Economic Development and Transport Committee

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Venue: National Assembly for Wales, Cardiff Bay
Title: Bioscience Federation

A discussion paper on issues for Bioscience Research in Wales

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We welcome the interest in science policy by the Welsh Assembly Economic and Transport Committee and the opportunity for dialogue with the Biosciences Community in HE and research in Wales. Biosciences have been identified by reports to the Welsh Assembly as an area where investment will be especially important for economic development. This is true of the Biomedical area, but also in Environmental Sustainability and other areas of biosciences. Many of the issues regarding the importance of science and its current problems are similar to those of other regions in England, but some different approaches could also be applied to develop a knowledge economy placing a premium on scientific knowledge.

In order to familiarise the Committee with background issues, some recent documents prepared for the UK Government by the Biosciences Federation are tabled for consideration.

- Building on Success (Executive Summary of a longer paper)
- The impact of government science funding policies on the health of the biosciences (outcome of a questionnaire survey of Heads of University Bioscience Departments)
- Strategic Science Provision in English Universities

Welsh HE and Biosciences Research is spread across the sector with most research concentrated in the pre-1992 Universities and the BBSRC Institute IGER. Cardiff University (Biosciences., Medicine, Pharmacy, related disciplines) was assessed at RAE 5*, 5 and 4 in various areas together with related bioscience research at the interface with physical science and engineering. Among the other Universities, Biosciences at Aberystwyth and Swansea was assessed at RAE 3, and at Bangor RAE 4. The cliff-edge effect of these funding decisions impacts seriously as QR funding is limited to RAE4 and above and so any pockets of excellence in lower ranked groupings are not funded. The future RAE2008 has changed policy to offset similar effects by giving an assessment with a profile of excellence, so avoiding strong grade boundaries. Aberystwyth, Bangor and Swansea submitted all their staff for assessment in 2001, and this probably counted

against them. Almost all other pre-1992 Universities submitted only 80% of their top researchers on average in order to enhance their overall grade.

Significant new research developments of note in the Bioscience areas are the establishment in University of Wales Bangor of an Environmental Centre for Wales, an Institute for Cognitive and Neuroscience and an Institute of Cancer Research. At Cardiff University several Interdisciplinary Research Groups have been established to help develop innovative research projects and the Henry Wellcome Building has been opened. In Swansea a new medical school has been developed and with the new support for the Institute of Life Science will be fully established by 2007 (a focus for interdisciplinary biomolecular and health science with the physical science and engineering schools). Aquaculture Wales at Swansea has excellent facilities for freshwater and marine research.

HEFCW has requested joint reconfiguration initiatives and in Environmental Research this is progressing through discussions between Aberystwyth, Bangor, Cardiff, Glamorgan and IGER. Other plans related to subjects in the biosciences eg medical microbiology (public health), neuroscience, nanotechnology are at an earlier stage.

QAA assessments for many HE bioscience courses have been excellent and many believe high-level teaching at third year needs to be informed by active research. The issue of improving primary, secondary and further education in science is also of importance and many members of the federation are engaged in public interactions and teacher/scientist networks. Recruiting science teachers of high quality is a well recognised problem, as is the expense of practical science and good laboratory facilities in schools as well as in HE.

The following are issues that appear to be a problem in a Welsh context. They are mentioned frequently in discussions with fellow bioscientists and should be considered by the Committee:

- Support for undergraduates is less than that in England and Scotland. This makes the economic viability of Departments/ Degree schemes even more difficult and worsens staff:student ratios. It also puts time available for research under pressure and leads to a culture that is less research orientated. In Biosciences, molecular disciplines that are economically important for a variety of industries, such as biochemistry, genetics, microbiology, and pharmacology are expensive to teach and particularly to provide practical training. Universities can also exacerbate the situation by altering the internal allocation of budgets.

- HEFCE has concluded there is not a problem for science courses in the current market place for University places. Recruitment for biosciences as a whole is currently healthy, but many traditional molecular biosciences courses are currently under threat although they are important for a skill resource in Biotechnology, Agro- and Pharmaceutical Industries.

- Raising the proportion of total UK income won by Welsh Bioscience Research is an issue. Recruitment of high-profile research scientists, who can raise research income, could be supported via Research Professorial appointments, possibly focussed in a few new Institutes empowered to develop new cultures. A five year

plan for further improving the biosciences would be appropriate considering their place envisaged in the economy. Wales is currently under-represented on the committees of the UK Research Councils in the Biosciences and this raises concerns.

Some other points raised in correspondence with the biosciences community include:

- The need to give clear and strong support for science objectives that support WAG science policy when Wales is represented on UK and EU groups with influence over funding (e.g. Defra Science Advisory Council).

- The need to promote a coherent approach within Wales to support mechanisms that are intended to assist R&D or its commercialisation. Such mechanisms should be open to all research providers, whether or not they are an HEI.

- The need to generate an economic development policy that recognises and works to support all the elements of a knowledge economy and does not concentrate only upon IP generation and exploitation. Exploitation of expertise to deliver R&D services brings financial benefit into Wales and provides high-level employment opportunities.

