil service help, is a major waste of experience researchers time and scarce University and commercial researcher's resources.

If you require a more detailed response on any of the above comments please do not hesitate to contact me.

Dr. Norman Fisher
Chairman

13 October 1989

APPENDIX 10

Memorandum by Professor Peter Day FRS, Director of the Institut Laue-Langevin (ILL), Grenoble (ES 32)

1. *Introduction*

As of today, the ILL is the premier neutron scattering facility in the world, a sweeping statement that can be justified by a number of factors. These include the sheer number of instruments put at the disposal of users (30 are fully scheduled at present), their variety (representing every facet of contemporary methodology, including some which are unique to ILL), and the intensive nature of the experimental schedule that leads to highly efficient exploitation of the source. The latter is made possible by the high reliability and stable output of the reactor.

Current British policy is to negotiate a reduced contribution to ILL after 1992. This submission summarizes the very broad scientific and technological utility of neutron scattering, the history of Britain's involvement will ILL, and the Institut's administrative structure, as a prelude to presenting scientific and managerial arguments against such a retreat. More details can be had from the Institut's Annual Reports and the Review of Neutron Scattering recently completed by an expert Panel set up by the Science Board of the Science and Engineering Research Council (SERC).

2. *Contribution of ILL to Science and Technology*

Neutron scattering techniques are vital to many areas of science, from elementary particle, nuclear and condensed matter physics, to materials science, chemistry and biology, plus the applied sciences and engineering. The primary mission of ILL is to give scientists from university, government and industrial laboratories in the member countries the opportunity to do their experiments by providing them with neutron beams, instruments and highly skilled help. Access to the Institut's facilities is highly competitive and proposals for beam time are assessed by international expert committees containing British representatives.

In 1989 the total number of experiments carried out at ILL in all the above fields rose to 850, performed by 1800 scientists, who made a total of 2400 visits.

The 'product' of research in science is new knowledge, disseminated through the peer-reviewed scientific literature and presentations to conferences. Publications arising from work done at ILL, with or without ILL staff members as co-authors, amounted to no fewer than 507 in 1988. Thus, roughly speaking, each experiment led to 0.67 publications.

Numbers of publications are easily counted; quality and significance are harder to evaluate. Citation analysis is of doubtful value, but one simple index may be mentioned. Most physicists would agree that the world's leading journal for rapidly publishing novel results of high general interest is 'Physical Review Letters'. Over the last five years, 62 Physcial Review Letters with ILL authorship have appeared, ie on average one in four of all issues over that period carried a paper from ILL!

A further qualitative measure of the scientific community's assessment of distinction in research is the award of prizes and promotion to academic appointments: 11 Professorships and other senior academic appointments and six awards by European Physical and Chemical Societies to members of ILL staff during the last five years alone. The ILL was also closely asociated with the work for which Messrs. Ramsey and Paul were awarded the Noble Prize for Physics in 1989.

3. *History*

The ILL was founded in January 1976 by an intergovernmental convention between France and the Federal Republic of Germany. The construction of the Institut and its high flux reactor required a total capital investment of 335 MF (1976 prices). The reactor reached its full power of 57 MW in December 1971. On 1 January 1973 the United Kingdom joined the ILL as a third equal partner. In 1981 a protocol was signed by representatives from the three member countries, which extended the intergovernmental agreement until 31 December 1992 (and beyond, on a year by year basis), unless two years' notice of termination had been given.

In 1979, SERC agreed to participate in a programme to modernise the facilities at the ILL and thereby extend its life as a leading world centre for neutron beam research. This programme had a separate budget totalling 104.2 MF (at 1979 prices) over seven years (ending in 1985) to which SERC contributed 33%. A second modernisation programme, to be implemented after 1992, is being prepared.

In 1986 an agreement was signed between ILL and the Spanish Interministerial Commission on Science and Technology, whereby Spain became an 'Associate Scientific Member', contributing 1.5% to the budget. In 1988, Switzerland also acceded to the same status, contributing at the same level as Spain, and a similar agreement has recently been concluded with Austria.

4. *Organisation*

Unlike CERN and EMBL, which have international legal status, ILL is fully integrated into the legal system of its host nation, being a non-trading company under French civil law. The partner countries are represented on the Institut's Steering Committee by the following Associates:

— Kernforschungszentrum Karlsruhe GmbH, Germany

— Centre National de la Recherche Scientifique, France

— Commissariate à l'Energie Atomique, France

— Science and Engineering Research Council, United Kingdom

The Institut is headed by a Director and two Assistant Directors, all with a five year tenure, the former nominated alternately by the German and the British Associates, the other two by the remaining Associates. A Scientific Council, nominated by the Associates, advises the Directors on the scientific programme.

At present the UK Government, through SERC, contributes 32% (about £10 M) of the annual recurrent and capital costs of the Institut and at the outset made payments towards the capital cost of the reactor, which was constructed by the French and Germans before the UK joined. However, the SERC Corporate Plan calls (section 2.34) for a reduction in the UK contribution to ILL after 1992.

5. *Future UK Participation in ILL*

The argument given by SERC for reducing the UK contribution to ILL is that it would enable more resources to be devoted to synchrotron research, including ESRF and a possible new soft X-ray/vacuum ultraviolet storage ring at the SERC Daresbury Laboratory, i.e. a financial argument. In the opinion of the ILL Director (at present a UK scientist), the scientific and managerial arguments against reducing the UK proportion of ILL funding below that of France and Germany are compelling. They are as follows:

(a) ILL is univerally acknowledged as the world's leading centre for neutron scattering. UK science can be proud of its involvement with such an institution. Retreat would be a blow to the UK scientific community.

(b) Because participation by the major partners has been equal up to now, access to the instruments has never been subject to national quotas. The peer review committees allocating beam time contain equal representation from Britain, France and Germany, and reach their decisions solely on grounds of scientific merit. With unequal partnership, there could be pressure to move towards a quota favouring the major partners.

(c) Under the present peer review system, without quotas, UK scientists have consistently won at least their share of the beam time on the scheduled instruments at ILL. (Data on the number of instrument days allocated to each country, alone or in collaboration, is given in Figures 1 and 2).

(d) The management structure described above has proved very stable and effective. If Britain became a junior partner there could be no automatic guarantee that a British Director would be appointed by rotation, as at present.

On the Institut's Steering Committee, the three partners have equal voting rights, though because of the small number of delegations, in practice decisions require consensus. An unequal partnership would undoubtedly diminish Britain's capacity to influence the scientific policy of the Institut.

The fields of science to which neutron scattering contributes are growth points for massive future advances, especially in chemistry and biology, and areas of condensed matter physics such as magnetism and superconductivity that are likely to impact technology in the medium term. In my view, 1992 would be a most unfortunate moment to announce a retreat from one of the world's leading laboratories which is, at the same time, a proven catalyst of European scientific cooperation.

April 1990

FIGURE 1

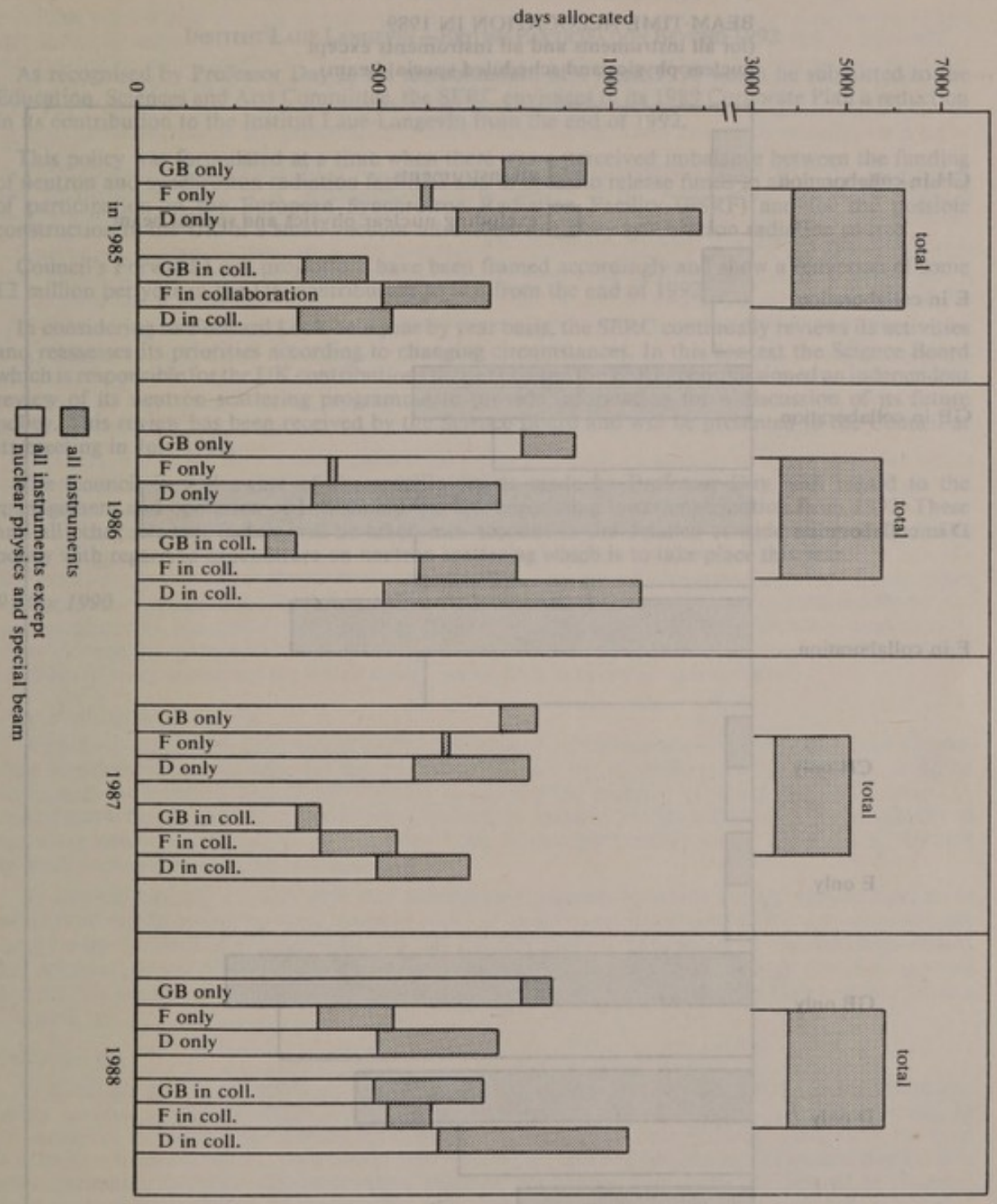
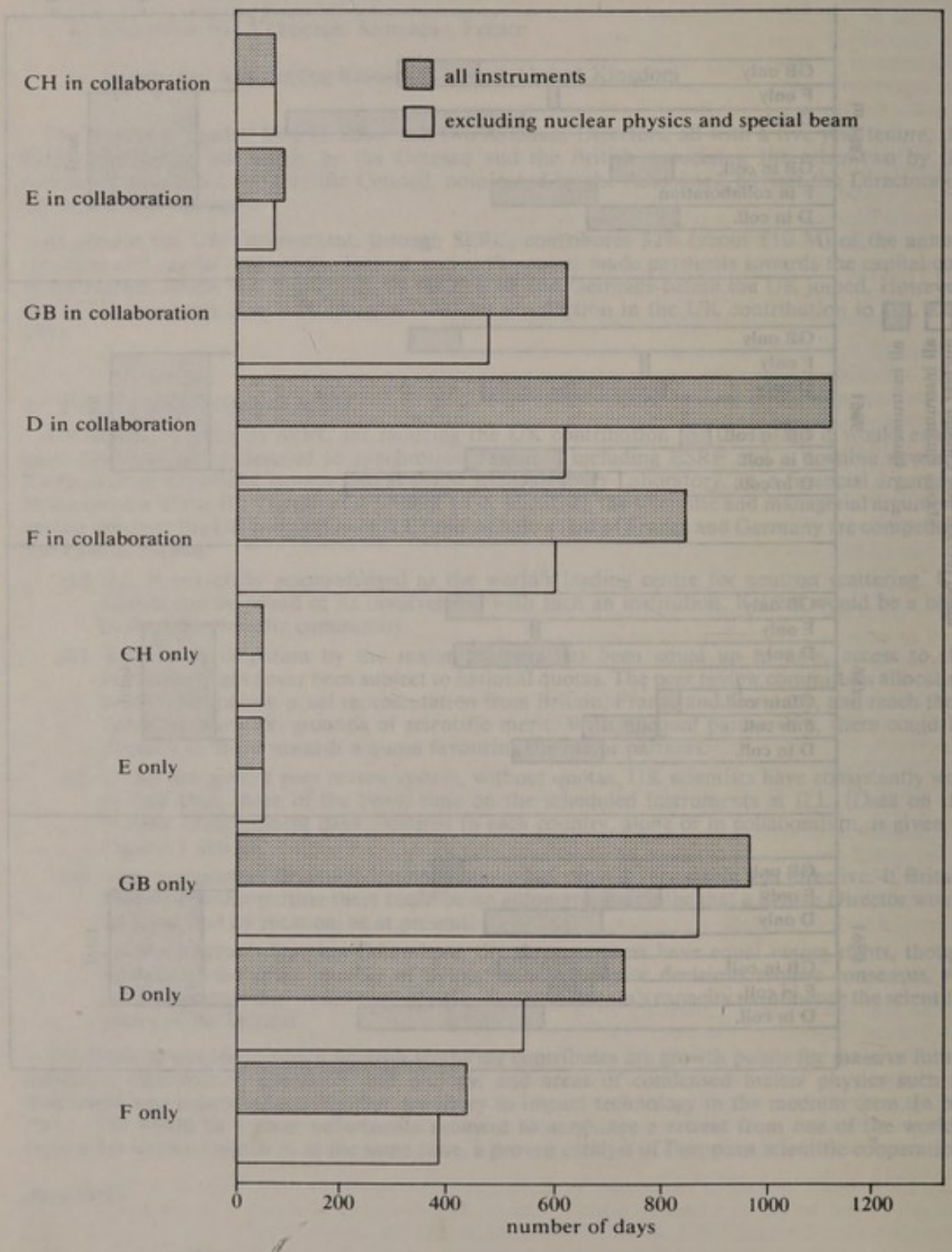

days allocated
0
500
1000
3000
5000
7000
in 1985
GB only
F only
D only
GB in coll.
F in collaboration
D in coll.
total
1986
GB only
F only
D only
GB in coll.
F in coll.
D in coll.
total
1987
GB only
F only
D only
GB in coll.
F in coll.
D in coll.
total
1988
GB only
F only
D only
GB in coll.
F in coll.
D in coll.
total
all instruments
all instruments except nuclear physics and special beam

FIGURE 2

BEAM-TIME ALLOCATION IN 1989
(for all instruments and all instruments except nuclear physics and scheduled special beam)



APPENDIX 11

Letter from Professort E W J Mitchell CBE FRS, Chairman, Science and Engineering Research Council to the Clerk of the Committee (ES 34)

INSTITUT LAUE-LANGEVIN —BRITISH PARTICIPATION BEYOND 1992

As recognised by Professor Day in his memorandum of 4 April 1990 which he submitted to the Education, Sciences and Arts Committee, the SERC envisages in its 1989 Corporate Plan a reduction in its contribution to the Institut Laue-Langevin from the end of 1992.

This policy was formulated at a time when there was a perceived imbalance between the funding of neutron and synchrotron radiation facilities and in order to release funds to allow a realistic level of participation in the European Synchrotron Radiation Facility (ESRF) and for the possible construction in the UK of a small vacuum ultraviolet/soft x-ray synchrotron radiation source.

Council's Forward Look projections have been framed accordingly and show a reduction of some £2 million per year in the UK contribution to ILL from the end of 1992.

In considering its Forward Look on a year by year basis, the SERC continually reviews its activities and reassesses its priorities according to changing circumstances. In this context the Science Board which is responsible for the UK contributions to the ILL (and the ESRF) commissioned an independent review of its neutron scattering programme to provide information for a discussion of its future policy. This review has been received by the Science Board and will be presented to the Council at its meeting in July 1990.

The Council is well aware of the specific points made by Professor Day with regard to the management and operation of ILL should the UK negotiate a lower contribution from 1992. These and all other relevant factors will be taken into account in the detailed consideration of Council's policy with regard to expenditure on neutron scattering which is to take place this year.

9 May 1990

APPENDIX 12

Memorandum by Professor T M Partington, Chairman of the European Committee, University of Bristol (ES 21)

The type of funding given to higher education institutions for EC Research programmes is not adequate, as the payment merely of marginal costs plus 20 per cent of overheads forces universities to depend even more on subsidies from other funding sources than is the case with other grants, such as those from Research Councils. The alternative of full cost contracts where the EC pays 50 per cent of all costs presents enormous problems for universities in establishing the correct overhead rate.

There is a common fear among Higher Education institutions that there may be a reduction of national research funded activities in favour of EC programmes. If the UK Government has reservations about the quality and content of EC Science policy, it should recognise the need to give a higher profile to national research opportunities.

16 November 1989

APPENDIX 13

Memorandum by the University of Birmingham (ES 6)

Thank you for your circular of 11th August inviting our response to the points raised by the House of Commons Education, Science and Arts Committee.

I have discussed the matter with the Dean of the Science Faculty, Professor Morrison, and with the European Liaison Officer, Dr MacNeill. I would like to make the following observations.

