

The Royal Society's response to the White Paper: *The future of higher education*

The Society welcomes this opportunity to comment on the Government's White Paper (WP) on the future of higher education (DfES 2003a). This response was prepared by the Society's Working Group on the Future Development of Universities, supplemented by the Society's Education Committee advised by a group of higher education experts, and has been endorsed by the Society's Council. The membership of each group is listed in Annex A. Other recent reports and responses to consultations by the Society relevant to the WP (Royal Society 1997a,b; 2001a–c; 2002a–d) can be found on the Royal Society's website (www.royalsoc.ac.uk).

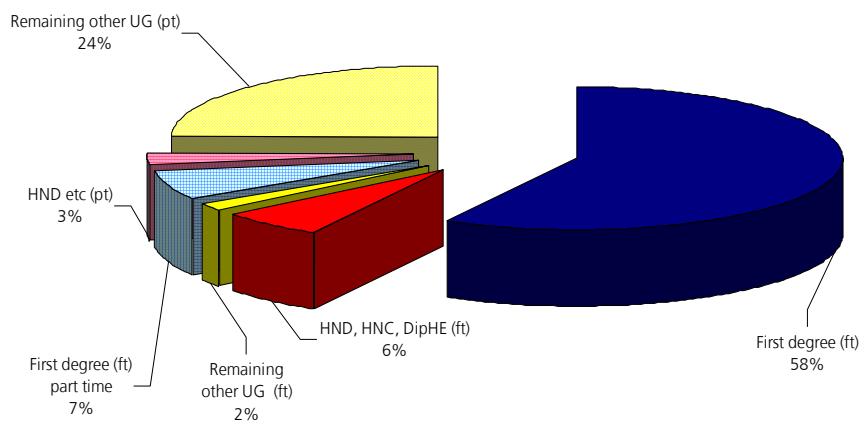
Summary

- 1 Higher education (HE) is an important component of the UK's education system and has a major role in maintaining its intellectual vitality and culture, as well as preparing its students for their future contribution to society. The structure of HE in England must take account of developments elsewhere within the UK, and the Society is particularly concerned at the apparent lack of coordination with the devolved Administrations and with the Office of Science and Technology. The structure must also be consonant with the European context for teaching, professional qualifications and research and much more work is required on the implications of the Bologna agreement on the future development of learning within UK universities. It is crucial to maintain the standard of the UK honours first degrees, so that they continue to be recognised as being equivalent to first degrees elsewhere in Europe.
- 2 There are significant problems facing higher education institutions (HEIs) over the next few years and **it is essential to develop a stable underlying structure for HE** that can provide a sound basis for institutions to develop their future policies.
- 3 **The universities are by far the major component of the UK's science base and close cooperation between the two streams of the dual support system is crucial to future developments.** The Society believes that the **present public research funding is already highly selective and further significant increases to research selectivity at a departmental level would have serious detrimental consequences.** Funding policy must recognise that it is individuals, not departments that undertake research, and it is important to maintain Funding Council support for excellent researchers wherever they are located.
- 4 The Society welcomes the Government's recognition that the HE sector in the UK is less well funded than in many other developed countries (WP 1.12), and that **the problem of low academic staff salaries needs to be addressed urgently, both in terms of the general level and of providing sufficient variance to enable particularly talented individuals to be rewarded adequately.** Relieving the sector of unnecessary administrative burdens from the centre would free up significant resources, and the VandeLinde review (WP 7.9) should strive to find the optimum balance between accountability and effectiveness.
- 5 **While an increased contribution from students is also required, this must take account of the varying future personal financial rewards from participation in HE, and must not substitute for existing public funds.** The stability and robustness of the proposals in the WP raise some serious

concerns on both supply and demand sides. There is a danger that demand for HE may be reduced rather than increased (WP 5.2). Institutions, most already in deficit, may take much longer to benefit from differential fees than anticipated. Given that arrangements could be made for the positive support of disadvantaged applicants, more flexible ways than imposing an arbitrary level of capping differential fees should be investigated. The Society is **also concerned about the possible impact of accumulating debt on the willingness and ability of graduates to pursue postgraduate studies**. This will have a serious impact on research and on the supply of teachers able to teach at honours level.