- That long-term investment is required; it is disappointing that Bio in Cardiff Bay is not yet evident or a physical building for Wales Gene Park as was originally discussed.

- The need to reduce delays and paperwork in obtaining support in the knowledge transfer process.

- That Wales should take account of Scottish models in realigning discipline groupings between Universities.

- Welsh Government funding of research should now involve the full-economic cost model.

Annex 1

BIOSCIENCES FEDERATION

Building on Success

A report on the impact of government science funding policies on the health of the biosciences

Executive Summary

Since 1997 the government has invested considerable sums in science and innovation with the aim of enabling Britain to remain at the forefront of. The growing global knowledge economy. This report assesses the outcome of government science funding policies on the capability and capacity of the bioscience sector and is informed by a survey of university Heads of Biosciences Departments and by consulting two major pharmaceutical companies.

The emphasis of a series of Comprehensive Spending Reviews has been on establishing a strong and sustainable science base; embedding in academic institutions a strong culture of knowledge transfer; fostering an environment in which companies can grow; maintaining a flow of people into science and technology; and improving public acceptance of science and innovation.

Much that is positive for the biosciences has been achieved:

- Greatly improved academic infrastructure in most universities allows work to be undertaken that would otherwise not have been possible;
- Increased funding and better balancing of the two arms of dual support, including the Research Councils moving towards paying full economic costs of the projects commissioned, offer the prospect of sustainability of academic research;
- Research in most areas of the natural sciences continues to be particularly strong and efficient in the UK;
- On a number of criteria, the working relationship between universities and business has continued to improve since 1997, and interaction remains strong in the pharmaceutical / biotechnology sectors;
- The UK is the European leader in bioscience industry and second only to the US in world rankings**;** it faces growing competition from Asia-Pacific countries;
- Both the government and scientists have learned the importance of openness in engaging with the public on scientific issues, and a recent poll found increasingly positive attitudes to science among the UK population;
- The government has recognised the serious challenge to bioscience training and research in academia and industry from animal rights extremists, and new legislation appears to be reducing the frequency of incidents of harassment.

However, there are also threats to the continuing success of the biosciences. Some of these have been created or exacerbated by the government's centralising tendency and emphasis on accountability, which introduces burdensome and unproductive bureaucracy as well as skewed priorities:

- There is a growing problem with recruitment and retention in the biosciences that is exacerbated by education policies. Too few well-qualified students are choosing to study core bioscience disciplines as undergraduates, and too few follow vocational courses. The result is that bioscience companies can recruit neither sufficient high quality researchers nor technical staff;
- The unit of resource for teaching science subjects in universities does not cover the cost of courses. Graduates leave most universities with insufficient practical training for R&D careers;
- The work environment in universities has deteriorated as a consequence of the continuing non-competitive pay and uncertain career progression; declining academic freedom; heavy

teaching work-load and increasing administrative burden. Departments are finding it increasingly difficult to recruit world-class researchers;

- The lack of clear mechanisms for meeting overheads of charity, government department, European Union and industry-commissioned research under full economic costing could lead to a decrease in research volume. It is essential not to price-out industrial collaborative research, nor to make Britain's European Union grant applications non-competitive;
- The government has focused too much on university push rather than industry pull for knowledge transfer;
- The increased centralisation of funding decisions such as the Office of Science and Technology allocating a larger tranche of the science budget, and some of the money to the Research Councils being ring-fenced for specified initiatives, is reducing the sums available for responsive-mode funding and restricting freedom of inquiry;
- Despite some government success, animal rights extremism remains a potent and expensive threat to biomedical research, and a disincentive for pharmaceutical companies maintaining research facilities in the UK. There is currently a sinister atmosphere of fear.

Recommendations

In order for the government to build on its already successful investment, the Biosciences Federation makes the following recommendations:

- The government should continue in the general direction set out in the 2004 10-year Science and Innovation plan. Funding must not be cut back since the UK is still only 6th among G8 nations in science spending as a proportion of gross domestic product;
- The reasons for recruitment and retention problems are multi-factorial. In addition to what it is already doing the government should seek to improve the science careers advice given to school pupils at key stages of their education. The policy of encouraging 50% participation in higher education must be reconsidered and thought given to how to encourage more students to follow vocational courses;
- The Higher Education Funding Councils should be invited to determine without delay the real cost of providing a practically-based science course and be given funding to adjust the unit of teaching resource appropriately;
- The government should take action to improve academic pay and conditions (not just for young researchers), which are adversely affecting recruitment. The idealised salary trajectory discussed at a Save British Science colloquium in 2004 provides a suitable model. Government must continue its drive to cut out unnecessary bureaucratic legislation impacting on academics and maximise the positive benefits of high quality academic researchers with freedom to inquire;
- Research Councils should not be pressurised to bring the research that they fund closer to the needs of end-users, but they should always endeavour to exploit high quality research by knowledge transfer. Their prime purpose must be to fund excellent basic research and train excellent researchers. This is also the strong view from industry;
- The government must ensure that its research priorities are backed by a majority of the scientific community, and should support its ring-fenced initiatives with fresh funds and not by diverting money from responsive-mode funding;
- Sufficient funding should be provided through the Research Assessment Exercise and Higher Education Innovation Fund streams to allow departments to make strategic decisions as to which type of research, and knowledge transfer, to pursue. The purposes of RAE and HEIF funding need to be clarified.