EC Role

As we currently understand the position, EC sponsored research is largely designed to complement that sponsored by individual member states. In particular the EC has concentrated on supporting research at the pre-competitive stage.

In general we support this policy and feel that EC action in bringing appropriate groups together has done much to strengthen European Science and prevented unnecessary rivalry. For large scale developments, in areas such as information technology or communications, we see the EC role as extremely important in preventing both duplication of effort and diversification of systems.

As regards pure research, we support the current programme involvement and would be happy to see some limited increase. There is for instance no doubt that, as research gets more expensive, there are areas of 'big science' where no single Government could (or should) go it alone. We do not, however, believe that EC funded research should supplant domestic science programmes.

One area where we see a major role for the EC is in providing support to new initiatives which may be highly significant but where initial activity is by a small number of dispersed research groups. (A good example of such a development would be in the field of superconductivity.) It would be most useful if the EC could develop a flexible mechanism to respond quickly to bring people together to co-ordinate and support their individual efforts. A useful model could well be the British Council's British–German Academic Research Collaboration Programme. This scheme provides grants either for exploratory visits to set up collaborative ventures, or for visits as part of existing collaborations and, importantly, has a relatively simple application procedure. (Of course the excellent work already done through the Science Plan is acknowledged here). Such a response mechanism could also facilitate interdisciplinary initiatives for which there may be little support at national level.

Priorities and Mechanisms

We believe the current priorities in supporting research initiatives of a strategic nature to be correct. One relatively cheap, yet effective mechanism of support for scientific research, however, might be to expand the numbers and range of grants to support the mobility of young research workers. A considerable boost could be given to many university research groups if they were given support to recruit researchers, primarily at post-doctoral level, from other member states. The social advantages of such a scheme would also recommend it.

As regards funding, it is our view that current arrangements by which the EC pays half the costs of applied research and the total marginal costs of pure research are sound. We are, however, not happy with the level of indirect costs and feel strongly that for EC sponsored research there should be suitable arrangements to encompass university infrastructure costs through the dual support system. We commend the efforts of CVCP to make such representations to the Universities Funding Council.

HE Priorities

Without doubt, EC programmes are having an effect on university priorities. Along with many other institutions, Birmingham is looking to maximise its return from EC programmes and in consequence is considering carefully the whole question of a 'European Strategy'. Also, there has been a definite response to the EC programme in the setting up, some 12 months ago, of an interdisciplinary Environmental Research Group bringing together academics from different Schools in Science, Engineering and Medicine. It may well be that such an initiative would have occurred in any case but the existence of the EC programme has made development take place more rapidly.

Government Policy

This question is not easy to answer since it is hard to identify a science policy, as opposed to a funding policy, in much of the current UK thinking. It may be that a particularly valuable contribution of EC science research is to further develop our strategic thinking and thereby help to identify the direction to follow.

Professor Michael Thompson
Vice-Chancellor and Principal

9 October 1989

APPENDIX 14

Memorandum by the University of Edinburgh (ES 1)

The University of Edinburgh submits the following comments for consideration by the Select Committee.

1. *EC Role*

EC Research programmes are taking on an increasingly important role for UK research institutions as an alternative source of research activity.

The EC programmes do in some respects complement existing National Research programmes but they are not seen as replacements.

The research programmes are approved and implemented under a Community Framework Programme which is approved by all member states therefore all programmes have member state support.

It is important to re-emphasise that EC support should be additional to existing national programmes.

2. *Priorities and Mechanisms for European Research*

The new Framework programme (1990–94) places increasing emphasis on environmental programmes and the expansion of mobility and training of young researchers, whilst funds for energy programmes represent a net percentage reduction. Overall, the proposed budget for Framework Programme 1990–94 is £5,005 million compared to the budget of £2,031 million for the current Framework Programme (1987–91).

One further important point is the shift away from Basic Research programmes to applied research. Whilst the latter is seen as a necessary and important method of funding it is important to ensure the continuance of Basic Research activities in UK HEIs not only from the EC but also through national research programmes.

3. *HEI/Research Councils*

HEIs see EC funding opportunities as additional research council programmes. UK HEIs are successful in obtaining EC research support due to their increasing efforts to attract funding. UK HEIs are particularly successful in Basic Research programmes and it is important that the UK ensures that every Framework programme includes Basic Research activities.

4. *Government Machinery*

It would appear to HEIs that the UK Government policy makers do not act as nationalistically as, say, our French counterparts in policy negotiations. It would help HEIs if Government representatives would actively promote UK research interests.

5. *Other Comments*

(a) In subject areas where there are large European programmes (eg IT) the amount of contact and collaboration with non-European countries has decreased significantly. Japan and the USA demand attention whatever happens in Europe and that means there is no time left for the rest of the world. That is obviously an over-statement of the position but it illustrates a trend which is inevitable in view of the source of research funding but which may not be altogether welcome.

(b) The planned EC expenditure on education-related topics is set to rise significantly in the third round of the Framework programme. In research, we have well-established though far from perfect procedures for judging quality and allocating resources. In education-related topics there is no such recognised procedure. To date, the Commission have simply avoided the problem by spreading their resources very thinly over a very large number of projects. That cannot continue and if there is a British call for a better procedure for selection then we also have the opportunity to say what that procedure should be.

(c) It is difficult for young academic researchers without substantial contacts to become involved in the projects, because most projects require multi-country and industrial partners and young researchers often do not have the contacts. On the other hand, these may be the best partners, because of vigour and recency of research experience.

(d) Lately, the programme goals have been pre-competitive and oriented about specific topics. Moreover, it appears that much existing research money is now redirected through these programmes. This has made it difficult to find money for more speculative research in the topics, or general research in other topics.

(e) As financial burdens bear on Universities with increasing pressure, finding adequate travel money to organise the setting up of European initiatives is beginning to be a significant problem.

Sir David Smith, FRS, FRSE
Principal and Vice Chancellor

15 September 1989

APPENDIX 15

Memorandum by the University of Leeds (ES10)

A UNIVERSITY PERSPECTIVE

The growing importance of research funded by the European Community in relation to domestic science programmes is such that all future developments in EC research funding are of considerable interest to the higher education sector in the UK. The University of Leeds is already actively involved in a wide range of EC research projects, and the Select Committee's inquiry on 'Science Policy & the European Dimension' provides a useful opportunity to express our views and experience of EC research funding.

Our submission is based on input from academic staff across the University and from the University's European Office. It has been grouped as far as possible under the areas of interest identified in the Committee's circular of 28 July, and concludes with some general points relating to prospective developments in EC research.

(i) *The role of EC research*

What is the EC role in relation to domestic science programmes?

The European Community is increasingly being seen as a useful additional and alternative source of research funding at a time when traditional domestic sources may be less readily available. There is a general recognition that the sheer scale and cost of some current research favour efforts at a European rather than national level. In scientific terms collaboration with European colleagues is seen as often stimulating and rewarding, although it can also be frustrating due to the added administrative and linguistic difficulties inherent in transnational projects.

One prime concern is that of 'additionality': that the prospect of increased EC research funding should not be used as a reason to reduce UK domestic science funding. Such a reduction would seem particularly unjustifiable where increased EC research can be supported by savings elsewhere in the existing EC budget, eg in the agricultural sector, such that higher EC spending on research need not necessarily mean a higher overall UK input to EC funds. The issue of how much further at this stage the balance of domestic funding should shift to involvement in collaborative European efforts is one in which consultation with the UK academic community, which has considerable experience of European-level research, is seen as important.

European funding is viewed positively in that it can bring together complementary skills, particularly in inter-disciplinary research, and the pre-competitive and more applied nature of much EC research is seen as complementing the UK emphasis on fundamental research. European funding also offers possibilities for enhancing training prospects for young scientists, particularly with 1992 on the horizon.

(ii) *Priorities and Mechanisms for European Research*

Are existing EC priorities, types of programme and conditions of funding appropriate?

In this area it appears that there is considerable room for improvement on current practices. One major concern is that the present EC funding mechanism for universities, that of *marginal cost*, under which the EC meets 100 per cent of additional costs plus a 20 per cent allowance towards indirect costs, is not satisfactory as it does not adequately reflect the real costs of the research and leads to an underselling of academics' time relative to their counterparts in industry. Following representations from the CVCP to the Commission a number of UK universities are now pursuing the possibility of adopting a '*full cost*' approach when the necessary accounting mechanisms can be established.

Another central criticism is that there is a high bureaucratic overhead involved in EC contracts; the conditions of funding are sometimes not as clear as they might be and the actual mechanics of submitting applications and monitoring ongoing projects can seem unnecessarily cumbersome and in need of streamlining.

An often-heard criticism is that information provision by the Commission is inadequate and ineffectual, leading to delays and unduly tight deadlines. A number of universities, including Leeds, have responded to these difficulties by establishing a European Liaison office with a specific responsibility for keeping academic staff apprised of EC funding opportunities. Nevertheless, there remains a lack of transparency about the *formulation* stage of EC programmes, and there is concern that UK academics have only limited opportunities to contribute to the definition of scientific and technical priorities when EC programmes are being prepared.

A recurring theme regarding EC priorities is that there can be an excessive use of political rather than scientific criteria in the selection of EC projects, with the danger that support may go to politically well-balanced but perhaps technically inferior research. To a certain extent such political considerations are endemic to the whole EC way of working; the Commission itself argues that the

basic criterion is scientific quality, and that EC funds are currently so oversubscribed that they can generally select projects which are desirable on both counts. However, it is important for the attainment of the EC's research objectives that genuine scientific quality be recognised and rewarded, and UK representatives on the various EC selection committees should seek to ensure as far as possible that the basic yardstick is that of scientific merit.

Other points about existing mechanisms and priorities include: a lack of flexibility in European funding relative to domestic funding, with excessively rigid procedures and timescales potentially inhibiting the pursuit of promising developments in new areas; the need for 'seedcorn' funding to explore possibilities for EC collaboration; the problem of obtaining funding for peripheral activities such as conferences.

(iii) *HEIs/Research Councils*

Priorities and approaches of HEIs and Research Councils?

HEIs such as Leeds have so far had considerable success in obtaining EC funding and have a high level of participation in EC programmes. However, such participation can be costly and time-consuming and requires commitment on the part of academic departments and the University administration. There is still potential for expanding universities' involvement in EC research.

As regards UK Research Councils, the growth of European research would seem to offer opportunities for closer cooperation both with EC funding agencies and with the Research Councils' counterpart bodies in other EC countries. The UK Research Councils do have a presence in Brussels; France and Spain now also have similar arrangements. Cooperation is going to become increasingly important in order to avoid duplication and to achieve complementarity.

One way in which Research Councils might encourage greater EC cooperation would be to offer more mobility grants to enable young scientists to study elsewhere in Europe, complementing EC initiatives in this area; there is also a clearly-identified need for seedcorn funding for exploratory discussions.

There are, in addition, a number of general issues of relevance to the future direction of European science policy which merit consideration:

(i) The Commission apparently plans in future to diversify its means of funding research. This might mean contributing to national research programmes in EC priority areas, or concentrating EC resources in scientific areas where only a few Member States have strengths, perhaps with non-participating Members States having preferential access to results. Such proposals would be unpopular with 'peripheral' countries but may find favour in the UK and elsewhere;

(ii) Another proposals is for the EC to increase substantially its support for the EUREKA initiative, possibly providing up to 25 per cent of EUREKA funding. While UK companies might favour this, UK universities' involvement so far in EUREKA has been relatively small and mainly limited to sub-contracting. Shifting a substantial proportion of EC funding to EUREKA would necessitate a reappraisal of EUREKA participation on the part of UK universities;

(iii) A further shift being considered is an increased devolution of programme administration by the Commission to national authorities such as government departments, research councils, etc. Selection and monitoring would remain with Brussels but national authorities might be involved in a degree of preselection, thus strengthening their existing role within the overall application process.

October 1989

APPENDIX 16

Memorandum by the University of London (ES 18)

1.1 UK science policy has essentially been determined by governments, advised by civil servants taking advice from the Research Councils/ABRC, and industry. Funds have been made available to support 'good science' in any field, as judged by peer group review, and to assist scientific enquiry in fields given high priority—as the Alvey Programme did for information technology priority themes of interest to the UK.

1.2 European Community science programmes have been almost entirely policy-driven, with research designed to underpin broad EC goals. In the 1970s these were increasingly dominated by the desire to improve Europe's energy self-sufficiency. In the 1980s, the goal of helping European companies compete more effectively with the USA and Japan has lead to 60 per cent of EC research funding being allocated to research programmes designed to reduce research costs in both new and established industrial sectors. The EC's programmes ESPRIT, DRIVE, AIM, DELTA, RACE, BRITE/EURAM, BRIDGE, ECLAIR and FLAIR are intended to assist companies in the fields of information technology, telecommunications, biotechnology, and the modernising of established industrial sectors.

1.3 Additional EC research programmes such as STEP and EPOCH (supporting environmental and climatological research) and Science and Technology for Development (Third World agricultural and medical research) underpin other policy initiatives of the EC.

1.4 The EC research programmes which most resemble the UK Research Council's support of fundamental research are the EC's SCIENCE and SPES programmes. The former aids transnational research in areas of the exact and natural sciences, while the latter is a small pilot scheme on similar lines for the economic sciences. The programmes are, however, designed, in part, to meet a European policy goal. The feeling that national administrations (with reduced funding available) do not adequately support research which lies across disciplinary boundaries, and does not give priority to more risky ('blue skies') research, and that this may weaken Europe's long term ability to compete with the USA, played a significant part in the discussions leading up to the establishment of the Science Stimulation programme (now renamed SCIENCE).

Relationship between UK and EC Research Programmes

2.1 The development of EC Research programmes has, in broad terms, shifted the balance of power in science policy-making from scientists to administrators and civil servants. In some sectors, such as information technology, the role of European industrialists has been of considerable importance.

2.2 The growth of EC research programmes, and their funding (in real terms) has, in part, contributed to the decline (in real terms) in funding available from the Research Councils to support research in the UK. Treasury controls over departmental spending—as part of macroeconomic policies to control the level of public expenditure in the UK through the PESC mechanism—ensures that EC research spending in the UK leads to reduced spending by government departments. While it is theoretically possible for departments to find savings in areas other than research spending (broadly, to match EC spending) it is more likely that departmental support for UK research will be reduced. Thus, the growth of the EC's ESPRIT spending in the UK has been paralled by a decline in the UK's Alvey programme spending.

2.3 The University of London is not concerned with the ways in which the UK and EC programmes interrelate financially. It is, however, concerned with the consequences this has for science policy, and the funds available to support scientific research in the UK—where London University carries out about 20 per cent of UK research in universities.

2.4 With UK funding increasingly rationed by the Research Councils through the process of too many alpha-rated projects chasing too little funding, scientists have turned to the EC to seek support for research in growing numbers. They have often found that funds are only available for projects in tightly defined subject areas, determined by processes to which few scientists (let alone UK scientists) have contributed. Criticisms of this system, and increasing awareness by the EC policy makers of the inherent weaknesses of this approach have lead to the establishment of some small 'Basic Research' programmes adjacent to the EC's ESPRIT and BRITE/EURAM R&D programmes.

2.5 Although some universities have secured EC funds, usually with the help of a small band of EC-funding consultancy specialists and/or in-house EC watchers, individual scientists have become increasingly frustrated by the need to meet EC research conditions—including the need for transnational/industrial partners, varying budgetary mechanisms, and other conditions.

EC Role

3.1 The link between UK research programmes and those of the EC, at the level of content is not clear, although there is some evidence that either individual Research Councils (such as the AFRC) or individual science policy administrators (such as those concerned with UK Alvey and EC ESPRIT) have attempted to integrate the research supported by the two areas.

3.2 There is, however, a fundamental dichotomy between scientists who wish to pursue scientific research in their chosen field (wherever it may lead them, and with whosoever they believe relevant to their line of enquiry, from anywhere in the world), and precisely defined research topics designed to meet research targets forming part of EC R&D programmes.

3.3 EC R&D programmes are developed through a process whereby EC officials (who propose them) take soundings from industry, national civil servants, and 'experts', and refined through a process of political compromise involving discussions within the Council of Ministers (briefed by civil servants, who then deputise for them in detailed discussed within COREPER) and the European Parliament and Economic and Social Committee. It is not surprising that this process ensures that political/departmental priorities are the most important factors in determining the content of EC R&D programmes, followed closely by those of industry (which is well able to present its case to the EC and to national administrations).

3.4 The priorities that London University's professional scientific researchers may feel important cannot be well reflected by this process. This is a matter of concern only because the EC R&D programmes are beginning to be substituted for UK research programmes where scientific priorities could more easily be reflected in the allocation of funds to support research.

3.5 EC research programmes, which are by and large applied research activities, are to be welcomed. Their apparent, and perhaps unintended, impact on fundamental research programmes undertaken at national level is of considerable concern to the University of London. The decline of funds available for fundamental scientific research —reflected in the increasing rejection rate of scientifically highly-rated research proposals by the Research Councils —appears to be a consequence of the growth of EC R&D programmes.

3.6 We believe that this problem needs to be addressed either by increasing the funds available to support fundamental scientific research in the UK, or by increasing the funds available to support fundamental scietific research at the European level (in all areas of the exact and natural sciences, and not just fashionable or industrially-lead areas) at a faster rate than hitherto.

Policy priorities

4.1 It is right that general policy priorities for the EC should be determined by the political process. This process will reflect the interests of the member states, with inevitable compromises to determine that the priorities of most member states are accommodated.