- 6 **The WP does not take sufficient account of the widespread and varied nature of HE provision**, and of those radical changes in HE and further education (FE) that have taken place over the past decade. HE is supplied by a widely differing set of universities and university colleges, by FE colleges, and by The Open University. It is delivered at undergraduate (UG) and postgraduate levels, in full-time (ft) and part-time (pt) courses:

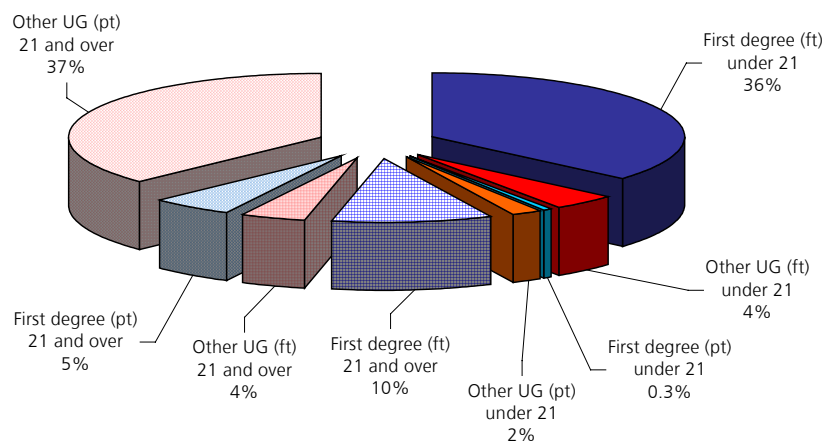
**UK undergraduate population 2001/02
(Total 1.6 million)**



Source: HESA (2003). Note that 'other UG (pt)' includes the 139,300 Open University students.

While over 70% of the students starting full- and part-time **first-degree** courses are under 21 years of age, the majority of students starting **all** undergraduate HE courses are now mature adults, and one-third of them are over 30 years of age:

**Age of first year UK undergraduate students (2001/02)
(Total first year UK domiciled students 0.65 million)**



Source: HESA (2003).

Opportunities to study at this level are already increasing through the developments in access provision and remedial teaching that have taken place in institutions, and potential candidates need to be helped to a better understanding of the many types of undergraduate courses available. Pathways should be developed, and student progression supported, between all the various levels that now exist and the new ones that are envisaged. This is the best way to tackle the fundamental problems of access, social balance and finance that will be sustainable in the long term.

- 7 The Society strongly supports efforts to improve student diversity within HE. **This should be achieved by creating extra support for disadvantaged students and positive incentives for institutions to provide appropriate remedial training.** HEIs also have a role in helping schools and FE colleges raise the aspirations of all young people.
- 8 The Society believes that it is crucial to maintain the standard and high reputation of UK honours degree courses, with for example their encouragement of student's critical thinking and, particularly in the S&T area, their exposure to the generation and analysis of data. **Personal scholarship and practical competence within a teaching unit underpins high quality learning as well as economic development and the advance of knowledge.** In particular, staff teaching honours degree courses need to be exposed to active research or similar activity relevant to their professional needs.
- 9 An important issue not raised in the WP is the need **to ensure that the under-representation of women within HEI academic staff is addressed**, especially in the more senior posts. The situation is particularly acute in science and engineering, and this is an area where the Society has taken a number of initiatives including those set out in paragraph 2.35.

Comments on detailed points in the White Paper

1 The need for reform

- 1.1 There are many problems facing HEIs as they move into the twenty-first century including:
 - the current overall under-funding of HEIs for teaching, research and interaction with the community; certainly the UK's investment in HE as a share of national wealth is lower than many other developed countries;
 - the urgent need to redress the general low salaries of academic staff and the difficulties of rewarding particularly high performing individuals, in order to attract and retain high quality staff;
 - despite there being little or no difference between the participation rates of young people of all social classes with suitable A-level passes, the overall low participation rate from families from 3b, 4 and 5 is of great concern;
 - the need to ensure that UK HE qualifications maintain their standing within Europe, and in particular the need to take forward the Bologna agreement;
 - the need to be able to compete with the US and European countries, and in the longer term with the emerging economies in Asia, for researchers, PhD students and in the research itself;
 - the high cost of many areas of research.

Many of these problems are further compounded by the need to increase the participation rate and to widen access.
- 1.2 It is essential to develop a stable underlying structure for HE that can provide a sound basis for institutions to develop their future policies. While there are important urgent short-term problems, these need to be addressed within the framework of a long-term plan for the sector.