- The government must continue to prevent and punish the illegal activities of animal rights extremists. While the Association of the British Pharmaceutical Industry recorded a smaller number of incidents in the first half of 2005, the decision by the owners to close down the Darley Oaks guinea pig breeding facility in August will be seen as a victory by activists. This issue requires urgent attention from the government, universities and bioindustry linked to engaging the public in the need to prevent unlawful harassment.
- The future of the UK bioscience sector depends above all on industry choosing the best technologies on which to focus, and pursuing viable business strategies to achieve profitable growth. The government role is primarily to create a steady and supportive environment. One of the requirements is to create a favourable, simple taxation regime that is well administered and non-bureaucratic, and in this respect the government needs to look again at the operation of the R&D tax credit system

Annex 2

BIOSCIENCES FEDERATION

The impact of government science funding policies on the health of the biosciences: results of a questionnaire survey of the views of university Heads of Department

1. Introduction

The present government has invested considerable sums of money in academic science because it believes that a first-class research base is essential to support innovative and dynamic companies that are able to compete in today's increasingly global market place. There is already abundant evidence that the investment in research infrastructure is having a substantial effect on UK research competitiveness, as documented by Save British Science (1,2) and the Wellcome Trust (3).

Increasing scientific innovation depends not just on improving the academic research infrastructure, but on establishing the conditions for a supportive and enabling work environment, being able to attract talented young people into science, and creating effective links between academia and industry. The Biosciences Federation recently conducted a questionnaire survey to learn the views of academic Heads of Department on the impact of government science funding policies on these, and other, indicators of the health of the biosciences sector.

2. The questionnaire survey

Heads of Biosciences Departments in UK universities were invited to respond electronically to the 20 questions listed in Appendix 1. These questions were compiled in collaboration with a member organisation, Heads of University Biological Sciences, and were intended to address a number of important and potentially controversial issues arising from aspects of government science funding policy. Replies were received from 38 Departments, of which 29 were located in pre-1992 universities and 9 in post-1992 institutions. The individual replies have been collated in Appendix 1, and a brief summary included of the balance of opinion on each question.

10 Comments on the findings

The Federation's Council is keen to discuss the views expressed by the Heads of Department with member organisations before adopting them as Federation opinion. Issues on which there was strong majority agreement among Heads of Department included:

- The current unit of resource for teaching biosciences is inadequate and is affecting the viability of courses (Q11);
- While universities recognise the benefits of the investment in infrastructure, many now have problems in finding the continuing resource to actually equip and run the improved facilities (Q4);
- The balance of research funding has shifted too far from responsive-mode grants towards top-down initiatives (Q6);
- There is still a need for more opportunities for young researchers to win Research Council grants (Q8);
- Uncertainty as to the ability to recover full economic costs of research carried out, depending on the nature of the funder (Q9);
- Government demands for accountability will add to an already high bureaucratic burden on researchers (Q10);
- The greatly increased PhD stipend in recent years has not led to a noticeable improvement in quality of applicants (Q14);
- Most Departments have difficulties in recruiting and retaining high quality teaching and research staff (Q16)

- The government is placing too much emphasis on Research Council funding becoming more closely aligned with the needs of the economy (Q7);
- A large proportion of Departments consider that they have good, or at least reasonable, engagement with industry (Q19).

None of these responses is particularly surprising, and several are inter-related. Many of the difficulties and challenges have multiple causes, and are not always a result of government policy. The most worrying aspect is probably the inadequate unit of resource for teaching, that has clearly been challenged by increasing student numbers. But there may also be issues of institutional resource allocation that cream off funding to cross-subsidise failing science departments, for instance, or to support inefficient administrations. The question of strategic science provision will be addressed in a forthcoming Commons Science and Technology Committee inquiry, to which the Biosciences Federation will submit views.

The questions about research funding touched on issues on which strong individual views are held: the desired degree of selectivity of funding (alluded to in responses to Q5), the balance between directed and responsive-mode (Q6), and the balance between fundamental and 'relevant' research (Q7). Certainly, it needs to be understood that applied science projects linked directly to industry will be starved of input if, upstream, fundamental blue-skies research cannot be maintained. But on the other hand, it was apparent from the responses to Q17 that the distinction between fundamental and relevant research can be more a question of culture and attitude than of reality. More thought needs to be given to the purposes of the different funding streams. And are Heads of Department being overly complacent in suggesting that they have satisfactory interaction with industry (Q19)? Many of those who responded positively to Q19 were also able to identify barriers to collaboration in Q20.