4.2 With regard to the determination of what might best be in the interests of the UK in the area of science policy and scientific research the process of determining what that interest might be seems at best opaque, and at worst wholly inadequate.

4.3 Busy Ministers, and hard-pressed civil servants will reflect the interests of the UK, and also of the UK's scientists, on the basis of what they know at a given point in time. The policy of moving civil servants to new jobs after three or four years, and the inevitable changes in the political responsibilities of Ministers, will from time to time weaken the presentation of the UK's interests as it takes time for new people to acquire the necessary knowledge and experience in a given field.

4.4 The process of reflecting the interests of the UK, and more particularly the priorities of the scientific community, are undermined further by weaknesses in the system by which the scientific community is able to articulate its views, knowledge and experience, to those formally charged with developing and refining EC R&D programmes. It may be expected that the scientists of London University, who live and work close to Whitehall, have had an advantage in making their views (and those of the wider scientific community) known to those charged with the role in EC policy formulation. We know of no evidence to support this.

4.5 We are unable to see how we might assist Ministers and their advisers who are working on the development and refinement of EC scientific research programmes, for we know of no formal or systematic mechanisms by which the views of scientists in London (or elsewhere in the UK) are sought with regard to the development or modification of EC programmes of scientific research.

HE/Research Councils

5.1 London University, like others in the UK, has responded to the opportunities available to fund research with EC money with some difficulty, but also with some notable successes.

5.2 The criteria for selection projects to be funded under EC R&D programmes are generally complex. Scientific excellence, progress beyond the state of the art, and novelty, are criteria common to UK and EC research awards alike. EC programmes, however, include many other selection criteria

(e.g. impact on industrial competitiveness, breadth of applications in industry, effectiveness of the project partnership in European/cross-border terms). Scientific excellence, originality, contribution to the development of a scientific field, etc, are in consequence almost irrelevant in the consideration of most EC project proposals (except for the underresourced SCIENCE programme)—but are certainly not irrelevant to scientists, and the Research Councils.

5.3 A major problem with regard to EC funding concerns the method of calculating the allowable costs for universities which are party to an approved project. EC standard contract terms permit marginal costs, with up to a 20 per cent overhead recovery rate, or alternatively 50 per cent of total costs. With Research Councils in the past UGE/UFC have topped up the Research Conuncil (marginal cost) grant with a 40 per cent overhead contribution. Participation in EC R&D contract is tending to undermine the long term viability of departments which do not also have reasonably large amounts of funds from other types of contract. Under the present rules UK university departments (and their funding agencies) are in effect subsidising EC R&D programmes, as they are not able to secure a sufficiently adequate contribution to their economic costs of undertaking such research.

5.4 The principal problem with EC R&D in comparison with UK Research Council funding, however, is that scientists in the UK are an integral part of the process of determining priorities both for areas of research funding and the selection of individual projects through the Research Councils, while the same does not occur in the EC. EC scientific policies are determined in ways that may only accidentally involve the views of UK scientists—such as those at London University—and projects are selected in complex ways (and ultimately by EC Commission officials advised by management committees usually composed of civil servants and other administrators).

5.5 The criteria for the development and prosecution of scientific policies at the EC level inevitably are less dominated by factors that most scientists would consider relevant than for similar policies in the United Kingdom.

Government machinery

6.1 The interaction between EC R&D programmes and UK programmes of scientific research may be well known to those civil servants who operate in both spheres. But the precise mechanisms by which EC programmes are taken into account in the determination of scientific policy priorities in the UK (or vice versa) are not clear to the University of London.

6.2 The scrutiny of EC R&D policy proposals leaves much to be desired. There is no mechanism that we know of for scientists to be invited to comment upon the content of proposed programmes of research (except at the individual project level through informal EC ad hoc working groups for some programmes), or through generalised invitations to submit declarations of interest and ideas for inclusion in EC programmes direct to the EC Commission staff themselves.

6.3 At the parliamentary level the House of Lords EC Select Committee is able to review any areas of EC policy it chooses, and to do so in some depth. It is, however, selective, and does not routinely look at EC scientific policy proposals.

6.4 The EC Select Committee of the House of Commons has terms of reference that seem to deter detailed examination of anything, and does not therefore appear to be an effective forum for facilitating the inclusion of views on EC science and technology programmes from the UK's scientists.

6.5 UK civil servants are a key part of the EC policy making and policy execution process (see attached diagram). The methods by which departments obtain advice on the scientific content and priorities of EC R&D programmes appear to us to be at best opaque, and at worst inadequate.

Conclusion

7.1 EC Science programmes, designed to underpin a number of EC policies, appear to be growing in importance. They also appear to be growing partly at the expense of UK programmes of scientific research.

7.2 The current process by which EC policies are developed and implemented do not adequately allow the UK's scientists to make an effective contribution, and do not give sufficient weight to scientifically relevant criteria.

November 1989

APPENDIX 17

Memorandum by University College of North Wales (ES 4)

This College welcomes the fact that the Committee has decided to undertake an enquiry into the development of UK science policy in Europe and hopes that the following comments will be of assistance to the Committee in its work.

1. *EC Role*

The College believes that major transnational science programmes which require multistate collaboration and co-operation if they are to be successful are necessary in many areas of science and should therefore be supported. We feel that effective UK participation in such programmes can be greatly reinforced by relevant national programmes which in turn benefit from complementary state input.

2. *Priorities and Mechanisms of European Research*

It is our view that the general objective of EC research should be to pursue science which will make Europe a better place in which to live. This entails the development of fuller scientific and technological capabilities to underpin, for example, sensible resource exploitation, environmental management, communications and safety considerations. Purely commercial and market-orientated programmes should not be funded by the Community. EC priorities should, we believe, transcend those of individual member state programmes in such a way that they can exploit fully the benefit of complementarity of expertise, facilities and study sites throughout the Community.

In general, funding procedures seem to us to be satisfactory, although some problems do arise in training programmes where there may be mis-matches between the timings of the EC financial year and those of the training organisations themselves.

3. *HEI and Research Councils*

Generally, we are satisfied with the success rate of the various applications we have made for the funding of research projects from the Community, but do have some reservations about the time delay which can occur in the EC decision-making progress.

The Committee might like to note that although some slight changes have been made to research priorities to enable departments in the College to be in a better position to benefit from EC initiatives, it is our experience that contrived changes to priorities merely to benefit from funding 'bandwagons' are usually counterproductive.

4. *Government Machinery*

Our experience suggests that the *setting up* of projects is most effectively done by direct contacts between potential collaborating institutions in different member countries. In this regard, the NERC office in Brussels is now becoming particularly effective. We have no major comments to make on the effectiveness of Government evaluation of EC science policy, but would suggest that the views of Higher Education Institutions are taken into account amongst those of Research Councils and Government bodies. Bodies such as the Co-ordinating Committee for Marine Science and technology would have a particularly valuable role to play in this context.

Please to not hesitate to contact me if you require clarification of any point in this submission. The College is, of course, very willing to provide oral evidence to the Committee should this be considered appropriate.

Gwyn R. Thomas
Secretary and Registrar

16 October 1989

APPENDIX 18

Memorandum by Dr. R. Watt, Department of Psychology, University of Stirling (ES 11)

I write in reply to the Press Notice "Science Policy and the European Dimension". I am presently part of a large European research consortium funded by the ESPRIT Basic Research Action, with an interest in the fields of human and machine vision.

A major shortcoming of the EC funding policy and mechanism, when compared with the UK research councils, is the absence of any straightforward route to obtaining support for a genuinely novel idea as distinct from a new development of an established field.

Roger Watt, Ph.D.

30 October 1989

APPENDIX 19

Memorandum by the University of Strathclyde (ES 14)

The University of Strathclyde strongly supports the EC Commission's goal of mobilising the intellectual and material resources of the member states in respect of Research and Development. It shares the view of the Commission that possession of leading-edge technology is one of the critical factors in becoming and remaining internationally competitive. Strathclyde University has been a major participant in the R&D (and related) schemes which have provided grants to consortia of EC universities and industries willing to pool their resources for the furtherance of our knowledge base.

In response to the inquiry by the House of Commons Education, Science and Arts Committee, the University would put forward the following observations:

1. The current range of EC R&D programmes appears appropriate, although the substance of some of them is meagre.
2. The budget for the EC Framework Programme is inadequate.
3. R&D policy is just one aspect of the mobilisation of Europe's intellectual resources, together with those of education and training, and should be perceived as part of this integrated whole.
4. European non-EC member states should be encouraged to participate in the programmes, as is starting to happen.
5. Strathclyde University has generally found very sound scientific and technological return in the many projects in which it has participated; however, the University's financial return has been less than adequate. This is because the Commission's funding formula does not recognise the true costs of carrying out cross-border collaborative research, and since the UFC recognises only a fraction of the EC programmes in its grant allocation. The absence of full funding formulae in EC programmes places unfair pressure on the universities' UFC economy and on individual universities to provide the concomitant finances to meet requirements such as accommodation, alterations and additions.
6. UK universities are currently in the difficult position of being denied a clear set of financial guidelines by the EC Commission, with the prospect of auditors eventually determining the financial principles to be applied and the possible payback of grants retrospectively deemed to be ineligible.
7. EC collaborative research is inevitably more demanding on time, given the necessity of regular meetings in diverse European locations. Scientific and technological research is most successful given short lines of communication and continuity of funding. Something akin to the SERC Rolling Grant Programme would assist continuity.
8. Many academics are discouraged from involvement for reasons such as delayed receipt of information, failure to comprehend EC documentation, doubt about working with industrial or European partners, and the cost of putting together a trans-national consortium. While Strathclyde University recognises the increasing efforts of the UK representatives to support these programmes, much remains to be done.
9. The UK should develop a clear and continuously evolving position from which optimum results in R&D can be achieved in both the European framework and at national level. The European and UK efforts should be integral and complementary. European R&D should be additional, and not used as a means to reduce UK research funding.
10. In this context, the UK academic community should be more aware of the valuable role it can play in shaping EC R&D policy through its expert input.

Strathclyde University fully supports the Committee's Inquiry, and would be pleased to comment in more detail on any of the above matters or others which the Committee thinks important.

Graham Hills
Principal and Vice Chancellor

8 November 1989

APPENDIX 20

Memorandum by the University of Surrey (ES 12)

The University's Research Committee noted that it is now Government policy to devote more public funding to EC research, thus leading to a reduction in research council funding which is available for general UK-based research. The University of Surrey currently receives a higher than average proportion of its research income from research councils and therefore, in order to maintain its current level of public research funding, it will be necessary for it to increase its share of EC monies. However, the Committee notes that, because of the shortfall of funding in EC contracts, academic staff are being discouraged by the University management from participation in EC research. The financial disadvantages of EC research contracts are a fundamental problem and the Committee urges that this issue should be addressed. The Committee also noted that while EC research contracts may erode the University funding for 'well-found' laboratories, these contracts are significant to the University's performance in such exercises as the UFC research selectivity exercise.

Members of the Committee commented in general on the difficulty of securing EC contracts, noting that the award of funds is not governed solely by peer review, but is dictated largely by political factors.

The Committee felt that all of the issues to which the press notice refers are affected by these fundamental problems of funding and the nature of EC research. Government machinery is not effective because it does not address these problems. Until recently the allocation of funding to universities did not recognise success or failure in gaining EC research funding and even now it does not recognise this fully.

October 1989

APPENDIX 21

Memorandum by the University of Warwick (ES 8)

Our Evidence is submitted under the four areas that the Committee has identified to be examined.

1. *EC Role*

The EC role in bringing together the scientific activity of member states is crucial to the long term development of Europe in a cultural and economic sense to enable it to withstand the developing pressures from other World Blocks, such as the Americas, the Pacific Countries including Japan, and very long term the Soviet Block. The prime role of Brussels funding should be to create and maintain an interactive working network between research laboratories throughout the Community and whenever appropriate, to include industrial laboratories. This should not replace the continuing development of bilateral and multilateral co-operation between member states not involving Brussels funding, but should be additional to these activities.

Domestic science programmes may or may not have the same emphasis as the EC programme. Each member state should develop its own programmes and imperatives. Where these differ from the view from Brussels, a constructive dialogue must be initiated which should enrich and improve the decision-making processes within member states and Brussels itself.

Of course as far as Universities are concerned, Brussels offers a valuable alternative source of research funding. Diversity of funding sources is important to ensure that imaginative research projects are not rejected by funding agencies because of the current policies or philosophies of a particular member state.

The scale of EC programmes will obviously depend upon the needs of the research projects and of the perceived needs of the Community as a whole.

2. *Priorities and Mechanisms for European Research*

In the broadest sense, the EC priorities and the types of programme funded are sensible. However, there is a need to develop within the EC, more sophisticated methods of determining European priorities for research and of developing the necessary constructive dialogue between individual member states and Brussels to enable the priorities to reflect the thinking of member states and to be regularly reviewed. The present arrangements are not satisfactory in all branches of Science.

Regarding the contractual arrangements between the Commission and UK Universities, one Directorate General is requiring Universities to choose between one or another type of contract on a once and for all basis. This is not acceptable and a review of this policy must be undertaken.

In the general area of managing and co-ordinating research programmes once funded, the Commission has a long way to go. It is of course difficult to mount and manage a multi-component research programme across the Community. Nevertheless, further effort is required to develop more effective strategies and mechanisms for creating and managing co-ordinated programmes.

3. *Higher Education/Research Councils*

Broadly UK Institutions have been successful in obtaining a good proportion of the research support provided by the EC. This has varied between programmes, but for example in Biotechnology, the UK has obtained more than 26 per cent of the total funding available for the programme. In general the UK has set its own research priorities and management and co-ordination mechanisms and has in many cases seen the EC following these examples rather than the UK following the lead from Brussels. This will not and should not always be so in the future. But returning to the earlier point, there should be better mechanisms for the determination of priorities in Brussels and more effective linkage back to national science policies, this being accompanied by a more vigorous and widespread dialogue between Brussels and appropriate institutions in member states. It is doubtful whether the main line of communication between Brussels and member states should only be the appropriate Government departments.

4. *Government Machinery*

A distinction should be drawn between the involvement of UK officials in the Brussels science policy determinations and the input of the EC policy thinking into local UK science policy discussions. In our view the UK input into the Brussels discussions has been patchy and has varied between research fields. The input of EC science policy into UK discussions has also, we feel, been highly variable. This is partly due to the UK having a dispersed science policy where it is necessary for each department of Government or other funding agency, such as a Research Council, to ensure that an input of the wider European dimension is made.

October 1989

APPENDIX 22

Submission from Save British Science Society (ES 35)

This paper was prepared in response to a request from the Secretary of State for Education and Science made at a meeting with a delegation from the Save British Science Society

LETTER FROM MARGARET SHARP, COMMITTEE MEMBER, SAVE BRITISH SCIENCE SOCIETY TO THE SECRETARY OF STATE FOR EDUCATION AND SCIENCE

Problems of Post-Graduate and Post-Doctoral Recruitment

When I visited you on 26 October as part of the Save British Science delegation, you asked me to put in writing to you both the evidence we had to support our claims of problems in filling post-graduate and post-doctoral positions, and the suggestions we had about ways in which the problems could be eased.

I now attach a paper which addresses these issues with two annexes providing documentary evidence to support our claims respectively on post-graduates (Annex A) and post-doctoral research students (Annex B). As we stressed when we spoke to you, Save British Science does not have the resources to mount a proper survey of these two issues, nor should we have to do so, since the evidence should be available from the respective research councils, one of which (SERC) has, we know, undertaken a special survey on the post-graduate issue. Various other bodies—among them SEPSU at the Royal Society and Lewis Wolpert for the Wellcome Foundation—also seem to be undertaking surveys on one or another aspect of this problem. I would also draw your attention to the survey from Careers' Officers about the first destination of graduates which shows an increasing proportion of science and engineering graduates going into finance. (What Do Graduates Do? Hobson's Publishing, Bateman Street, Cambridge CB2 1LZ.)

What we have attempted to do in our paper and its annexes is to put flesh on the "anecdotal evidence" which we had accumulated—to provide you not with a survey, but with substantial documentary evidence to support our claims of crisis or impending crisis. This has involved a rapid appeal to committee members of Save British Science and others with whom we had contact for comments on the situation. We have been surprised, I admit, at the overwhelming support for our claims that this evidence has brought. The problem seems suddenly to have become very acute.

To respect confidentiality of our sources we have not included names with the quotations in the Annexes, but merely attributed by discipline/department and quoted the recent UGC/UFC grading of the department. You will note that the overwhelming majority are top ranking four and five star departments—indeed among them are comments from the Laboratory of Molecular Biology at Cambridge, Bristol Physics, Warwick Biological Sciences, Oxford Physiology, Leicester Biochemistry, Imperial College Physics, UCL Electronics. If these top ranking departments are in trouble filling post-graduate positions, so *a fortiori* are their lesser colleagues.

We would also like to draw your attention to the obvious reluctance on the part of departments about returning studentships to the Research Councils for fear of losing future allocations. This helps to explain the relatively rosy picture produced by the Research Councils themselves. But behind it lies, as is evident from a good many of the comments, a hasty casting around for any candidate with a 2i who can be mustered into research. As many of our respondents commented, it is impossible to find any objective measure of quality. But for most of them, there was little doubt that subjectively they considered standards to have fallen quite sharply in the last few years.