2 Research excellence – building on our strengths

- 2.1 The universities are by far the major component of the UK's science base and close cooperation between the two streams of the dual support system is crucial to future developments. Hence it is important that no one side should be making major changes in research funding unilaterally.
- 2.2 University research in the UK has a general high international standing across the disciplines. One indicator of this is the higher than average number of highly cited papers published by the UK across most disciplines. Furthermore, despite this wide coverage, which is appropriate for a country with a diverse economy and interests, UK research is also cost effective in terms of both the unit cost of the publications and of the citations as shown by the table below. These results are for research undertaken in the mid-1990s, before the recent increased selectivity, and it is not clear from these that any further increase is required.

Publications per \$million HERD		Citations per \$million HERD	
UK	13.4	UK	42.8
Italy	9.2	US	36.7
France	8.8	The Netherlands	27.3
Sweden	8.7	Sweden	27.8
The Netherlands	8.0	France	25.2
Germany	7.9	Germany	23.6
US	7.6	Italy	21.3
Japan	6.0	Japan	14.1

Source: European Commission (2002). (HERD is total expenditure on HE R&D).

- 2.3 While citation analysis can be helpful in showing gross comparisons and indicating temporal trends, it is less helpful in analysing the detailed situation. The Engineering and Physical Sciences Research Council (EPSRC) has coordinated five reviews using panels of non-UK-resident experts of the UK's standing in chemistry, physics, materials science, computer science, and engineering (see <http://www.epsrc.ac.uk/WebSite/default.aspx?ZoneID=6&MenuID=695>). These reviews report that the highest quality research in the UK is of world-leading standard, but in many areas there appears to be less strength in depth of quality research than in other advanced countries. The latest review, on chemistry, also noted that there was less indication than hitherto of work that may lead to significant breakthroughs. Possible causes put forward in some of these reports were short-term funding and the lack of infrastructure, both of equipment and technical support.
- 2.4 The financial problems relating to existing research activities are largely the result of long-term under-funding of the Funding Councils' stream of the dual support arrangements, and insufficient indirect costs being recovered on research funded through grants and contracts with charities, Government Departments and public and private sector users. The additional funding provided both to the Higher Education Funding Council for England (HEFCE) and for Research Council grant indirect costs (from 2005) in the recent Spending Review should help to redress the dual support imbalance, but there must be an integrated strategy for the future funding by Funding and Research Councils. The new Transparency Review Accounting (TRAC) methodology being developed for costing within the sector should help with this and also the costing of research projects undertaken outside the dual support arrangements.
- 2.5 The creation of an Arts and Humanities Research Council (WP 2.22–2.23) is an important and welcome development, recognising as it does that there are no hard and fast divisions across scholarship and research. It provides a basis for the development of more project support in these subjects, and also for the growing interaction with research funded by the other Research Councils. This is a two-way interaction with, for example, design being crucial to many engineering problems and for the performing

and other arts to experiment with techniques to exploit new underpinning technologies. However, the arts and humanities are of importance in their own right, both from cultural and utilitarian points of view. It is, for example, essential for the Government and business to be able to call on expertise at short notice in the language, culture or history of a specific area or country.

Relationship between teaching and research – the fundamental importance of scholarship

- 2.6 Scholarship is necessary as a background to any professional activity in the universities, indeed throughout education. There is no single definition of scholarship across academe, but it may involve, amongst other things, undertaking research, reviewing existing knowledge, and understanding the needs of students and the potential users of research outcomes. The balance of these will vary depending on the discipline and the type of activity it is supporting. Equally, it is important to recognise that the mediation of staff development through scholarship by, for example, participation in seminars, attendance at national and international conferences, and the use of libraries and databases, requires proper funding and time management.
- 2.7 It is also important to recognise that 'research' means differing things even within a discipline and certainly across disciplines. It includes the generation of new knowledge, and the novel analysis of, and synthesis from, existing knowledge. There is a wide range of costs associated with these.
- 2.8 A key issue raised in the WP is whether scholarly teaching requires an active research programme. It is fundamental to the concept of HE that students, particularly those on honours first-degree courses, are both exposed to at least some frontiers within their subjects of study, and enabled to continue to keep abreast of developments into the future. The strong linkage between teaching and research was acknowledged in *Investing in Innovation* (HM Treasury 2002, paragraph 3.42). The WP quotes the Hattie and Marsh meta analysis (Hattie and Marsh 1996), which purports to show little or no correlation between the standards of teaching and research. However, the studies examined in this paper are very largely on the basis of individual staff performance in the two activities, whereas the Society believes that it is the overall performance of the teaching unit that needs to be considered. The fundamental issue is the creation of an appropriate high quality learning environment, to which excellent teaching is a necessary but not sufficient input. Here there is likely to be synergy between quality of the learning environment and research. The impacts of research within a university department are many: the attraction of good staff, the attraction of highly qualified and motivated students, and the incorporation of research into the curriculum, especially in research projects that are an integral part of the final year of an honours degree. The latter appears to be of particular interest to future employers.
- 2.9 Clearly the amount and type of research that is helpful in the teaching context depends on the type of course and discipline. It may be helpful to distinguish between honours first-degree courses and 'other undergraduate' courses, and the balance between the two in the institution or department. The Society is particularly concerned about the research support for first- and higher-degree taught courses associated with professional qualifications, such as those in engineering, medicine, dentistry and law. Here it is essential that undergraduates are made aware of developments and the associated research methodologies likely to change current professional activity.
- 2.10 For vocational courses at any level, it is also important for departments to have staff with an up-to-date knowledge of the practice of the profession in question through, for example, consultancies, joint activities with users, or recent employment in relevant jobs. Again, however, the need is for a corporate level of expertise, not necessarily a requirement for all members of staff.