The increasing bureaucratic load was commented on in replies to a number of questions. It was considered to contribute to a poorer work environment (Q3) that leads to recruitment and retention problems (Q16), and to reduce time available for other key activities (Q10) including establishing and maintaining links with industry (Q20). Since much of the bureaucratic load is the result of justifying the translocation of funds from one place to another it is debatable whether the resulting efficiency gains compensate for the time lost across the board. The lack of attraction of PhD courses (Q14), and the difficulties with recruitment and retention of academic staff (Q16) are part of a more general problem with salaries and opportunities in the university sector

It is intended that these and other issues will be addressed in an overarching report later in 2005 that will seek to praise the government for the benefits that its policies have brought to the biosciences sector, and to suggest how policies could be changed to be even more successful.

References

1. Save British Science. *The benefits of recent investment in scientific research; Survey of grant-holders following the 1998 Comprehensive Spending Review.* Paper 00/15 (2000).
2. Save British Science. *Delivering a return on scientific investment.* Supplement to newsletter 40 (2004).
3. The Wellcome Trust. *Evaluation of the Joint Infrastructure Fund.* Results of a study carried out for the Trust by Evaluation UK (2003)

Appendix 1 Summary of the responses of Heads of Department to the questionnaire survey

2. Has your Department received infrastructure funding in recent years from the JIF, SRIF or other government streams?
   Yes 35; No 3

3. Has the government investment largely solved the problem of antiquated, ill-equipped research laboratories?
   Yes 7; No, or only partially 27; Not relevant 3; No response1

While valuing the improvements that JIF and SRIF funding have brought about, and the improved competitive position, most respondents considered that significant further investment is required to bring all infrastructure up to an adequate standard.

4. What have been the greatest effects on your research output, whether direct or indirect?
   Times mentioned: improved staff morale 12; improved recruitment / retention of quality staff 9; ability to perform work otherwise not possible 7; help with other grant bids 6; positive effects counteracted by worsening work environment 4

While one or two mentioned improved publication output, more referred to indirect benefits such as those above as being what can be measured at this early stage. A few noted that the positive effect on team morale has been counter-balanced by a worsening work environment, including larger student:staff ratios and increased administrative burden.

5. Do you have adequate funding to actually equip and run the improved facilities?
   Yes 10; No 24; Don't know yet 1; Not relevant 3

   10 institutions referred specifically to difficulty in paying for technical support from grant income, and 6 to difficulty in meeting the maintenance contracts on major equipment. Those agreeing the notion tended to be larger institutions having more staff flexibility, and they often qualified their comments by reference to "coping at the moment" or "facing extreme pressure on cost recovery".

6. How do you anticipate that the continuing funding for science infrastructure that is proposed in the 10-year science and innovation framework will enhance research in the UK
   Times mentioned: will concentrate research in a smaller number of large institutions 8; will allow some departments to be internationally competitive 5; will lead to a slow improvement in infrastructure 4; will maintain the present position 4

Most thought that research infrastructure will improve further, but the benefits will be skewed. The leading research universities will benefit most and should be able to remain globally competitive. The overall effect may be to concentrate research in a smaller number of large institutions, and there is some concern that this will reduce the breadth and diversity of research. Continuity of investment needs to be assured in order to allow forward planning. There will be no immediate change in terms of the climate for research and the attractiveness of research as a career.

7. Is the balance between directed funding for initiatives and non-earmarked responsive- mode funding for individual projects about right in your area? If not, comment on how the distribution of Research Council funding should be changed.
   Yes 10; No 27; No response 1

A large majority considered the balance is not right. The need for more responsive mode funding was stated by 18 respondents, and four of these added that responsive mode grants are generally acknowledged to fund better science overall. This was rationalised in terms of directed initiatives often effectively shutting out smaller departments from applying; causing researchers to chase after initiatives because of the extra funding rather than from a deep commitment to the project; and the peer-review process being perceived to

be less rigorous. It was argued that directed initiatives are not efficient – the smartest researchers will always use the best approaches to address the most pertinent issues – but recognised that Research Councils run them in order to leverage money from the government.

8. Do you consider that the government is placing too much emphasis on research funded by the Research Councils becoming more closely aligned with the needs of the economy?
   Yes 28; No 10

It was acknowledged that in return for its investment in the science base the government has a right to expect an economic return, but argued that there is too much emphasis on short-term rather than long-term benefit. Universities are most effective in performing fundamental research whose economic value may only become apparent in the longer term. There should be a separate pool of funding for more applied research, as indeed is the case with the HEIF fund.

9. Are there sufficient opportunities for young investigators to obtain Research Council grants in your area?
   Yes 5; No 32; Don't know 1

A large majority considered that there are too few schemes for young researchers, and/or too small funding pots in such schemes, resulting in competition being "horribly fierce". A very strong track record is needed to win Research Council funding, and the adverse situation for young researchers is exacerbated by the relative decline in responsive mode funding.