We would welcome the opportunity of discussing these results with you. Overall, we find them very depressing. As we stressed to you when we saw you, these post-graduates and post-doctoral students are the seed corn of the system. If we fail to renew the seed corn, or use poor quality seed, then it is a poor outlook for the science base for the future.

The lags are long term, but for that very reason trends, once established, are difficult to reverse. We suggest some possible courses of action, and we urge you to consider these, and other possible ways of reversing these trends, and to take action as quickly as possible.

We shall be making these documents public within the near future. The press release we issued after seeing you in October created some interest and we have promised a number of journalists that we would release our findings once we had sent them to you. We shall also be sending them to the Cabinet Office and the CBI.

Margaret Sharp
Committee Member, Save British Science
Senior Research Fellow, Science Policy Research Unit
University of Sussex.

12 December 1989

Recruitment to Post-Graduate Students and Post-Doctoral Positions

1. This paper summaries the evidence collected by Save British Science on the problems university science departments are facing in recruiting good candidates to fill post-graduate studentships and post-doctoral research assistantships. The evidence is attached to this paper and consists of extracts from letters, etc, received from people in a wide range of departments across Britain. In order to honour confidentiality we have not revealed names of departments, but have graded them by the recently published UFC ratings. The paper is divided into two sections. The first deals with the problems of recruiting for post-graduate studentships, the evidence for which is presented in Annex A; the second section deals with post-doctoral recruitment with the evidence presented in Annex B.

Recruitment to Post-Graduate Studentships

2. The position here seems to have deteriorated sharply in the last two to three years, with several respondents noting that five years ago they could pick and choose between good applicants for each post whereas today there is often little choice with the best applicants shopping around between departments (and causing further confusion by accepting and then subsequently reneging on offers).

3. Some departments/individuals have refused to compromise on standards and send studentships back if they cannot get candidates of the quality required. In general, however, Heads of Department are anxious not to do this because they fear it will mean fewer quota studentships the next year, and generally speaking a black mark for the Department at the Research Council.

4. Every effort is therefore made to fill quota studentships even when this involves a good deal of "hassle", interviewing late applicants, etc. Nearly all the respondents note the increasing number of lower 2.1s, 2.2s upgraded into an entry qualification by means of a one year MSc, and the acceptance of EC students who can now quality for quota studentships. Many feel these make less satisfactory graduate students than previously, although they admit it is difficult to find a precise measure of quality. There is some scattered evidence in the letters and telephone calls received of a higher drop-out rate amongst these students and slower completion rates.

5. From a Department's point of view the preferred "pecking order" in terms of recruitment is:

(i) Quota studentships;

(ii) CASE studentships;

(iii) Research Assistant posts (RAIBs).

From the students' point of view the order is reversed. Their first preference is the research assistant post in which they can earn a salary and work for the PhD on a part time basis. If no RA posts are available, they will look for a CASE award which offers an extra £1,000 a year on top of the basic. (Wellcome, Cancer Research and a number of other foundations also do this.) Bottom of their list comes the straight quota studentship. Quite a number of Departments are bending the rules and employing post-graduate students as research assistants because they are so anxious to train and retain their own (and others') bright students. This helps to explain the low take-up of CASE awards—for both Department Heads and students they are the "second best" option. Heads of Department, in particular, put pressure on students to fill quota places first.[1]

6. The reason for the declining take-up of graduate studentships seems to be partly the relatively low level of grant[2] in relation to salaries available elsewhere, partly the poor career prospects for post-docs (see below) and the now general perception of an academic career as unattractive. As regards the first of these, it is significant that students rate research assistant posts as their most sought after route to a PhD.

7. Our suggestion is that the Government makes *de jure* what is now *de facto* and encourages students to work their way to a PhD through research assistantships. But we would also like to see a limited number (say 25 per cent of current numbers) of crack studentships established at the same level of funding as research assistantships (£9,500 per annum) to encourage the brightest and best science students to take a research degree. Effectively this would establish a twin track to a PhD—a scholarship route for the really bright student who would concentrate full time on his/her research and be expected to complete in three years, and the five year research assistant route for other students.

[1]This is unfortunate. From industry's point of view, CASE studentships have been very good value for money and a chance to make contact with a department without too much commitment, and has proved an excellent mechanism on which to build further technology transfer links (see SPRU Evaluation SERC Biotechnology Directorate 1988). From industry's point of view the shift from earmarked CASE awards to general departmental awards has been unpopular and may explain some lack of enthusiasm on their part. (This has come through very clearly in SPRU interviews with industrialists. The CBI will also bear this out.)

[2]Until SERC increased the value of grants by £600 p.a. in the summer of 1989, the take up was heading for a 20% drop.

Problems with filling Post-Graduate Research Posts

8. Traditionally post-doctoral students have been the mainstay of scientific research in Britain—like junior doctors in hospitals, the key workers in the system to whom many of the substantive research tasks are delegated. As with junior hospital doctors, the grade is, however, a training grade, a pre-requisite for any aspiring research scientist. A successful career in academic science has typically been three years undergraduate training, three years post-graduate, followed by three to six years in a post-doctoral research post, with promotion to lecturer at ages 28-30. Pressure on university finances in the last 10-15 years has, however, meant little new recruitment to the lecturer scale and as a result even bright post-docs have found that they have to complete two and often three periods of contract research work before being appointed lecturer, while funding uncertainties may mean switching labs and projects on each occasion. Universities for their part are most unwilling to employ contract researchers for more than six years because after that time they are liable to pay redundancy claims. If a lecturer post is not secured, these 30 year olds are deliberately shunted from one project to another to the detriment often both of their research careers and family life. It is not surprising to find many have voted with their feet and chosen to go into other careers where, even if there is no security of tenure, they will usually be amply rewarded for the risks involved.

9. The evidence cited in Annex B reveals a frightening situation in relation to post-doc positions. The response to advertisements is derisory, with advertisements costing upwards of £500 frequently attracting only one or two replies, and these often from people without the requisite qualifications. From the responses received it would appear that approximately half the post-docs currently being appointed come from abroad, quite a few of them from Third World or Eastern European countries and seeking the experience and training that this level of posting secures. While this may fill the post-doc position—often not very satisfactorily—it nevertheless negates the whole purpose of the post-doc tradition which is to train a future cadre of scientists for research careers. Some of the foreign post-docs may stay in Britain, but most return to their own countries. Unless we can attract more *British* students to continue in scientific careers, at both post-graduate *and* post-doctoral levels, we shall not have a cadre of scientists capable of running our university departments in years to come. At the substantive research grade, the lack of qualified post-doctoral students also poses a threat to current research capabilities. Research projects, approved through the peer review processes of the Research Councils, are often delayed or interrupted by difficulties encountered in recruiting post-docs, and sometimes not pursued at all.

10. Trends in the recruitment for post-doc position are particularly worrying in the light of the age profile of current university staff. As the 1988 study by the Institute of Manpower Studies for the ABRC (Scientific Research Manpower—A Review of Supply and Demand Trends) reveals, the current age profile of university teachers is disproportionately weighted towards those over 50, (28 per cent) whereas only 17 per cent are under 35. The report makes clear that the bulge in retirements (because so many older staff have already taken early retirement) will come from 1995 onwards. The report sums up its findings as follows:

> "If these trends come about then the Science Base is likely to be seeking more recruits at a time when demand from other employers is expected to grow and the supply of new graduates and post-graduates will at best have increased slightly for a few more years and then have started to fall. Even though the Science Base will be seeking a relatively small share of the available graduates and post-graduates, they are unlikely to be able to attract sufficient high quality recruits to fill all the available vacancies if their salaries, employment conditions and career prospects remain as uncompetitive as at present."

11. As the evidence we cite on both post-graduate studentships and post-doctoral positions makes clear, it is not just salaries but career prospects that deter potential entrants to the profession. Our proposal is that the Secretary of State acts now to smooth the recruitment bulge of the latter half of the 1990s. By bringing forward appointments due to be made at that time, two birds can be killed with one stone—firstly, it would dramatically improve career prospects, secondly, it would avert a potential crisis in recruitment in the latter half of the next decade. We therefore recommend that the Secretary of State authorises a scheme along lines similar to the New Blood lecturer appointments, but continuing throughout the next five years, in order to smooth recruitment patterns and improve career prospects.

Women Returners and Post-Doctoral Positions

12. One source of recruitment to post-doc positions over the last few years has been married women "returners"—women with post-graduate science degrees who opted out to have children and now wish to return to a scientific career. In a detailed study being undertaken of 35 post-doc posts created by the SERC's Protein Engineering Club in its four year life, seven posts (20 per cent) were filled by married women returners, with two posts being shared by two half-timers apiece. There are, however, major obstacles to the continuing employment of women in such positions. First, Research Council rules vitiate against their employment—age means they are initially appointed higher up the scale than the typical post-doc and their continued employment is not encouraged once they have filled these posts for six years because universities shun the redundancy implications. (The implicit

assumption underlying Research Council rules on this issue is that the typical post-doc student is 25-30 and should not be encouraged to remain in research if no permanent position has been secured by the age of 30.) Secondly, many of these women are also ruled out by age from consideration for lecturer posts either explicitly by age bias on new blood appointments, or implicitly by universities not wishing to make appointments above the first few points in the scale. After five or six years, therefore, many of these women are forced to give up this type of work. We suggest that this is a substantial waste of talent and highly trained manpower, particularly given the difficulty encountered in filling post-doc positions, and that consideration should be given to establishing a proper career structure of Research Fellow/Senior Research Fellow gradings for those who wish to remain either full time or part-time in research careers.

Summary and Recommendations

13. The evidence contained in Annexes A and B reveals a worrying situation in relation to the recruitment of post-graduate and post-doctoral scientists. It indicates that the best and the brightest in British science are no longer choosing a career in academic science. While this may have some advantage for the careers they choose to enter, it augurs badly for British academic science which has until recently had the pick of the nation's brain-power. At a time when we are aiming to make our way in the world increasingly by selling our wits rather than by selling manufactured goods, it is essential that we make the most of those wits.

14. The evidence indicates that, while shortages at the post-doctoral level have been apparent for some time, there is a new and potentially more damaging shortfall in good applicants for post-graduate studentships. We urge the Secretary of State to commission a study which undertakes a systematic survey of the situation at both levels and investigates the implications of the shortfall on the capabilities of the science base in five to 10 years time. In the meantime, we ask him to consider three measures which in our view would substantially improve the current situation:

(i) to establish a twin-track route to a PhD, with five year research assistantships for those prepared to work their way to the higher degree and a limited number of crack three year studentships at the same rate of pay for the really bright students;

(ii) to smooth the bulge in recruitment which will hit the science base in the mid-1990s by bringing forward, through a continuing programme of New Blood appointments, recruitment to lecturer posts which would otherwise not occur until after 1995;

(iii) to create a proper career structure for those, including women returners, who wish or are best suited to a continuing career in scientific research.

ANNEX A

DOCUMENTARY EVIDENCE ON DIFFICULTIES ENCOUNTERED IN FILLING POST-GRADUATE STUDENTSHIPS

Biochemistry (4)[1]

There is some evidence to suggest that quality of PhD students is falling. Whereas in 1976–77, 50 per cent rates 1st or 2i category of PhD, this has now dropped to 40 per cent. The proportion of students from polytechnics or colleges of technology has risen over the same period from 0 to 20 per cent. In general, these students are not as good intellectually as university graduates but may turn out to be at least as good or better than them at research.

"I personally had to return to two ear-marked studentships this year, one SERC, one AFRC. I got no suitable applicants through the mini-UCCA scheme and only one applicant (who accepted a position elsewhere) in response to an advertisement in the New Scientist. In addition I circulated all relevant departments in the UK with no results. The only studentship I have managed to fill is an industrially funded one which carries a stipend significantly higher than research council ones."

Biological Sciences (5)

"(b) Out of 33 studentships, failed to fill eight. First year we have had this problem.

(c) Applicants for post graduate studentships 50 per cent down and a struggle to get good candidates."

Molecular Sciences (4)

"For the last three years I have tried unsuccessfully to get a student to carry out site-directed mutagenesis/structure/function studies. In desperation I applied for an RAIB post this year—two years ago I advertised an RAIB position and got 52 applicants, several of whom were very good."

"The RCs previously encouraged students to move to other universities for PG studies. Now the situation is so bad that we are forced to go all out to try to retain some of our own students. Everyone else is doing the same, and offering firm positions before the results are out."

[1]The figures in brackets denote the rating given to the Department in recent UFC Research Selectivity exercise.

"I tried to fill a CASE studentship last year, but no-one of suitable quality applied. I have sometimes taken on someone of lower calibre than desirable, but it's seldom worth it. We are in danger of losing all our best people and taking on the mediocre."

Biology (4)

"In 1989, two of the students taken on to do PhD last year (1988) as 'last minute candidates' dropped out as a result of poor performance/lack of interest in research. All our 1989 students (four) were last minute candidates, found in July."

"In my opinion, staff will scour the country for anyone with a 2.1 rather than return studentships."

Biology (4)

"1987–8: 19 applicants: one received instant award; one declined by Supervisor; two withdrew before interview; 12 withdrew on receiving offer from another department; one withdrew because offer not quick enough; two accepted offer. These were far from the best applicants.

1988–9: 17 applicants; 15 declined or withdrew; two accepted offers.

In 1987–8 we were awarded four CASE studentships. We advertised in May and June. The total applicants were two. One was ineligible. One was from Eire.

In 1988–9 we advertised three CASE awards, and received one enquiry from someone who did not bother to put in formal application. One earmarked studentship was turned down by the only applicant and lost. One replacement studentship was also lost."

"Prior to 1987, the averge number of applicants was 40–50. In 1985–6 we took five people with Firsts. Now we have to make offers before the degree result is known."

Biological Science Research Institute (4)

"In 1988–9 we had only two candidates for NERC studentships; only one for SERC-CASE; one SERC studentship unfilled; one of the SERC students left after six months to go into supermarket management. Generally speaking the current students in my lab are the worst I have had in all the time I've been here."

Molecular Science (5)

"We have a quota of 10 MRC studentships, for which, up to three years ago, we had no difficulty in finding appropriate candidates. However, the number of studentships which we have been able to take up has now dropped substantially. Last year we took six MRC students, and this year four. This decrease reflects not only a drop in the number of applications—down to 65 a year from 100 a year three years ago—but an even greater decline by some 50 per cent in the number of outstanding candidates as judged by their university records and references.

This is not the whole picture. there is also a trend for more foreign students, who are wholly financed from abroad, to work in the laboratory with the consequence that such students constitute an increasing proportion of our output of PhDs. From my conversations with both research students in the lab and also undergraduates in the university, it seems clear that it is not so much the level of support for studentships that is the crucial factor, as the students' perception of the career prospects in science."

Maths (4)

"We interview all our honours students in their final year to ask about their plans and try to attract them to MSc/PhD courses. Of the seven Firsts in the last two years, the future plans were:

One PhD
Three Actuarial or Finance
Two Scientific civil service
One Software House

The department (in conjunction with Civil Engineering) obtained seven earmarked SERC research studentships for specific projects in 1987–88. Desptite being widely advertised, about half were unfilled. We take overseas PhD students to keep up our post-graduate school. I estimate at least five of these (our p/g school is 40) are below the standard we would like to take. We would much prefer to have good UK post-graduates but we find these very hard to attract, despite being a highly regarded research school."

Physics (5) (Three comments from the same department)

(i) "Approached all members of 1988–89 class who got firsts, but none were interested in taking SERC grants still available in June. Student finally taking grant narrowly missed a 2ii."

(ii) "Since 1987 it has become increasingly difficult to persuade bright undergraduates to continue their studies to PhD level. I have had a CASE award since June and as yet no candidates have appeared. I am well aware that colleagues in other departments are in the same predicament. X in chemistry, for example, told me that he had several post-graduate positions he was unable to fill."

(iii) "Problems recruiting bright students to fill post-graduate posts are facts of life that we all experience and have done so increasingly for several years. Surveys of first destinations that I have seen provide overwhelming evidence that our bright students are not going into post-graduate studies. We failed to fill our SERC quota awards (even here in Physics at —) last year."

Biochemistry (4)

"On the subject of research students we are not officially prepared to admit to having difficulties filling places (an advertisement has just gone out related to three unfilled places) or that standards are dropping. 'Such an admission would lead to a cut back in quotas and we don't want that' is the line taken by our Head of Department."

Zoology (4)

"I regard the last two post-graduates to finish studying in my lab on MRC and SERC studentships as weak. How you make this assessment 'scientific' I don't know. One took five years to complete."

Microbiology (4)

Re 1988–9 graduate —"She proved an excellent researcher —enthusiastic, capable, productive. She was offered research positions but also the opportunity to train with ICI as an accountant. After a lot of consideration and consultation she opted for the ICI offer because it promised higher financial reward and better career opportunities."

"We have been fortunate to fill our PhD quota allocations, although two of four this year were filled at the very last moment. Both are likely to be satisfactory, but the lack of choice concerns us."

"In the last four to five years it has become very difficult to find top class graduates to fill our quota allocations. To my knowledge, we have appointed five or six students who in previous years would probably not have been engaged. Perhaps two of the six have shown an aptitude for research, while three left prematurely. Perhaps the most obvious monitor of the decline is that where ten years ago we would have a dozen or so applicants for each studentship, today we are lucky if we can muster two or three serious applicants for each award."

Physiology (4)

"There is a problem recruiting post grads. The intake is sufficiently low that fluctuations in demand affect us dramatically. In 1985–86 we had 17 home enquiries and 18 overseas enquiries. The take-up is less than one in ten. 1987–88 was a particularly bad year; as a result we have only 1 post-graduate in the second year, and in fact sent back the Research Council studentships allocated to us. Last year, 1988–89, was better. We had 15 home enquiries, but only seven overseas. Overseas interest has nose dived (fees/poor accommodation probably)."

Botany (2)

"Four post-grad posts available, and failed to fill two of them. One NERC post filled with sixth choice who had low 2.1; the five others turned it down. Three Firsts in 1988–89, none have stayed to do research."

Physics (5)

"Good student with good 2.1 took up SERC post-grad award, made excellent progress, enjoyed the work, but decided after a few months to give up physics and go in for actuarial training. We were fortunately able to hold open the award."

Biophysics (2)

"Two studentships (one earmarked, one CASE) unfilled this year."

Physiology (3)

"Two qualified students refused offers; two grants put in abeyance —several 2ii appointed to RAIB posts."

Microbiology (2)

"Only one candidate for the one studentship."

Chemistry (4)

"Two CASE studentships unfilled first time round. One third of PhD students below 2i standard."

Computer Science (4)

"Only 10 per cent of our Firsts and 2i went on to PhD studies, only half our post graduate places are filled with *good* candidates."

Biological Sciences (4)

"Never failed to fill a PhD studentship so far, but my numbers of applicants have been 1984—ten; 1985—nine; 1986—seven; 1987—six; 1988—five. In the last two years, only three candidates were acceptable, whereas formerly all were strong candidates. I have twice accepted marginal students and have partially regretted it. I fill my post-doc places, but have few applicants and a very limited choice."

Biological Sciences (4)

"Failed to fill two studentships this year for the first time ever. Most of my good applicants seemed to disappear to Imperial or Leicester. In 1989 and 1987 the only real applicants for studentships were candidates with 2ii who had funded themselves through a one year MSc in order to qualify for a research studentship. My observation is that their extra experience does not compensate for lower ability. In 1989 the Department as a whole accepted four such candidates out of a total of 18 new PhD students."

Chemistry (2)

"My two studentships this year were filled with students from polys and their background is not as good as desirable, though keenness may overcome this."

Computer Sciences (4)

"First time in ten years that I failed to fill a studentship. Those coming are not of poorer quality, but there is less choice than in previous years."

Biological Sciences (4)

"I had three applicants for a research studentship. Two were low standard, no hopers. One bright candidate accepted the offer and then pulled out on receiving an offer of a not very well paid "proper job". I filled my CRC studentship, but the grant was £1,000+ more than university levels."

Biochemistry (4)

"Of our three Firsts last summer, one is doing a PhD, one has made a determined move into finance, despite numerous offers of research opportunities, and one is drifting, not attracted by most career paths, but determined not to enter science via a research studentship."

Biochemistry (3)

"A colleague returned a studentship rather than fill it with a poor candidate. One of my students, who was the top student of his year, forsook his PhD studies after six months to go to the City. The students who generally are available for late PhD places are now often from the Polytechnics (nothing wrong with that but they are probably a bit limited in horizons). On the whole we have been successful in filling our studentships, but often with an enormous amount of hassle. This latter is people saying "yes" and then reneging after others have been told to go elsewhere. This has happened twice to me and twice to others in this Department in the last two years."

Electronic and Electrical Engineering (5)

"We just about made our quota of studentships, but would not have done so if we have not been cut back on earlier years. What was infuriating was that we had a very good person to fill one studentship who had done an MSc after poor initial degree, but was refused a studentship because he had not completed his industrial experience requirement. So we lost a potentially very good student due to SERC's inflexibility."

Pharmacology/Physiology (5)

"These two departments each failed to fill one studentship. Many of the students interviewed in fact held several offers. Two had accepted research assistantships instead of studentships. We interviewed everyone who had a prospect of a 2i, not just our Firsts and good upper seconds—and two students whom we did not think good enough for research got offers of studentships elsewhere."

Crystallography (5)

"Five years ago when I recruited PhDs, I took only Firsts. This year I have three new students, all with somewhat chequered CVs:

(i) a 50 year old with an undergraduate degree (3rd class) in chemistry who has been attending—part-time;

(ii) a physics 2ii from QMC who spent last year doing an MSc, self financed, and is now on an SERC CASE award;

(iii) a chemistry 2i who started a 'wet' biochemistry PhD last year and did not fit, but is good at computing (which is what I need)."

Physics (5)

"In a popular subject such as laser physics in which I work, PhD places used to be heavily over subscribed, whereas now the number of well qualified applicants is roughly equal to the number of places available, and ours must surely be one of the most attractive laser research schools in the country. My current list of PhD students is—two from the UK, four from Pakistan, two from Greece and two occasional students from Germany. The Department considers me a big earner.

Over the past two years I have quizzed my UK students to try to discover the origin of the change. My sample is only 30 out of a class of more than 200, even so it is interesting. Surprisingly, I find it is not just a question of starting salary. Here are some of the answers:

(i) Students living in London are heavily in debt by the time they finish u/g studies (often by several thousands). A further period of study with only a studentship to live on is out of the question;

(ii) British companies are very possessive with their R&D staff; they tend to offer them one track careers, with little opportunity to branch out. They resent the idea of being 'technicians' and seek a route into wider management;

(iii) They also resent the fact that arts graduates, whose studies they regard as 'easier', are naturally drawn into management careers because they have no speciality skills. The message is—if you want to get on the Board of Directors, don't bother with a PhD;

(iv) An academic career in the UK is not perceived as attractive. This was a view held strongly by all the students."

Biochemistry (5)

"In the spring of 1988 we sent back three SERC earmarked studentships in areas which were high priority ones as measured by the Council's wish to award them here to specific members of staff working in 'initiative' areas. Last spring we sent back a quota studentship to SERC which we felt we should not try to fill with one of the students still on our list. Although we can say that we have not filled studentships with candidates who were not up to it, there is no question but that we are having serious difficulties in finding able candidates. Let me give you a few examples.

Ten years ago it was not uncommon for us to have 50 or more completed applications for the four to five quota studentships on offer. At least a dozen would be strong Oxbridge students expected to get good 2is in biochemistry. We have not seen an Oxbridge candidate for the last two years.

Another anecdote relates to my own personal research. Ten years ago when our work was by no means as exciting as it is now, it was not uncommon for me to interview six to eight very able students each spring, and I invariably had no difficulty convincing one of the most able to join me.

At present I am without a research student and have not had a new one for four years. Last spring I interviewed three, none of whom were sufficiently able or had the appropriate skills.

We *never* advertised studentships in newspapers or the scientific press until two years ago. Now we are spending considerable sums of money for elaborate advertising including all the catchy words we can think of."

Chemistry (4)

"Of the best 12 people graduating in Chemistry, only two chose to stay on for research, here or elsewhere. A higher proportion of the good Chemical Physics and Biochemistry graduates stayed on. We were able to fill our quota of research studentships, but would have liked a significantly larger number of the very best Chemistry students to have stayed on, as they would have done up to recent years."

ANNEX B

DOCUMENTARY EVIDENCE ON DIFFICULTIES ENCOUNTERED IN FILLING POST-DOCTORAL POSITIONS

Molecular Sciences (4)[1]

"For crystallography PDRA positions, one is usually lucky to find one candidate. Molecular genetics is equally bad or worse. It means positions unfilled for several months. We were recently awarded a PDRA position in collaboration with Leicester. Our advert raised only two possibilities, neither of whom had the experience we were looking for. So the first year was spent in training. We live in fear of people leaving for better paid jobs."

Biology (4)

"One good post-doc is leaving to move to Geneva (Glaxo Research). He is excellent, with a good publication record. When I suggested he should apply for a lecturer post in Manchester, he said he had seen too much of my "grubbing around after money" and would get everything he needed in Geneva in a well equipped lab. I now have to find a replacement."

Physics (5)

"I got a SERC grant with two years' funding for a research position. Despite advertising in Nature, I received only four applications, none from the UK and only one suitably qualified. This was a Chinese national who was unable to obtain an entry visa, so I eventually had to return the grant to SERC."

Biochemistry (4)

"In our experience, advertisements for post doctoral research invariably attract few home applicants but several foreign ones. These usually have little or no relevant experience in the field, and are hoping to acquire the expertise sought. This is highly unsatisfactory since part of the role of the post-doc is to provide experience for those new to research."

"My own experience ... is on research grant committees. It is very clear that there is a serious shortage of well qualified post-docs with experience in molecular genetics, plant biochemistry, and other related disciplines. There is, of course, a shortage of good post-docs of all types in science. This is seen most clearly by the slippage in the starting date for work on grants. The delayed grants cause problems in terms of anticipating expenditure by the RCs, and are also a good indication of the commonly observed comment that inadequate people are eventually appointed just to enable work to start at all."

Botany (3)

"Great difficulty filling PDRA funded NERC, and then filled it with someone without the expertise they were looking for. This held up the project and puts a question on how effective the work will be. Another post-doc came from Holland. He stayed for two years and then left because he could not pay mortgage. Has now returned to Holland to temporary job. An AFRC funded post-doc position was filled with a Chinese national who had done PhD in France, and will return home as soon as the job is finished."

Physics (5) (Comments from five different members of staff)

(i) "During the period 1982–89 I have held two SERC PDRA grants for work on X-ray diffraction of liquids and glasses. Despite advertising in national and international journals, no UK resident applied, and eventually the post was accepted by an Indian who is already a lecturer in Delhi. Another grant I have from the NBRC has been held by three different people in three years—with consequent effect on the amount and quality of work undertaken."

(ii) "One of our research posts was offered to two very powerful experimental post-docs. They were each fascinated by the research line but turned it down in favour of more remuneration, in fact and in prospect, elsewhere."

(iii) "Both our post-docs are foreign—there were no suitable UK applicants."

(iv) "Currently A is looking for a post-doc opportunity in the US and B (top of 1986 class) says he will not go forward in the UK. C (1st 1986) withdrew from CASE award on HTSC because of financial difficulties. D has just turned down an offer from Brian Coles at Imperial because of money problems—he is currently supporting himself in his 4th year. E is looking to go to the USA. F previously left to go to Canada. Two recent quite senior post-doc visitors from abroad to the lab have confided that they will not now return again as situation is now so poor."

[1]The figures in brackets denote the rating given to the Department in recent UFC Research Selectivity exercise.

(v) "All UK students on MSc course obtained a 2ii. Two of our new blood lecturers have left—one for Bell Labs the other for RSRE. Two others are contemplating leaving the university."

Zoology (4)

"I was awarded a SERC grant in January with post-doc salary. I offered the job to two people with post-grad degrees but they turned it down. In the end the most promising applicant was not a post-doc, but a recent graduate."

Maths (4)

"Regarding the post-doc situation, it is now becoming established to fill SERC RA posts with talented pre-doctoral students who have say, a one-year MSc. They then do a PhD part-time while fulfilling their RA comitments. This is the only way to pay them enough to prevent them going elsewhere."

Biophysics (2)

"Of some eight PDRA posts recently advertised, only about three were filled first time without delay. Several were eventually filled by candidates without experience. No applicants at all for one post and finally filled by a Hungarian I met at a conference."

Physiology (3)

"One PDRA left after six months; no eligible candidates for refilling post."

Chemistry (4)

"For one post, a Pole was appointed since there was no suitable UK candidate. For second post we had only one eligible candidate."

Biological Sciences (4)

(i) "Recently advertised two year post-doc position in an exciting field and received only two external responses."

(ii) "Applicants responding to my last two adverts for post-docs were unsuitable either through age or lack of relevant experience. My own graduating PhD students have no intention of continuing in post-doc work in the UK."

(iii) "Since returning from the US last year, I have been shocked by the situation. My own salary is insufficient for me to obtain a mortgage for a house, so I am not surprised to see post-docs leaving science. Even those who want to continue find it difficult to stay in universities beyond their late 20s, and permanent jobs in industry are surprisingly scarce. One disenchanted post-doc left to train as an accountant after many attempts over the years to find a job."

Biological Sciences (5)

"15 out of 56 post-doc positions unfilled. Five of these advertised three times with no response. Others filled with difficulty and re-advertising. Virology, Molecular Biology, plant biochemistry and cell biology posts are a problem."

Biochemical Engineering (5)

"I have spent four times as much on advertising for research staff this year for a national centre activity. I can't think how much universities as a whole are spending—you've only got to look at the New Scientist to see how well they are doing. Three of our six post-doctoral or equivalent team leaders are Greek nationals, one is South African and one Iranian."

Biochemistry (3)

"Very few applicants reply to PDRA advertisements and those who do are generally not suitable."

Crystallography (5)

"Last time I advertised (admittedly for a one year post) I got *no* replies. A student in the lab has filled my most recent RAIA. This is against what I think is in the best interests of the student—viz to move labs after completing a PhD."

Physiology (5)

"We currently have nine research posts which we are having great difficulty in filling. Some of these posts have been vacant for up to six monhs. Even by advertising nationally we receive only one or two applications for each post, whereas four years ago we would have received a dozen or more good applicants for each post. Many of the applications we now receive are well below the minimum standard required."

We now receive few applications from UK citizens for research posts. Most come from the Third World or Eastern European countries. There are often language and work permit problems with such applicants.

National advertising is very expensive and a waste of money when the results are so poor. A recent advertisement in Computing Weekly cost nearly £700 and netted only one applicant whose background was not ideal, since he did not have a post-doctoral qualification. I attach an extract from his letter in which he says that his current salary of £12,350 was low by national standards. We would not be able to offer him more than £11,680."

APPENDIX 23

Memorandum from the University Funding Council (ES 36)

Introduction

1. The Education, Science and Arts Committee (ESAC) asked for a memorandum "giving the UFC's view of the possibility of altering the funding arrangements for universities in such a way as to bring the value of a European Community (EC) grant up to the same level as a Research Council grant". This request arose because the Royal Society and the Committee of Vice-Chancellors and Principals (CVCP) had expressed to ESAC the view that the funding arrangements for universities make EC research grants less attractive than Research Council grants. This view is based on a misconception of the UFC's funding arrangements.

2. It is necessary to start by defining the terms being used in connection with a research project. For the purpose of this memorandum, the definitions are as follows:

The **marginal cost** is the additional cost to a university of doing the work.

The **direct cost** is the marginal cost plus the cost of the time of academic and technician staff already employed by the university which will be devoted to the work. Even if the work is not undertaken, the university will still incur these staff costs.

The **full cost** is the direct cost plus an overhead to cover the cost of administration, other central and departmental costs such as maintenance of premises, and an element for the replacement of buildings and basic equipment. The overhead rate will vary from university to university. As a reasonable generalisation for the average university, the full cost of a typical research project can be taken to be the direct cost of doing the work plus 50 per cent.

Funding of Research Projects

3. Research grants provided by Research Councils are at present intended to cover marginal costs, ie they do not include any contribution to the cost of academic staff time or of premises.

4. For EC supported work, a choice of funding arrangements is available, as was described in para 7 of the CVCP memorandum: the Commission will either meet 50 per cent of the (audited) full cost of the project or it will meet the marginal cost of the project plus 20 per cent. The stated principle of the European Commission is to take account of who had paid for an institution's infrastructure. Its objective is to support pre-competitive industrially-oriented strategic research. For most projects, the payment involved is likely to be about the same whichever funding option is used. Indeed, that is the Commission's intention. The only practical option for universities in Great Britain (and in Germany and possibly in other countries of the Community) is the second one, because the paperwork involved in the first is too onerous.

5. At present therefore a university receives a higher proportion of the full cost of a project from the EC than it does from a Research Council.

UFC Funding Arrangements

6. The reason why Research Councils only pay marginal costs is that the Government currently supports university research through the dual support system. Under this system the funds provided to the Universities Funding Council for allocation to universities are intended not only to contribute towards the cost of the teaching but also to assist universities to provide the research infrastructure—laboratory space, equipment, and technician support—that enables the academic staff to do their research, whether externally funded or not. (In the academic year (AY) 1989/90, funds provided through the UFC represent about 75 per cent of the total general income of British universities, most of the balance coming from tuition fees for home and overseas students. By AY 1991–92, however, this proportion is likely to fall to about 50 per cent as a result of the Government decision to shift the balance of funding of higher education towards fees). By custom, major research charities benefit from the infrastructure provided under this system.

7. In 1986 the then University Grants Committee introduced a formulaic approach to the allocation of resources between universities. Under this process, the total available was allocated on a variety of criteria. About 60 per cent was allocated on teaching-based criteria and about 35 per cent on research-based criteria. The balance of about 5 per cent covered particularly high and unavoidable costs that affected a limited number of universities: the most significant example of this was the cost of paying staff in London universities a special London allowance.

8. One-sixth of the research-based component (representing about 5 per cent of the total resource) was to be allocated on the basis of universities' *relative* success in obtaining research grants from Research Councils or major research charities. This element of the allocation process is in effect a competition among universities for a fixed sum of money. The decision to take account of research grant income in this way is the origin of the common misconception that the UFC provides a topping up grant or that it pays overheads on such grant-supported work. It does not, and it is easy to

understand why not: if all universities were to increase their research grant income by the same percentage, none would receive any additional money from the UFC because the total being allocated in this way is fixed.