10. Do you expect that the introduction of full and economic costing (FEC) will enable your department to meet properly the costs of research projects?
    Yes or qualified yes 8; No 20; Too early to tell 10

Some respondents were strongly negative, but the majority expected some improvement, depending on the balance of funding sources used and the proportion of FEC that Research Councils, charities, government departments, the EC and industry end up paying. Seven expressed direct concern that it could result in fewer research grants being available, partly through applications to charities and the EC being disadvantaged. This would be disastrous for the biosciences in view of the growing competition from countries like the US and Japan.

11. How concerned are you that government demands for accountability in the use of research funding, or in the recovery of FEC, will place a heavy bureaucratic burden on researchers?
    Seriously, very, extraordinarily or increasingly concerned 21; Concerned, quite concerned 11; not too concerned, not concerned 5; too early to tell 1

There was almost unanimous agreement that the administrative burden on academic staff is already high, and continually growing. Any disproportionate increase could further drive researchers out of academic life, act as a disincentive to applying for grants, or reduce the precious time available for other key activities. Those who were not unduly concerned considered that their universities would provide appropriate software or algorithms to ease the task of calculating FEC. It is essential that university administrators communicate effectively with RCUK and HEFCE to ensure that they do not exceed the appropriate level of detail.

12. Is the current unit of resource for teaching biosciences adequate? If not, please indicate how this has affected biosciences teaching in your institution.
    Yes 4; No 33; no response 1

It was agreed almost unanimously that the unit of teaching resource is inadequate. The consequences noted most frequently were an inability to provide an appropriate level of practical teaching, field work or project work; an unacceptably high student:staff ratio adversely affecting the student experience; and an inability to renew and maintain high-cost lab equipment. Bioscience courses have to be cross-subsidised by various means, which makes them an attractive target for closure in order to reduce institutional costs.

13. Has the limited resource for teaching science caused your institution management to consider decreasing the class sizes and the diversity of science subjects taught?

Yes 8 No 29 No reply 1

The biosciences have not been affected by course closures to the same extent as the physical sciences. The loss of chemistry provision, which is an integral part of many bioscience disciplines, hinders bioscience teaching. Rather than class sizes being reduced, the norm is for them to have increased. Some of the less research-intensive universities have adopted a strategy of maintaining teaching numbers at all cost and have added new 'popular science' courses such as forensics or lifestyle biology, often without increasing staff numbers. Others reported that modules have been streamlined to cut out the less popular ones, and courses designed to share modules where possible in order to maximise teaching efficiency.

14. Is your Department able to attract a cohort of undergraduate entrants of as high a calibre as 10 years ago? If not, what differences do you note?

Yes, or qualified yes 18 No 18 Not relevant 2

There was a very mixed experience, with the leading universities and those perceived as up and coming tending to be still able to attract as strong cohorts as 10 years ago despite the increase in student numbers. Several observed that their best students tend to be from abroad. The expansion of medical school intakes has reduced the pool of the most able students available to the biosciences. Some noted that students are less able on entry despite having stronger paper qualifications, others that there is a longer tail of less able students. The most frequent criticisms of students were poor numeracy, followed by a lack of chemistry knowledge, then poor written English. It was suggested that the expansion of modular A-levels has resulted in students being less able to synthesise information from across modules and subjects. Students often need more initial support than former cohorts, but can achieve well eventually. On the other hand, some noted that other skills such as IT and verbal communication are better developed in today's students.

15. Has the increased PhD stipend in recent years led to the recruitment of higher quality PhD students?

Yes, or in some areas 9 No 27 Too early to tell 1 Not relevant 1

Most respondents reported no noticeable change. A minority commented that PhD students are driven by the science and that stipend is not that critical; the reputation of the department is also likely to have an influence. A larger number commented that the increase in PhD stipends coincides with an increase in graduate indebtedness and since the PhD stipend is still less than can be earned elsewhere it is not an attractive proposition. The Research Council stipend is still significantly lower than that offered by the Wellcome Trust, which has a record of attracting excellent students. Some respondents commented that undergraduate courses do not prepare students as well for lab work as they used to. Finally, postgraduate students need to be able to see a longer-term, well-paid career route in science, which is currently lacking.

16. Are the additional funds made available for PhD training and career development of young scientists following the recommendations in the Roberts Review sufficient to enable you to enact the improvements called for in the Review?

Yes 10 No 19 Partly 3 Too early to tell 1 Don't know 3 No response 2

Mixed views, but a majority find the new money alone insufficient to satisfy the intended purpose. Several noted that the money has not filtered down to department level. Those responding positively tended to be already heavily engaged in providing broader generic skills training and not dependent on the new money as a primary source of funding

17. Do you experience difficulties in recruiting and retaining high calibre teaching and research staff? If yes, what do you consider to be the chief contributing factors?