9. In AY 1991–92 this element of the UFC resource allocation process will be discontinued when the Government implements its decision to adjust the balance of the dual support system. This will involve a transfer of funds from the UFC to the Research Councils, the amount of which has not yet been decided. As a result the Research Councils will in future be paying marginal costs plus a percentage which has yet to be determined. They will still not be meeting the costs of academic salaries or of premises: these costs will continue to be met out of general income—of which the UFC grant would by then represent about half. If the amount to be transferred is about £70 million, as has been quoted by the Department of Education and Science as a rough estimate, then the Research Councils will be paying rather more than the EC for the research they support, the reverse of the present position. Universities will still need to decide whether they wish to take on such research. In both cases, the Government funding through the UFC will continue to provide a significant part of the cost of the research infrastructure which is needed to underpin such partially-funded research.

Options for Change

10. When the EC was considering its policy for funding university research projects, the British universities argued for marginal costs plus 40 per cent. In the event this was not accepted and the EC Council of Ministers adopted the compromise decision described in para 4 above. Although the Commission has said it might review this in the light of experience, a change is not in immediate prospect.

11. The other options that are in principle available to bring the funding arrangements of the EC and the Research Councils into line either involve extra money being provided by the Government or the diversion of funds at present provided either through the Research Councils or the UFC.

12. Success in attracting EC research grants is a factor which is taken into account in the UFC's research assessments, and through these it affects the grant to individual universities—see para 13. The Council would welcome additional funds earmarked to supplement EC grants, but would not regard such supplementation as commanding the highest priority for any extra funds that might be made available.

13. This is not to say that universities will necessarily be underfunded if they take on EC research projects. Because of the highly selective nature of the UFC allocation of funds on research-based criteria, those universities which have the highest rated research (based on an assessment made by the UFC in 1989) attract a greater share of the available resources and this ensures that they are in the best position to be able to take on such work.

14. The Council concludes that there is no reasonably practical way in which it could modify its own funding arrangements that would increase the level of research project funding provided by the European Commission. Nor does it consider that it would be right to modify its present policy of selective funding in support of research excellence—a policy which has been endorsed by Ministers.

1 June 1990

APPENDIX 24

Decision by the Council of the European Communities concerning the Framework Programme of Community Activities in the Field of Research and Technological Development (1990 to 1994) (ES 38)

THE COUNCIL OF THE EUROPEAN COMMUNITIES

Having regard to the Treaty establishing the European Economic Community, and in particular Article 130q(1) thereof,

Having regard to the Treaty establishing the European Atomic Energy Community, and in particular Article 7 thereof,

Having regard to the proposal from the Commission([1]),

Having regard to the Opinion of the European Parliament([2]),

Having regard to the Opinion of the Economic and Social Committee ([3]),

Whereas the Single European Act incorporated a Title VI (Articles 130f to 130q) into the EEC Treaty; whereas that Title constitutes a new legal basis for Community activities in the field of research and technological development; whereas, in particular, Article 130f lays down that the Community's aim is to strengthen the scientific and technological basis of European industry and to encourage it to become more competitive at international level;

Whereas it is necessary for the Community to encourage enterprises, including small and medium-sized undertakings, research centres and universities in their research and technological development activities and, in order to achieve that, to support their efforts to co-operate with one another by appropriate measures;

Whereas it is recognized that small and medium-sized undertakings are able to make a significant contribution to the innovative process and should play a substantial role in the implementation of Community research and technological development activities, thereby contributing to the improvement of industrial competitiveness on a broader basis; whereas, therefore, particular attention should be paid to the specific needs of these undertakings in order to encourage their access to information, their effective participation in Community programmes and their ability to exploit the results of Community research;

Whereas under Article 130i all the Community activities referred to in Article 130g should be set out in a multiannual framework programme;

Whereas, following an initial framework programme for the period 1984 to 1987, a second framework programme for the period 1987 to 1991 was adopted by Decision 87/516/Euratom, EEC([4]) amended by Decision 88/193/EEC, Euratom([5]), and is in the process of being implemented; whereas it should be possible to continue implementing it, for specific programmes which have not yet been adopted, even after adoption of the third framework programme for the period 1990 to 1994;

Whereas the Commission submitted a communication on "a framework for Community research and technological development actions in the 90s" on 13 June 1989;

Whereas, in addition, pursuant to Article 4 of Decision 87/516/Euratom, EEC, the Commission has examined and assessed progress in carrying out the second framework programme, in particular through an evaluation report prepared by a group of independent experts;

Whereas, in view of the rapid pace of technological development, new economic challenges which the Community must meet, the increased level of global competition and the need to keep in view the horizon beyond 1992, Community activities in the field of research and technological development must be intensified and augmented; whereas, in the light of these factors, it has been judged appropriate to adopt a new framework programme for the period 1990 to 1994 developing out of the current framework programme 1987 to 1991;

Whereas the Community's activities must be based on the principle of subsidiarity, and whereas the Community's activities in the field of research and technological development must thus provide added value in relation to activities carried out at national and other levels;

Whereas efforts should be focused on a limited number of activities corresponding to the strategic objectives laid down in the framework programme;

([1]) OJ No. C 243, 23.9.1989, p.4.
([2]) OJ No. C 15, 22.1.1990, p.338.
([3]) OJ No. C 56, 7.3.1990, p.34.
([4]) OJ No. L 302, 24.10.1982, p.1.
([5]) OJ No. L 89, 6.4.1988, p.35.

Whereas it is necessary to promote the overall harmonious development of the Community with a view to strengthening its economic and social cohesion; whereas it is intended that the implementation of common policies of the Community and its strategy for research and technological development shall contribute to this objective; whereas a Community framework programme should play its part, along with other Community instruments, in contributing to strengthening scientific and technological infrastructure and potential throughout all parts of the Community;

Whereas the process of technological progress requires a continuum of interlinked activities, ranging from basic research through to the demonstration of the applications of new technologies; whereas, however, the pre-competitive aspect must remain central and still take priority in Community research and technological development;

Whereas the prenormative dimension referred to in Article 130f of the Treaty could enable Community research and technological development activities to guarantee the scientific and technical basis necessary to establish adequate norms and standards; whereas such an approach will help make it easier for the Community to meet the increased responsibilities linked with completion of the Single Market, in other areas such as the environment, safety and health;

Whereas the Joint Research Centre is called on to contribute to the implementation of the framework programme particularly in those fields in which it can offer an impartial and independent expert opinion for the benefit of all Community policies;

Whereas the dissemination and exploitation of the results of research and technological development activities are essential elements in the innovative process, in particular for small and medium-sized undertakings; whereas, for this reason, each specific programme must specify the procedures for disseminating results, and provision should be made for centralised action to disseminate and exploit the results of research;

Whereas a new initiative should be launched to improve the mobility and training of young researchers at post-graduate level, particularly relying on networks of laboratories and research teams, both public and private, in Member States, throughout the whole Community;

Whereas the framework programme is to be implemented through specific programmes and may also be implemented through supplementary programmes within the meaning of Article 130l, participation within the meaning of Article 130m and co-operation with third countries or international organisations within the meaning of Article 130n or may take the form of joint undertakings or other structures within the meaning of Article 130o of the EEC Treaty;

Whereas a complementary relationship should be promoted between Community activities and Eureka projects which fit in with the extension of the Community's research and technological development strategy, by the choice of appropriate instruments, in accordance with Articles 130m and n of the EEC Treaty;

Whereas the Community is ready to co-operate, on a mutually advantageous basis, with third countries, particularly those which have concluded framework agreements with the Communities;

Whereas European co-operation in the field of scientific and technical research (COST) activities are making an increased contribution to the implementation of the framework programme and playing a specific and complementary role by encouraging scientific and technical co-operation between the Community and the members of COST by means of research projects of a multilateral character;

Whereas it is necessary to make an estimate of the Community financial means necessary for the realisation of the research and development activities envisaged, in accordance with Article 130i(1) of the EEC Treaty; whereas this amount is compatible with the financial perspective included in the Inter-institutional Agreement of 29 June 1988 for the years 1990 to 1992;

Whereas as regards the implementation of the framework programme in 1993 and 1994 provision should be made for the amount deemed necessary and the continuity of research activities should be ensured;

Whereas the Scientific and Technical Research Committee (CREST) has been consulted;

Whereas the Scientific and Technical Committee referred to in Article 7 of the EAEC Treaty has been consulted by the Commission and has delivered its opinion.

HAS DECIDED AS FOLLOWS:

Article 1

1. This framework programme for Community activities in the field of research and technological development, hereinafter referred to as the "third framework programme", shall cover the period 1990 to 1994. The Decisions adopted in implementation of Decision 87/516/Euratom, EEC, concerning the framework programme for 1987 to 1991 shall not be affected by this Decision. The remaining Decisions necessary to complete the implementation of Decision 87/516/Euratom, EEC, may be adopted.

2. The third framework programme shall provide for the carrying out of the following activities:

ENABLING TECHNOLOGIES:

1. Information and communications technologies
2. Industrial and materials technologies

MANAGEMENT OF NATURAL RESOURCES:

3. Environment
4. Life sciences and technologies
5. Energy

MANAGEMENT OF INTELLECTUAL RESOURCES:

6. Human capital and mobility.

3. Without prejudice to the amount of ECU 3,125 million deemed necessary in respect of the framework programme for 1987 to 1991, which it will be possible to enter in the budget from 1990 onwards, the amount deemed necessary for Community financial participation in the entire programme shall be ECU 5,700 million, of which ECU 2,500 million are deemed to be necessary during 1990, 1991 and 1992 and ECU 3,200 million during 1993 and 1994.

4. The latter amount shall be intended for the financing in 1993 and 1994 of activities begun in the period 1990 to 1992. If this amount is covered by any financial perspective fixed for 1993 and 1994, it shall be deemed to be confirmed. In any other circumstances, the Council should as soon as possible take, in accordance with Article 130q(1), the decisions deemed necessary to ensure the continuity of the present framework programme.

5. The breakdown of the amount deemed necessary for the period 1990 to 1994 between the six activities referred to in paragraph 2 is set out in Annex I.

6. The activities referred to in paragraph 2 and their scientific and technical objectives are described in Annex II.

7. The selection criteria to be applied in the implementation of the framework programme are laid down in Annex III.

Article 2

1. The third framework programme shall be implemented through specific programmes in accordance with Articles 130k and 130p of the EEC Treaty. For activities covered by the EAEC Treaty, programmes shall be adopted in accordance with Article 7 of the said Treaty. Each programme shall fall within one of the activities referred to in Article 1(2).

2. This implementation may also give rise, as necessary, to supplementary programmes within the meaning of Article 1301, to participation within the meaning of Article 130m, to co-operation within the meaning of Article 130n and to joint undertakings or any other structure within the meaning of Article 130o of the EEC Treaty. In such cases the decision shall be taken by the Council pursuant to the rules of the Treaty.

3. If a decision is taken in implementation of Article 1(4), the various specific programmes or other decisions shall be adjusted to take account of such decision.

4. Each specific programme shall determine its precise objectives and make provision for an evaluation of the results achieved as compared with those objectives and with the criteria in Annex III, which include that of contributing to the economic and social cohesion of the Community.

Article 3

The detailed rules for financial participation by the Communities in the third framework programme as a whole shall be those provided for by the Financial Regulation applicable to the general budget of the European Communities.

The rates of financial participation by the Community are set out in Annex IV.

Article 4

Measures to disseminate the knowledge gained from and to exploit the results of the specific programmes and the supplementary programmes, as described in Annex II, shall be implemented, on the one hand, through the specific and supplementary programmes and, on the other, by means of a centralised action.

The amount deemed necessary for the above-mentioned centralised action is ECU 57 million, as indicated in Annex I.

The detailed arrangements for the dissemination and exploitation of the knowledge gained, in particular the definition and the implementation of the centralised action, shall be the subject of a Council Decision.

Article 5

During the third year of execution of the third framework programme, the Commission shall assess its progress by reference to the criteria set out in Annex III. It shall examine in particular whether the objectives, priorities, activities envisaged and financial resources are still appropriate to the changing situation. It shall also make an evaluation of all the specific programmes implemented under Decision 87/516/Euratom, EEC. It shall communicate the findings of this examination and evaluation to the Council together with its comments.

After the Council has examined this communication, the Commission shall submit to it the necessary proposals for Decisions.

When implementation of the third framework programme has been completed, the Commission shall make a new evaluation of that programme.

Done at Brussels,

For the Council
The President

ANNEX I

BREAKDOWN OF THE AMOUNTS DEEMED NECESSARY TO IMPLEMENT THE VARIOUS ACTIVITIES ENVISAGED

	in millions of ecus			
	1990–1992		*1993–94*	*TOTAL*
I. ENABLING TECHNOLOGIES				
1. Information and communications technologies	974		1,247	2,221
—Information technologies		1,352		
—Communications technologies		489		
—Development of telematics systems of general interest		380		
2. Industrial and materials technologies	390		498	888
—Industrial and materials technologies		748		
—Measurement and testing		140		
II. MANAGEMENT OF NATURAL RESOURCES				
3. Environment	227		291	518
—Environment		414		
—Marine sciences and technologies		104		
4. Life sciences and technologies	325		416	741
—Biotechnology		164		
—Agricultural and agro-industrial research(1)		333		
—Biomedical and health research		133		
—Life sciences and technologies for developing countries		111		
5. Energy	357		457	814
—Non-nuclear energies		157		
—Nuclear fission safety		199		
—Controlled nuclear fusion		458		
III. MANAGEMENT OF INTELLECTUAL RESOURCES				
6. Human capital and mobility	227		291	518
—Human capital and mobility		518		
TOTAL	2,500		3,200	5,700(2)(3)

ANNEX II

THE ACTIVITIES

The third framework programme of research and technological development (1990–1994) defines objectives for giving an innovatory thrust to Community action during those five years. The specific programmes of the second framework programme (1987–1991) are retained. The third framework programme will be able to bring to them the necessary elements of continuity.

(1) including fisheries.
(2) including ECU 57 million for the centralised action of dissemination and exploitation provided for in Article 4, drawn proportionally from each activity.
(3) including ECU 180 million for 1990–92 and ECU 370 million for 1993–1994 for the Joint Research Centre.

The selection of the broad outlines of the third framework programme meets six major concerns:

—improving industrial competitiveness whilst maintaining the pre-competitive nature of Community activities;

—meeting the challenges linked to the attainment of the large market as regards norms and standards by strengthening prenormative research;

—modifying industrial operators' attitudes in the direction of further transnational initiatives;

—introducing a European dimension into the training of scientific research and technological development staff;

—increasing economic and social cohesion whilst ensuring the scientific and technical excellence of research projects;

—taking into account environmental protection and the quality of life.

The choice of scientific and technical objectives rests inter alia on the principle of Community added value and subsidiarity. In this sense, the criteria laid down for the previous framework programme and set out in Annex III, take on an added significance; they will be taken into account in the evaluation of the different activities.

There will be greater consultation of representative scientific, technical and industrial bodies in the Community.

In industrial programmes, the emphasis will be on pre-competitive research and technological development. The main objective will be to contribute to strengthening the technological bases for the development of standards in order to encourage the attainment of the single large market, thus making it possible for industry to invest in the design of products on the basis of common standards. Transfer of technology in order to encourage the use of new technologies will assume particular importance and will include certain demonstration projects with particular reference to use of such standards. There will be no financing of product development.

The principal instrument of the specific programmes remains the shared-cost action, without ruling out the possibility of adjusted rates of support. In those cases where co-ordination of existing research activities at national level is the predominant aspect, concerted action will be used. The other methods of implementation provided for in the Treaty may be used, in particular to establish or strengthen links with long-term Eureka projects meeting the criteria for Community action.

The Joint Research Centre is to participate in the implementation of the framework programme in those fields where it has the necessary competence. These are inter alia industrial and materials technologies, research with a prenormative character, nuclear safety (fission and fusion), technological forecasting, the environment and industrial risks.

The research, development and innovative capacities of small and medium-sized undertakings, higher education establishments and research centres will be given sustained attention and their activities in partnership will be encouraged. Particular attention will be given to promoting the access of small and medium-sized undertakings to Community programmes.

Emphasis will also be placed on the various courses of action on fundamental research geared to any area where it might become necessary.

The Council will define the detailed arrangements for the dissemination of knowledge resulting from the specific programmes and other arrangements for implementing the framework programme. Within this legal framework, dissemination activities will be coherent and co-ordinated, which presupposes on the one hand a central level of management and on the other freedom of action in specific programmes to organise a level of specialised dissemination. In both cases, such activities may be carried out in particular through publications or by computerised means according to common standards and protocols.

The activity of dissemination will also cover information on Community programmes and actions to provide easier access to information for small and medium-sized undertakings and private and public research laboratories. To this end, encouragement will be given to the creation or extension of the activities of national and regional relay centres for the dissemination and exploitation of results.

As far as the exploitation of results is concerned, although it is clear that in the first place it is the responsibility of undertakings and laboratories, in certain cases it requires Community action, co-ordinated with the operators concerned and the competent public or private organisations in particular at national or regional level (including inter alia the above relay centres), in order to protect certain results and facilitate and guarantee the best possible innovation transfer.

Both for the dissemination of knowledge and for the exploitation of results, it is necessary to specify or define the rules concerning intellectual and industrial property and the exploitation of the results within the Community and to observe them.

In addition to the evaluation activities involved in the various programmes, work on the methodology of evaluation, forecasting and strategic analysis will also continue unabated in co-operation with the Member States with a view to improving the effectiveness of Community research.

In strict accordance with the guiding character given to the framework programme by the Treaty, the following paragraphs make reference to the strategic elements of the 1990–1994 framework programme.