Yes 27 No 9 No response 2

A large majority experiences difficulty, due to a complex mixture of factors that varies between institutions. This includes: the level of remuneration (stated particularly in relation to the high cost of living in London), job insecurity and poor career structure, difficulty in obtaining funding for a newcomer to establish a lab, competition between universities to recruit the best researchers, location of institution and size, and the perceived worsening in job environment (reduced academic freedom, greatly increased administrative bureaucracy, the tendency to separate research and teaching functions, perceived lower

status of academics).The RAE is seen to have driven the competition to acquire star researchers and the change in research /teaching balance.

18. Do you see a clear differentiation between applied research that could be funded through the RAE and that more appropriate for "third-stream" funding?

    Yes 13 No 19 Don't know 5 No response 1

Most respondents had a definite view on this question, but opinions were fairly evenly divided. Some stated that the functions of the two funding streams are particularly blurred for biosciences because of the strength of the biotech sector and strong encouragement to commercialise research discoveries. The RAE is often criticised for discriminating against applied research, but the experience of the 2001 Biosciences RAE panel was that very little applied research was actually submitted.

19. Does your Department seek "third-stream" Higher Education Innovation Funding? If so, how easy is it to access?

    Yes 16 No 15 Don't know 5 No response 2

Evenly divided. Those that have obtained such funding have often done so as part of a broader university initiative. The funding was considered to be no more difficult to access than Research Council funding, but the process is radically different and it is valuable to have experienced staff with specific responsibility for facilitating this route.

20. Do you believe that there is good engagement between your department and industry?

    Yes, or reasonable 26 No 12

A large proportion of heads consider that they have good engagement with industry. Many of those who said the links were only reasonable or poor indicated an intention to improve them, but in some instances were unsure how to make the right contacts (see question 20)

21. What could be done to improve further the collaboration between your department and industry?

    Times mentioned: Better communication, better appreciation of each other's capabilities and requirements 10; Improved working practices to give academics more time to look for industry collaborations 7; More collaborative training schemes such as CASE and ROPA 4; Stronger industry pull 3

Mechanisms to improve communication and aid an understanding of each sector's capabilities and requirements were highlighted. This could be achieved by increasing the number of collaborative training awards, and by incentives to increase the industry pull for collaboration. At the same time the work load on academics needs to be decreased, whether by decreasing the student: staff ratio, reducing the amount of bureaucracy, or by other means, to give them time to pursue industrial interactions.

Annex 3

BIOSCIENCES FEDERATION

Strategic science provision in English universities

A response from the Biosciences Federation to the Commons Science and Technology Committee Inquiry

January 2005

The Biosciences Federation was founded in 2002 in order to create a single authority within the life sciences that decision-makers are able to consult for opinion and information to assist the formulation of public policy. It brings together the strengths of 35 member organisations, including the Institute of Biology, which represents 45 additional affiliated societies (see Appendix). The organisations that have already joined the Biosciences Federation represent a cumulative membership of some 65,000 bioscientists and cover the whole spectrum from physiology and neuroscience, biochemistry and microbiology to ecology and agriculture. The Biosciences Federation is a registered charity (no. 1103894).

Responses to the particular points identified by the Committee

The impact of HEFCE's research funding formulae, as applied to RAE ratings, on the financial viability of university science departments

1. Income from both research and teaching is vital for most universities, and the challenge is to manage the balance between these according to the standing of departments. Research in universities has been funded at very much below the full economic costs for at least 20 years. The steep gradation in QR funding between RAE 4 and 5 ratings following the 2001 RAE exercise has impacted particularly on the financial viability of departments ranked below 5, and has been cited as a factor in recent well-publicised decisions to close physical sciences departments. Universities are increasingly pursuing strategies to maximise QR income, and focusing resources on groups capable of achieving 5 or 5* grades. Science departments scoring below 5 are vulnerable to closure for strategic reasons because of the extra expense for laboratories, technicians and equipment required for teaching as well as for research. It is often assumed that biosciences have been less affected than physical sciences because they have been relatively successful in retaining student numbers. But closures of departments and courses are beginning to impinge on the full breadth of biology, including some of the more molecular areas and particularly applied areas such as agriculture. Furthermore, threats to the viability of disciplines such as physics and chemistry are threats to the underpinning support of the current excellence of UK biosciences.

2. Both the provision of additional funding through the Research Councils to enable universities to recover the full economic costs (FEC) of research, and the change in RAE 2008 to a grade

profile approach, could improve the financial viability of university science departments. The latter may remove the current financial 'falling off a cliff' that results from a drop of RAE grade below 5, but this depends entirely on the weightings allocated to the new star grades for individual researchers. It remains essential that the very best research is funded at an internationally competitive level, but the weighting for work of national importance that has the potential to develop to become internationally competitive needs to be restored to something like its value prior to RAE 2001.

The desirability of increasing the concentration of research in a small number of university departments, and the consequences of such a trend

3. The Biosciences Federation recognises that critical mass of researchers and good shared facilities are often central to good biological science. In many areas of biology that require large facilities or specialised expertise, the concentration of resources is particularly necessary and, in any case, an inevitable consequence of a finite budget if high quality outputs are to be maintained.