I. ENABLING TECHNOLOGIES

1. *Information and communications technologies*

The development of the relationship between information and communications technologies, the increased requirements of users regarding standardised systems and trans-European services networks to assist in unifying the European area and the strengthening of scientific and technological bases lead work on information and communications technologies to be directed in three main ways. An essential aim is to achieve open standards making it possible to improve the integration of advanced systems into the networks. In all the areas concerned, the active participation of users and small and medium-sized undertakings and the transfer of technology to their advantage will be encouraged.

A. *Information technology*

Whilst ensuring that all the work relating to information technologies remains focused in the pre-competitive area, the emphasis will be placed, on the one hand, on demonstration activities for the preparation and validation of standards and for the integration of technologies and, on the other, on basic research, in particular in sectors which have the potential to make a substantial impact on industrial innovation, such as the cognitive sciences. In addition, activities on topics dealt with in the ESPRIT programme will be oriented towards the new generations of technologies. In a general sense, the balances between the various basic areas of technology defined in ESPRIT II (including those for microelectronics) will be respected.

The various activities envisaged may be grouped round four large fundamental topics which contain elements of continuity but also exhibit new facets in comparison with earlier research.

(a) *Microelectronics*

The objective is to contribute, by means of pre-competitive research and technological development work, to the strengthening of the European technological base in respect of semiconductors on which to base a European manufacturing capability for advanced products and the technologies for component processing. This work will also concern application-specific integrated circuits (ASIC), multi-function circuits, very fast circuits, opto-electronics, advanced power circuits (smart power), new equipment and materials for integrated circuits and, in conjunction with other initiatives in the Community such as JESSI, the technologies linked to submicron silicon.

Research into and development of advanced and standardised computer-aided design tools for integrated circuits will also be pursued, particular attention being given to users' needs.

These actions will be organised in such a way as to link users and producers and encourage and ensure broad participation by operators in the Community as a whole, for the benefit of all.

(b) *Information processing systems and software*

The rapid development of this sector leads research to be directed towards parallel architectures, knowledge-based systems, work stations, hosts and distributed and real time systems. The tools and methods necessary to increase the productivity of the software and the integration of the systems will continue to be developed.

Emphasis will be placed on the portability of the software, re-usability and design of standardised modules and on prenormative research. Attention will also be given to seeing that European industry, in particular small and medium-sized undertakings, can adopt standardized software on a large scale and use the best practices in the area of programming tools, methods and environments, taking account of national activities in this area.

(c) *Advanced office technology systems and peripherals*

The main objective will be to use European technological competence to construct improved forms of architecture, software packages and other system components capable of adding to the value of devices and systems, in particular those based on standards.

The two main themes are research and development concerning the use of software engineering for the development of selective applications based on open standards and the integration of sophisticated information systems and interfaces. Among the fields concerned may be cited information systems adapted to mobile terminals, co-operation work (groupware), house automation and intelligent buildings and integrated data processing systems for business.

In this context, peripherals take on an added importance. The objective of research and development work is to reinforce the scientific and technological bases for new generations of peripherals which are reliable, cheap and capable of being produced in large quantities, without going as far as product development. This requires the use not only of basic technologies at the best state-of-the-art level, but also of new generic methods of manufacture. The action will have to lead, for instance, to new in-out arrangements and storage systems.

(d) *Computer-integrated manufacturing and application of information technology to industrial engineering*

The objective is to provide, by means of pre-competitive research and technological development work, the bases for open, multisite and multi-vendor systems. The work will cover planning and scheduling systems, production control, computer-assisted engineering systems, robotics and quality-guarantee technologies. The areas concerned are those of discontinuous, continuous and batch manufacture, flexible assembly and mass production. Technology transfer activities will comprise some demonstration projects in which information technologies occupy an important position and which may be launched in real industrial environments enabling standards to be validated and their use to be promoted. These activities will be carried out in close co-ordination with those under heading 2.

This action will contribute to better integration in advanced systems of design and computer-assisted production of the needs voiced by industrialists including problems of work integration and organisation and job evaluation.

B. *Communications technologies*

The principal objective is to enable the integrated broadband network to take on the emerging new services, constructed on "open" standards, and to make the use of integrated services both flexible and cheaper.

Parallel to the continued development of the integrated broadband network and the strengthening of the research effort on optical communications and techniques of synchronic/asynchronic switching, the new activities will be directed towards the development of intelligent, reliable and secure networks and new value-added services that are both profitable and adapted to the developing needs of users. These actions include a Community R&D effort of the prenormative type in order to guarantee the interoperability of the systems on the basis of common standards and protocols.

Particular attention will be given to the growing demand for mobile telephony services and the integration of these services into networks.

The following actions are planned:

—Development of intelligent networks, using new techniques of information transfer, optical communications and possibly artificial intelligence. The objective is to enable second-generation systems to exploit foreseeable progress in data processing. This requires research and technological development work in the fields of standardisation and interconnection protocols. This work should take into account the development of a new European regulatory environment on open architecture (ONP—Open Network Provision).

—Mobile communications. The objective is to contribute to definition of the standards necessary for the third-generation system which should appear on a time-scale of 1996 and beyond and permit the exploitation of new hyperfrequencies in mobile telecommunications services.

—Image communication: building on numerical image transfer (including high-definition television—HDTV), research efforts are needed into processing, storage and display to integrate image into multimedia communications and to ensure the development of allied protocols and coders-decoders.

—Service engineering: work of a prenormative type on architectures and software, realised on basic teleservices and on improved value-added services, with particular attention to their ease of use by small and medium-sized undertakings and preparing the scientific and technological bases for development of standards both for systems and for telecommunications services.

—Experiments in advanced communications. It will be necessary to identify the characteristics and functions of certain advanced model services. These experiments of a generic kind, in real conditions, will contribute to developing interconnection standards and to verifying the feasibility of integrated communication systems so as to limit the dangers when they are introduced later.

—Security of information. The objective is to contribute to the development of technologies which can guarantee effective and practical security meeting the requirements of interconnected or integrated communication services used by economic operators and by the general public. Priority research and technological development work is required to contribute to the definition of international standards and verification technologies.

C. *Development of telematic systems in areas of general interest*

The general objective consists, by means of prenormative research and a limited number of experimental development activities concerning the validation of common functional specifications, in ensuring the interoperability of systems, peripherals and telematic networks at trans-European level. Special attention will be given to considerations of quality, reliability, security and ease of use of services, and to economies of scale and the abolition of barriers to information exchange.

The work will be carried out in areas corresponding both to requirements resulting from the implementation of the large European market and the new increased requirements of a social and economic nature which can both benefit from the use of new telematic resources.

The realisation of the large internal market is setting new requirements in the field of services and information exchange. In relations between public administrations, new requirements are being expressed, for instance, in the areas of emergency services, justice, the social services, statistics, customs and the environment. Sectors of general concern are dominated by questions of transport, health, problems relating to the handicapped and aged, problems of training, problems of links between libraries and access to rural areas.

To meet these requirements, beyond the efforts being undertaken within regional or national contexts, an additional Community effort is also needed in research and technological development.

More specifically, some of these sectors have already been explored in the course of exploratory activities (AIM, DELTA, DRIVE) or preliminary activities (investigation of needs in rural areas and libraries). The planned research and technological development actions will be based on the experience and results obtained from these exploratory actions. Endeavours will be made to achieve their continuity so as not to lose the advantage of the community of interest created.

It will only be possible to develop such projects fully outside the framework programme: the setting-up and exploitation of networks and services are not covered by this work.

In each of the above two areas, making services easier to use will require a sustained effort in language research and engineering. Following work already done as part of the EUROTRA programme, it is now necessary to encourage the development of operational systems linked to information and communications systems.

All these actions will involve information and communications industries, telecommunications operators, providers of telecommunications services and pioneer users of advanced communications. In the case of telematic services, the trans-European dimension will be even more necessary for success than elsewhere.

2. *Industrial and materials technologies*

The objective is to contribute to the rejuvenation of European manufacturing industry by strengthening its scientific base through research and development work. With that in mind it is important to encourage:

—basic technical research;

—integration of new technologies by user industries;

—acquisition of the scientific and technical knowledge needed in order to establish standards and codes of good practice facilitating the transfer of such technologies;

—harmonization of methods of measurement and testing.

The advanced technologies required cover the whole life-cycle of materials and aim at reducing the "design to product" lead time and improving manufacturing processes. In selecting actions to be implemented, account will be taken of the experience acquired through current programmes and pilot projects (BRITE-EURAM, Raw Materials, Recycling and BCR).

These technological developments will integrate considerations of future market requirements and more severe constraints as regards the environment and working conditions, while at the same time enabling improvements to be made in the competitiveness of European producers and users.

The more it can be guaranteed that technologies will have a human dimension, the more the quality of work and consequently the quality of production will increase. Work will therefore cover research and development concerning the working environment and continuous adaptation of the skills of workers to technological change. New methods of management and organisation will be sought in order to ensure a smooth relationship between technology and the working world.

Work carried out in any of the three areas described below will be linked to the others and consequently not performed in isolation, but under a systematic approach. Research on new materials will be closely linked to research on the design and manufacturing processes needed to make economic use of the materials and pre-normative research allowing the incorporation of such materials into products and ensuring environmental acceptability.

The research work proposed will help to consolidate and further technological developments within the Community and make more effective use of resources. A particular effort will be made to help small and medium-sized undertakings become more involved in transnational research, develop links with other undertakings and universities and manage their technical resources better.

Research on measurements and testing is necessary to the application of harmonisation of quality standards and testing methods and the acceptance of results throughout the Community. Greater collaboration between laboratories will improve the quality of results and their acceptability, as called for by the completion of the Single Market.

This approach concerns both the following areas of activity and their interfaces:

A. *Materials—Raw materials*

The objective is to contribute to improving the performances of materials at a cost which permits competitive industrial exploitation over a broad range of applications not restricted to a few high-performance items. The aim will be to promote an integrated approach to the whole life-cycle of materials, including recycling.

The activities in question will concern both research on advanced materials for key applications, such as ceramic composites and metallic matrices, which may have important spin-off effects in other areas, and research on traditional materials of broader application, such as are used in the construction industry where improvements to the materials life-cycle are needed.

Emphasis will be placed on research enabling innovative uses of materials, metals and industrial minerals, and on their production and processing, including exploration, recovery and recycling.

There will also be strong encouragement to undertake basic research and exploit emerging and rapidly-developing technologies.

Particular attention will be paid to research into new materials to improve understanding of their structures and properties, including the production cycle.

B. *Design and manufacturing*

The objective is to reduce the "design to product" lead time and to improve the means, processes and management of design and manufacturing operations, on the basis of the state of the generic technologies concerned.

Emphasis will be placed, *inter alia*, on quality, reliability, the control of products and processes, and on the research and technological development work needed for the adaptation of computer-aided design and manufacturing techniques, especially for small and medium-sized undertakings. Care will be taken to ensure close co-ordination of this activity with the generic aspects of such design and manufacturing techniques covered by heading 1.

The development of the technologies necessary for the modernisation of European industry requires a basic research effort, in particular in the areas of physics and chemistry. Similarly, recourse will be had at the same time to generic disciplines (such as mathematical modelling, acoustics, fluid dynamics, process engineering, etc.) and new technological developments (concerning, for example, surface treatment, miniaturisation, optomatronics, etc.).

C. *Measurement and testing*

The objective is to lead, by means of improved harmonisation of methods of testing, measuring and analysis, to the elimination of certain obstacles to trade in the large internal market.

To that end, transnational actions will be undertaken in four main fields: establishing the scientific and technical bases for Community regulations and directives concerning measurements (including exploitation of research results concerning instrumentation), testing and analysis; the resolution of such sectoral testing problems as might arise when an international approach to certification and testing is adopted and implemented; work arising out of a co-ordinated approach to the provision of measuring standards adopted henceforward in the Community; and support for the development of new methods of measurement.

The drawing up and implementation of standards and codes of good practice, which are necessary to meet the requirements of the market and which require prenormative research and development work, will be guaranteed by means of the research programmes concerned and are covered by other lines of activity.

In carrying out the research outlined above, flexibility of means of action will be particularly important. Two notable means of implementing these proposals will be:

—Technological stimulus and co-operative research action to extend current initiatives, an open arrangement, without any constraints of theme or timetable, will be set up to support particularly innovative technological projects which, at any given time, could not be included in the other

actions. This will help in particular to solve technical problems common to groups of small and medium-sized undertakings without research facilities of their own. This activity is defined in relation to the other sections of the programme as meaning that as a general rule only small and medium-sized undertakings can be considered, in conjunction where appropriate with research centres, with a view to increasing their involvement in Community research programmes.

—While maintaining the generic approach followed under this heading, selected integrated projects will be considered in appropriate fields where a range of generic technologies need to be brought together with a view to providing users with a definition of operational specifications. These projects will have specific targeted objectives, bringing suppliers and users together in a systematic approach and at the same time facilitating the participation of small and medium-sized undertakings. Product development and commercialisation will be a matter for the competent industries.

In view of the needs created by the setting up of the large internal market, the fields to be considered here would include, for instance, transport (which may be the subject of integrated activities concerning, for example, the aeronautical industry—after evaluation—the motor industry and the "clean car"). The logistical aspects of harmonisation and standardisation of means of transport will also be given special attention in conjunction with the activities under heading 1. Other fields will be likely to benefit from an integrated approach.

In general, all these actions will have to contribute to the emergence of European small and medium-sized undertakings, in particular by encouraging their integration in the technological networks developed at that time.

The Joint Research Centre will contribute to these activities via work on advanced materials which gives priority to the prenormative aspect, the preparation of nuclear and non-nuclear reference materials, the acquisition of reference data and the validation of certain reference techniques.

II. Management of Natural Resources

3. *Environment*

Here the purpose is to develop the scientific knowledge and technical know-how the Community needs in particular to carry out its role concerning the environment, as spelt out in Title VII of the EEC Treaty.

In this sector, the research activities are directed towards an understanding of the fundamental mechanisms of the environment, identification of pollution sources and assessment of their combined effects on the environment. They will contribute to the preparation of quality standards, safety and technical standards and the working out of methodologies for environmental, health and economic impact assessment, and will also be geared towards the prevention of natural and technological hazards and towards rehabilitation of the environment. In addition to these activities, "horizontal" aspects of the environment will be taken into account in the various courses of action.

A. *Participation in global change programmes*

The objective is to contribute to understanding of the processes governing environmental change and to assess the impact of human activities. Community participation will be concentrated on problems which will have an impact on environment policy and in areas where the Community is best placed to ensure European co-ordination in the framework of large international programmes while taking account of national programmes. This participation will contribute to the development of research on natural and human-induced climatic change, the interaction between biogeochemical cycles, atmospheric physics and chemistry, effects on ecosystems, physical, chemical and biological oceanography and climatic processes in general, as well as the depletion of the stratospheric ozone layer.

B. *Technologies and engineering for the environment*

The objective is to promote better environmental quality standards by encouraging technological innovation at the pre-competitive level. The two main lines of research in this field will be environmental monitoring, including remote sensing applications and the development of techniques and systems to protect and rehabilitate the environment (for example recycling, treatment of toxic wastes, of contaminated soil and of waste water, and clean technology).

C. *Marine sciences and technologies*

In the area of marine sciences and technologies, in addition to the MAST pilot programme a special effort will be made on basic know-how (including oceanography), coastal engineering and technologies for the exploration and exploitation of resources whilst respecting the environment.

D. *Research on economic and social aspects*

The objective is to improve understanding of the legal, economic, ethical and health aspects of environmental policy and management, and concerns: natural and technological risk assessment, perception and management, the economic evaluation of environmental impacts, the socio-economic impact of the implementation of environmental policies, and the effectiveness and consistency of laws and regulations related to environmental matters.

E. *Integrated research projects*

The objective is to co-operate on interdisciplinary research into a limited number of areas of transnational interest. These transnational projects may involve co-ordinated campaigns, extending from observation and experimentation to integrated operations attaching to all aspects of a regional issue and encompassing general research work on natural and technological risks. Integrated research into modelling will also have to make possible assessment of technological strategies for the environment. There will also be a concerted action on the databank.

The Joint Research Centre (JRC) will contribute to activities in the environmental field, in particular by prenormative work on atmospheric chemistry and on modelling, by study of the assessment and management of technological risks and by use of experimental ways of assessing such risks. The JRC will make a specific contribution to the application of remote sensing techniques in co-operation with the European Space Agency; in co-operation with the future Environment Agency of the European Community, it will contribute to the development of new instruments and trial techniques, to the harmonisation of methods of measurement and to intercalibration.

4. *Life sciences and technologies*

The long-term strategic objective is to contribute in a selective and integrated way to the development of Europe's potential for understanding and using the properties and structures of living matter.

A. *Biotechnology*

The aim of this research is to reinforce basic biological knowledge as the common and integrated foundation needed for applications in agriculture, industry, health, nutrition and the environment.

All the necessary importance will be attributed to the ethical implications of such work and their relevance to industry.

The goals of the BRIDGE programme will be expanded. The priority areas will include protein structure and function, molecular modelling, the structure and function of genes, in particular genome analysis in representative species, the conservation of genetic resources, the expression of genes and controls thereon, cellular regeneration and development, and the reproduction and development of living organisms. Work will also cover animal and plant microbe metabolisms and their *essential physiology*, the ecological implications of biotechnology, with particular reference to microbe ecology and the environmental behaviour of modified genes and organisms. Communication systems within living matter, in particular immunology, neurobiology and the operation of receptors, will also be studied.

The methods and tests making up the requisite scientific prenormative bases for the preparation of Community rules will be developed.

B. *Agricultural and agro-industrial research*

The objective is to contribute to securing a better match between production of land and water-based biological resources and their use by consumers and industry. Within the pre-competitive field, sights should be set on upgrading and diversifying agricultural and sylvicultural products, on enhancing the competitiveness of agricultural and agri-food undertakings in line with other Community policies, while contributing to better rural and forestry management and to ensuring proper protection for the environment.

These will involve interdisciplinary projects which make use in particular of the findings of biotechnology and take account of genetic factors, agricultural and sylvicultural engineering, cultivation or breeding techniques, and environment-plant interaction. In particular, there will be a project to develop effective remedies for desertification and deforestation. Research in the field of acquaculture and fisheries will be pursued.

Work has already started on some topics in the second framework programme, especially under the ECLAIR programme. Still within the pre-competitive field, they will be supplemented by demonstration projects jointly developed by producers and users to bring the products of research and development closer to their applications.

In the field of industrial uses for agricultural and sylvicultural raw materials, still within the pre-competitive sphere, research must as a matter of priority be directed to innovative processes aimed at industrial exploitability of the by-products of food-oriented applications and at developing new, cleaner industrial and energy applications holding out favourable economic prospects.

Agri-food research already begun under the second framework programme, in particular the FLAIR programme, will be amplified, particularly as regards: definition and satisfaction of nutritional needs, toxicology and food hygiene, new technologies for agri-food processing. Further work in these sectors will take account of ongoing programmes (ECLAIR, FLAIR, agricultural research and fisheries).

When these projects are being implemented, encouragement will be given to the execution of innovative projects by small and medium-sized undertakings.

C. *Biomedical and health research*

The chief objective is to contribute to improving the effectiveness of research and development in medicine and health in the Member States, in particular through better co-ordination of their research and development activities, to applying their findings through Community co-operation and to using available resources in common.

The main focus is on new approaches to tackling economically and socially significant diseases (in particular cancer, AIDS, cardiovascular disease and mental illness), ageing, the problems of the handicapped and the problems of health at the workplace, through harmonised methodological and protocol studies in epidemiological, biological and clinical research. Activities will also cover the analysis of the human genome and will be closely co-ordinated with work done elsewhere on the other genomes. Ethical, social and legal aspects of implementing the findings of research into the human genome will be carefully assessed.

This action will be supplemented by pre-competitive research into ways and forms of administering medicines.

Particular attention will be paid to methods of early screening for risk factors, to the development and assessment of prophylactic and therapeutic methods and to the management of health services.

D. *Life sciences and technologies for developing countries*

The objective of this programme is to increase co-operation in the fields of tropical agriculture (including fisheries), medicine, health and nutrition between European scientists and scientists from developing countries so as to enable the developing countries to benefit from the scientific knowledge and technological developments available in the Community and to encourage the development of their own research capacity and the Member States of the Community to increase their own capacities.

All the problems associated with tropical areas (soil, water, forests, energy, environment, agriculture, population, health, nutrition, etc.) will be taken into account.

In tropical agriculture, emphasis will be placed on integrated management of agricultural resources, including aquaculture and forestry, for reducing food shortages in regions at risk while conserving the environment with due regard for the human factor. Special attention will be paid to crops which are potential substitutes for those used for producing narcotic drugs.

Tropical medicine research will undertake new initiatives on major health problems, particularly as regards transmissible diseases and health care systems.

5. *Energy*

The main aim of Community action in this area is the development of sound, environmentally-safe energy technologies designed to improve the Community's energy balance at reasonable expense within the large market. This will be pursued in the following three areas.

A. *Fossil and renewable energy sources, energy utilisation and conservation*

The objective is to contribute to the development of new energy options that are both economically viable and more environmentally safe, including energy-saving technologies, by means of joint activities to assist Member States in this direction. In this connection, increased attention must be paid to work on those energy technologies which, despite their high potential and the fact that they have no adverse effects on the environment, particularly the climate, cannot be used under satisfactory economic conditions at present as this work cannot yet be fully funded by industry.

Activities will be concentrated in three interconnected areas: energy conservation, renewable sources and reduction of the adverse impact on the environment. As regards energy conservation, account will be taken of the leading role of fossil fuels in the Community's energy supplies. This will include work on improving technologies for economising energy in all its uses, energy production from fossil sources using advanced technologies, in particular combined cycles, and suitable substitutes for conventional fuels in the transport sector. As regards the environmental impact of producing and using energy, in particular electricity, emphasis will be placed on reducing emissions of gases responsible for the greenhouse effect, including CO_2. R&D work in the field of renewable energy sources will be stepped up to bring it rapidly up to the level where it can make an optimal contribution to the Community's energy policy.

Research into modelling should also enable technological strategies relating to energy conservation and energy-environment interaction to be assessed.

B. *Nuclear fission safety*

The aim of this action is to continue the common endeavour to support Member States in the fulfilment of their responsibilities for regulating and protecting the environment.

Community action will foster a harmonised approach to safety by bringing together all the parties involved, thus reinforcing the prenormative dimension of research. A new impulse will be given by concentrating research on reactor safety with greater attention to passive technologies, radioactive waste management, decommissioning operations, intervention in a hostile environment, fuel elements, actinides and control of fissile materials. Radiation protection research will cover radiation from natural and medical sources, a better definition of the risks of low radiation doses and new technologies to assess quickly the radiological consequences of nuclear accidents.

The Joint Research Centre will participate in this action through work in the field of reactor safety, radioactive waste safety and management, the management and safety of fissile materials, nuclear fuel and actinides.

C. *Controlled nuclear fusion*

The long-term objective of the Community fusion programme is the joint creation of safe, environmentally sound prototype reactors. The immediate objective is the establishment of the scientific and technological base for the construction of an installation designed to achieve and study the ignition and prolonged combustion of plasma and related technological problems (Next Step). Accordingly, in order to achieve control of plasma in conditions close to those of the Next Step, the Council could decide, in the light of the evaluation, to prolong the JET Joint Undertaking beyond the date currently planned. Work relating to the Next Step and the new systems will be continued taking into account developments in ITER co-operation. Following assessment of ongoing actions, work may include the building of specialised equipment necessary for attaining the objectives of the programme. Some existing fusion devices will be phased out, having completed their experimental programmes. The present keep-in-touch activity with other approaches to controlled thermonuclear fusion, and particularly with inertial confinement, will be continued.

The Joint Research Centre will make its contribution by means of work on installation safety, support for NET and some basic work on materials. This work will be closely co-ordinated with that undertaken in the same fields in associations.

III. Management of Intellectual Resources

6. *Human capital and mobility*

The objective is to help increase the human capital in terms of research and technological development which the Member States will be needing in the next 10 years and to make optimum use of their scientific and technical infrastructure, paving the way for a genuinely European scientific and technical community. This action should provide Community added value of benefit to all Member States.

Unlike the preceding headings, which are to be organised in a thematic or sectoral manner, this action will be organised across the board, following a bottom-up approach, around two main strands: training and mobility of research staff, and the building-up of networks.

Increased mobility of research staff will enable more of them to spend a significant amount of time during their careers working in high-level scientific and technical establishments in other Member States.

Actions will be aimed chiefly at training young people embarking on careers in research and technological development (especially at post-graduate level) and may also cover other staff, at times when they need to acquire new specialisations, particularly during retraining required to adapt to rapid scientific and technological change, and in exchanges and co-operation schemes which are to be maintained on a permanent basis.

The building-up of an infrastructure of networks under this action is of crucial importance for the achievement of the objectives of the Community's research and technological development policy in consolidating and complementing the structuring effects of thematic programmes.

The networks will bring together both public and private sector laboratories and research teams from the Member States, so that they can all benefit from the experience acquired by the best amongst them. They will particularly encourage interchange between different disciplines, the grouping together of several techniques and the extension of applications from one area to another.

The networks should extend to all the regions of the countries of the Community, particularly bearing in mind the special needs of peripheral regions and regions that are currently lagging behind. Highly-qualified scientific and technical potential will thus be built up in these regions.

The activities being carried out under the SCIENCE plan will be taken further. In addition to twinning between laboratories, encouragement will also be given to projects of the same type involving both applied and industrial fundamental research, grouping together institutions from several countries or bringing together national and Community initiatives.

The effects of such action will be increased by developing co-operation between laboratories and teams of research establishments (including the Joint Research Centre), undertakings and higher education establishments.

Account must be taken of demographic factors and of the research and training structures peculiar to the various States, to help each of them to acquire the best possible capabilities.

This will also involve encouraging special access to existing major scientific facilities and fostering consultations when future facilities are being planned.

All these schemes will cover the various branches of technology, the exact and natural sciences, including mathematics and the human and social sciences, which help to strengthen the scientific and technical base of European industry and make it internationally competitive. Interfaces between basic science and technological applications will be taken into account.

Care will be taken to see that these activities have due regard to the existing bilateral and multinational co-operation to which the Member States are party, including co-operation in the COST framework.

Care will also be taken to see that they are in keeping with other Community training and research activities.

The scientific, technical and industrial community will be involved in implementing this project, particularly in identifying networks and choosing beneficiaries, with due regard for the guiding principles of the projects and for Community added value.

ANNEX III

Selection Criteria

In general, Community research and technological development (R&TD) actions should be selected on the basis of scientific and technical objectives, their scientific and technical quality and their contribution to the definition or implementation of Community policies.

A particular aim of Community R&TD shall be to strengthen the scientific and technological basis of European industry—including that of small and medium-sized undertakings—especially in strategic areas of high technology, and to encourage it to become more competitive at international level.

Community action can be justified where it presents advantages (added value) in the short, medium or long term from the point of view of efficiency and financing or from the scientific and technical point of view as compared with national and other international activities (public or private).

The following criteria in particular justify Community action:

—research which contributes to the strengthening of the economic and social cohesion of the Community and the promotion of its overall harmonious development, while being consistent with the pursuit of scientific and technical quality;

—research on a very large scale for which the individual Member States could not, or could only with difficulty, provide the necessary finance and personnel;

—research, the joint execution of which would offer obvious financial benefits, even after taking account of the extra costs inherent in all international co-operation;

—research which, because of the complementary nature of work being done nationally in part of a given field, enables significant results to be obtained in the Community as a whole in the case of problems whose solution requires research on a large scale, particularly geographical;

—research which contributes to the achievement of the common market and to the unification of the European scientific and technical area, and research leading, where the need is felt, to the establishment of uniform rules and standards.

ANNEX IV

Rates of Community Financial Participation

The rates of financial participation by the Community are as follows:

—direct action will in principle be fully funded;

—concerted action may receive a contribution of up to 100 per cent of the costs of concertation;

—for shared-cost projects, the contribution will not normally be more than 50 per cent. Universities and other research centres participating in shared-cost projects will have the option of requesting, for each project, either 50 per cent funding of total expenditure or 100 per cent funding of the additional marginal cost;

—for the implementation of the activities provided for in Article 2(2), the Council will decide for each individual case the details of the Community's financial contribution.

There may be no derogation from these general rules, except under the conditions set out in each specific programme.

APPENDIX 25

Memorandum by Professor I Butterworth, Principal, Queen Mary and Westfield College, University of London (ES 43)

1.1 The points which I make in this submitted evidence refer to political or policy issues relating to European Community Research and Development programmes.

Policy Vacuum

2.1 There is a complete vacuum in policy as to what research should best be funded on an EC basis and what on a national basis. There is no debate on the matter, indeed no mechanism for the debate.

2.2 The ABRC funding document "Allocation for the Science Budget 1990–1993", the main paper to the DES on British Science Policy, has not a single mention of the EC. One would have expected significant input on the interaction between Brussels and Whitehall.

2.3 The Select Committee should therefore press for an informed debate on this matter.

Basic vs. Applied Research in EC Terms

3.1 Initially, EC R & D programmes were established on the basis of overall Community aims, for example European energy self-sufficiency, or research supportive of the Single Internal Market. Such programmes might, at first sight, primarily involve only applied research.

3.2 But Science is a "seamless garment". Even applied research is not easily limited, as is sometimes assumed, to subjects which are commercially relevant. (But which, of course, if they are to be EC funded rather than privately must not be so close to the market as to involve competition).

3.3 In practice, some EC research programmes are *far* from the market. For example, the human genome programme is rather fundamental research; it will be many years before it affects therapy.

3.4 The EC has for some time explicitly funded a small amount of very basic research (SCIENCE Programme).

3.5 As more activities in society gather a European dimension, it is natural to expect that there will be a growing involvement in basic scientific research by the EC. It is to be welcomed. Much scientific research in this country would benefit from greater international collaboration. Some areas (particle physics, space research etc) have seen effective exploitation of international collaboration reducing overall national funding, yet obtaining better science. But some of our science suffers from parochialism. Internationalism is necessarily good for basic science. Involvement by the Community is an obvious mechanism to encourage national standards.

3.6 But decisions as to what basic research might be best funded through Brussels must be on the basis of informed debate on policy. It should certainly not be determined by simple accountancy arguments on additivity or non-additivity of programmes between EC and national programmes.

The Voice of the DES

4.1 Overall, the DES has too small a voice in EC matters.

4.2 The present study is concerned with Science Policy, but in the UK some 90 per cent of research workers are involved in basic and strategic science, and a significant fraction of applied scientists, are in academic institutions. It is therefore impossible not to relate science policy and higher education policy.

4.3 Within the Member States and in the Commission, there is growing and lively interest in the appropriate role of the Commission in education and particularly in higher education.

4.4 For many reasons, therefore, both within the area of Science Policy and elsewhere, the DES should be more active on EC matters.

4.5 As regards the policy vacuum on EC vs. national funding (Para 2.1) the obvious UK body to initiate debate is the new ABRC.

4.6 However, debate should take place in conjunction with similar bodies in other Community countries. We are too inclined in the UK to form our own views without registering those of others. This not only leads to a loss of ideas, but means that we are frequently surprised by our views not being fully heard.

The Voice of the Active Research Worker

5.1 There must be a greater involvement of working scientists in EC Research Policy.

5.2 It is of the nature of really innovative research that probably only the active practitioners can sense where developments are needed and where they will lead.

5.3 The EC is much too inclined to rely on officials or science administrators either in the Commission or from Member States.

5.4 As a counter-example, the universally acknowledged scientific quality of the international programme at CERN almost certainly results from the fact that all policy decisions, from detailed experimental programmes up to strategic policy debates, come from active scientists. In CERN it has proved possible to organise formal arrangements that blend the experience of older scientists with the up-to-date awareness of younger scientists.

5.5 Though it is not easy, the need to involve 40-year old research workers is essential to policy planning. Otherwise, there is a real danger of encouraging olf-fashioned policies (almost by definition, distinguished scientists are no longer up-to-date).

5.6 In this connection, the SERC in its national and international programmes is probably better than many agencies in its decision-making. So I would again hope to see it playing a larger EC role.

Brussels vs. UK Methods

6.1 I would hope that my view that there is need for a greater involvement of active scientists in EC matters will not be interpreted as a criticism of Commission officials as I have obtained a high opinion of them in the research area.

6.2 Many, including myself, dislike the "Eurospeak" of EC papers. (Though it is perhaps to be expected when only 10–20 per cent of papers will have been triggered by a native English-speaker. The French, of course, feel the same).

6.3 But I believe that many who are critical of Brussels and its officials have seriously misunderstood the ethos of the Commission. EC officials are used to a very *interactive* approach to discussions on the various programmes. I have been very impressed to find in them a much greater awareness of policy issues that is often the case in the UK, and greater willingness to explore the nature, the problems and the likely development of some programme and its impact. Those who have been able to forget the unhelpful attitude of British officialdom and even secrecy will find it in many ways easier to be involved in EC programmes than national ones.

Overall Findings

7.1 It is almost impossible to discuss any question on science policy in the UK without facing the fact that our basic research infrastructure on equipment or research manpower is less than in France or Germany or in relative terms to many of the Community countries (See: Research in the United Kingdom, France and West Germany SERC July 1990).

7.2 We are therefore less able to take full advantage of any source of funding which is available, either EC or National, than would be the case elsewhere.

7.3 Of course, our weakness is sometimes unrecognised in a purely national programme. One of the advantages of international collaboration is that it can clearly draw attention to what is needed to be competitive and can demonstrate what we can be losing in comparison with French and German science.

7.4 One of the unfortunate consequences for Science in the UK has been the internal squabble between "big" and "little" science. "Big science" being expensive, was forced into international funding and often with good consequences (Para. 3.5). But some of those involved in "little science" falsely conclude that cheapness is in itself good and that their science must be better than that which involves large expensive facilities. This error has had the consequence that all sciences have had lowering of funding and status.

In France and Germany there is a much less internal conflict and a greater recognition that *all* areas should be *appropriately* funded. International and national programmes are better coupled and are less damaged by inter-scientist jealousies.

Resume of Principal Points

1. There is a vacuum policy as to what research should best be funded on an EC basis and what best on a national basis. The Select Committee should press for an informed debate on the matter.

2. There will be and should be growing involvement of the EC in basic research.

3. The DES should have a stronger voice in EC matters.

4. The ABRC should be the body to initiate debate on EC vs. national funding in various areas, but it should be in conjunction with similar bodies in other Community countries.

5. The voice of active research workers should be heard.

6. There are positive aspects to increased Brussels involvement.

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