4. However, the Biosciences Federation has argued consistently that the grade weightings applied after RAE 2001 have led to too much research concentration; it is already greater than in most comparable countries. For many subjects there is little evidence that research is more productive in large units (1), and in many disciplines it is clear that small groups can do research of international excellence. The Biosciences Federation is concerned that further concentration could eliminate whole areas of research and expertise from English universities and reduce the strength in breadth of knowledge and opinion that characterises the UK in international surveys (2). It is to be hoped that the grade profile approach in RAE 2008 will prove to be efficient in identifying and supporting pockets of research excellence in otherwise less research-intensive institutions.

5. Other likely consequences of a trend towards more research concentration include:
   - restricting the availability of research-informed teaching;
   - creating problems for less research-intensive universities in recruiting and retaining staff;
   - making it more difficult for new areas of research to emerge;
   - hindering the formation of new research teams outside the main centres and improving the performance of such units;
   - reducing the capability to tackle regional research problems;
   - loss of talented researchers to overseas institutions

The implications for university science teaching of changes in the weightings given to science subjects in the teaching funding formula

6. In a survey of Heads of Biosciences Departments that the Federation undertook in the autumn of 2004, 87% of respondents considered that the current unit of resource for teaching biosciences does not meet the costs of course provision. The consequences noted most frequently were an inability to provide an appropriate level of practical training, field work or project work; an unacceptably high student:staff ratio that adversely affects the student experience; and an inability to renew and maintain high-cost lab equipment. Biosciences courses have to be subsidised by various means, which makes them an attractive target for closure in order to reduce overall institutional costs.

7. Evidence has been emerging that the difficulty in providing adequate practical training in undergraduate courses is causing problems for the pharmaceutical industry. In his role as Chair of the Association of the British Pharmaceutical Industry Academic Liaison Group, Dr Malcolm Skingle (GlaxoSmithKline) told the Federation: "International pharmaceutical companies have located in the UK in order to interact with the excellent academic research base. In recent years pharmaceutical companies have been alarmed to note that biosciences graduates frequently lack practical skills that would formerly have been taken for granted, and this has encouraged companies to recruit more staff from abroad."

8. The campaign by science-based organisations deterred HEFCE from splitting subjects in teaching price band B in 2003 following its consultation on the future teaching funding method. Save British Science pointed out, however, that the revised weightings that HEFCE introduced still meant a significant shift of funding from laboratory-based subjects to arts subjects. It is essential that TRAC methodology is used to determine the real cost of providing science courses, and for HEFCE to commit to meeting such cost. Any increase should not be achieved by shifting funds from one area of science to another, since this would defeat the primary objective.

The optimal balance between teaching and research provision in universities, giving particular consideration to the desirability and financial viability of teaching-only science departments

9. It is not possible to define an optimal balance since this will vary among institutions. For all institutions, overall income from teaching and research will have most impact on the viability of departments. For both pragmatic and financial reasons, there should be a broad spectrum of offerings whose appeal will vary according to the needs and interests of individual students. Instead of all universities attempting to market themselves on the same model, they should emphasise their distinctive qualities and philosophies with regard to the higher education opportunities they provide.

10. The question as to whether teaching can be separated from research has been raised in a number of consultations in recent years. Among Federation societies that submitted views to the current consultation, a large majority again insisted that exposure to research is needed to provide enthusiastic and informed teaching. Otherwise there is a risk of teaching becoming stale, outdated, and uninteresting. The Federation supports the view that specialised final year teaching, which is often influenced by the research interests of the department, is better provided by staff with first-hand experience of the research. Set against the general statement that teaching and research cannot be separated is the abundant evidence that staff who have been recruited to major teaching roles, and assessed primarily on their achievements and potential in teaching, can be very successful teachers.

11. Among less research-intensive universities there is scope for imaginative solutions for exposing final year undergraduates to research-informed teaching. These include developing creative links with neighbouring research-intensive universities, institutes or industries, whilst focusing themselves on resources and innovations in teaching. Consideration should also be given to alternative models of higher education. Two-year Foundation degrees in specialised, teaching-only institutions could be encouraged for many students, with transfer to research-

intensive institutions for an Honours year only for those both seriously considering, and capable of pursuing, a research career.

12. Provision of the current 3 or 4-year Honours degree with students having no access to research-informed teaching is considered undesirable, although it may be financially viable. Many university departments already survive on very little HEFCE research funding. Non-research departments would need to have a workload model that reflected the commitment to teaching, which would almost certainly mean a high student:staff ratio and consequently a further reduction in practical training. It is questionable how employable the graduates of such departments would be. It is likely that such departments would also experience difficulty in recruiting and retaining quality staff and maintaining morale.

The importance of maintaining a regional capacity in university science teaching and research

13. It is essential in a leading Western economy and society that all the major branches of science are represented in the UK as a whole, and that there is the capacity and expertise to perform competitive research in all these branches at least somewhere in the UK. But it is difficult to argue that all branches must be represented in all regions if there is not the student demand for the courses, the capability of winning significant academic research funding, or the pull from regional businesses to provide industrial research funding support.

14. Set against this, the disadvantages of not maintaining a regional capacity in science teaching and research include:
    - It is government policy to encourage more social diversity in higher education. Evidence shows that students from under-represented social groups are more inclined to live at home and study at a local university. If science disciplines are not fully represented this could lead to such students pursuing whatever courses are available rather than those that are of strategic importance to the UK.
    - The forthcoming introduction of increased tuition fees could lead to increasing numbers of students choosing to study at a local university.
    - The government is very keen to promote the development of small companies and existing science-based industries on a regional basis. Easy access to the science department of a local university is important for such industries in terms of providing consultation, research support and activities such as the KTP scheme.

The extent to which the government should intervene to ensure continuing provision of subjects of national or regional importance; and the mechanisms it should use for this purpose

15. The government should have the capacity to intervene, but first it must accurately characterise the problem, which has been brought about largely by a lack of cohesion in prior policy-making. For example, the present difficulties for the physical sciences are caused by a shortage of student demand for courses and an inability to recover the full costs of providing expensive science courses. Any action by the government must address these issues. The Federation would not support *ad hoc* subsidies to particular universities to maintain failing courses.

16. To address the demand issue, government action needs to invigorate science teaching throughout primary and secondary schooling, sixth-form colleges and Further Education colleges. This may need curriculum changes and improved resources for practical work as well as incentives for more good graduates to enter science teaching. The government should also encourage and support outreach activities from universities, scientific societies and research councils, for instance, and ensure that pupils are able to receive reliable advice on the opportunities that a training in science can open up. Bursaries in selected subjects may need to be offered to provide an incentive to study science in higher education.

17. The finance issue could largely be addressed by HEFCE identifying through TRAC methodology the real cost of providing science courses, and applying a more realistic unit of resource (see paragraph 6). This will be helped if the new grade profile approach in RAE 2008 leads to some relaxation in research funding selectivity, but 3 more years is a long time to wait for this development. Universities themselves have a responsibility to consider imaginative ways of sustaining the physical and applied sciences. For example, many crystallographers and enzymologists are chemists, and chemistry can be organised to generate stronger links with its end users in biosciences or materials science so as to reduce the overall costs to universities of maintaining chemistry expertise.

References

1. *Funding research diversity: the impact of further concentration on university research performance and regional research capacity.* A report by Evidence Ltd for Universities UK (2003)
2. *PSA targets for the UK research base.* A report by Evidence Ltd for the Office of Science and Technology (2004)

Appendix Member Societies of the Biosciences Federation

Association for the Study of Animal Behaviour
Biochemical Society
British Association for Psychopharmacology
British Biophysical Society
British Ecological Society
British Lichen Society
British Mycological Society
British Neuroscience Association
British Pharmacological Society
British Phycological Society
British Society of Animal Science
British Society for Cell Biology
British Society for Developmental Biology
British Society for Immunology
British Society for Medical Mycology
British Society for Neuroendocrinology
British Society for Proteome Research
British Toxicological Society
Experimental Psychology Society
Genetics Society
Heads of University Biological Sciences
Heads of University Centres for Biomedical Sciences
Institute of Biology
Institute of Horticulture
Laboratory Animal Science Association
Linnean Society
Nutrition Society
Physiological Society
Royal Microscopical Society
Society for Applied Microbiology
Society for Endocrinology
Society for Experimental Biology
Society for General Microbiology
Society for Reproduction and Fertility
UK Environmental Mutagen Society

Represented through the Institute of Biology

Anatomical Society of Great Britain & Ireland
Association for the Study of Animal Behaviour
Association of Applied Biologists
Association of Clinical Embryologists
Association of Clinical Microbiologists
Association of Veterinary Teachers and Research Workers
British Association for Cancer Research
British Association for Lung Research
British Association for Tissue Banking
British Biophysical Society
British Crop Protection Council
British Grassland Society
British Inflammation Research Association
British Marine Life Study Society
British Microcirculation Society
British Phycological Society
British Society for Allergy Environmental and Nutritional Medicine
British Society for Parasitology
British Society for Plant Pathology
British Society for Research on Ageing
British Society of Animal Science
British Society of Soil Science
Fisheries Society of the British Isles
Freshwater Biological Association
Galton Institute
Institute of Trichologists
International Association for Plant Tissue Culture & Biotechnology
International Biodeterioration and Biodegradation Society
International Biometric Society
International Society for Applied Ethology
Marine Biological Association of the UK
Primate Society of Great Britain

PSI - Statisticians in the Pharmaceutical Industry
Royal Entomological Society
Royal Zoological Society of Scotland
Scottish Association for Marine Science
Society for Anaerobic Microbiology
Society for Low Temperature Biology
Society for the Study of Human Biology
Society of Academic & Research Surgery
Society of Cosmetic Scientists
Society of Pharmaceutical Medicine
UK Registry of Canine Behaviourists
Universities Federation for Animal Welfare

Represented through the Linnean Society

Botanical Society of the British Isles
Systematics Association