Purpose and structure of HEFCE funding of research

- 2.11 It is of concern that the WP does not explain in detail the purpose of HEFCE recurrent research funds (except in terms of ‘supporting the underpinning research capabilities of institutions’) – although in a number of places it is stated that it would be used to ‘reward’ particular activities. However, within a dual funding arrangement, where the Research Councils and – largely in the biomedical area – the charities provide project funding, HEFCE funds are to provide a stable foundation for the formulation of research proposals and the underpinning facilities for undertaking grant-funded research. First and foremost, the funds are required to provide the salaries of academic staff while they are undertaking research, together with the associated indirect costs and the basic accommodation. Secondly, the funds are required to provide support technicians, laboratory furnishings, IT infrastructure, and access to libraries and databases. The current support per member of research-active staff for departments rated 4 (about £10,000 for a laboratory based subject) does not cover the salaries and related indirect costs of research-active staff, which will have to be found from other sources if research is to continue. This funding would be required even if the research were undertaken elsewhere at a national or international facility, or in collaboration with a larger and better-equipped research-intensive department.
- 2.12 In considering critical mass, it is helpful to separate two requirements:
- to make best use of expensive facilities;
 - to provide intellectual stimulation.

In both cases, but particularly the first, the required unit size is highly dependent on the discipline, and varies within disciplines. Where critical mass is needed to justify a large capital facility this can be provided from a national or international centre, or by collaboration either between sites of equal size, or between smaller sites and a well-equipped larger department at a research-intensive university. It is important to recognise that those using facilities elsewhere can have a relatively small home group, as the intellectual stimulation can come from email communication and also visits to the centre. While the creation of regional, national and international centres needs central coordination and management, for other collaborations it is important that these should be needs driven. While funds should be available for such activities, and funding arrangements should encourage rather than discourage collaborations, experience has shown that top-down collaborations have been disappointing in their outcome and may waste significant amounts of money.

- 2.13 It is notoriously difficult to make selectivity comparisons. In some cases this is because of the different structures for publicly funded fundamental research. In the UK and, to a lesser extent, the US this is predominantly in the universities, while in France and Germany much of it is undertaken in research institutes – principally the CNRS and Max Planck institutes respectively. Even the comparison between the funding distributions in the US and the UK has to be handled with care. The figures quoted in the WP (WP 1.14) are misleading, because the 235 research and doctoral universities and colleges in the US, out of the 1600 four year institutions, account for 55% of the science and technology first degrees and 70% of masters degrees. This puts the apparent discrepancy between the US and the UK in rather a different light, even before account is taken of the size of US institutions and the more general curriculum of the US first degree. That does not necessarily mean that the current degree of selectivity is right; rather, as with the correlation between research and teaching decisions, policy should not be based on unsatisfactory or misleading information.
- 2.14 The Society wishes to stress that it is individuals and groups that undertake research and not departments, and certainly not institutions. Hence, consideration of selectivity on an institutional basis is of limited value.

- 2.15 There may well be a different critical mass consideration for the minimum number of PhD students in a department or institution, as discussed in paragraph 2.29.
- 2.16 It is most important that complementary policies for the use of Funding Council monies should be developed alongside those for the Research Councils, which currently fund significant research in 3a and 4 rated departments, supporting some excellent individuals and some significant niche research programmes of relevance to local and regional needs, for example in medicine and in engineering.

Research Assessment and its use to determine the level of recurrent HEFCE research funding

- 2.17 The research assessment exercise (RAE) is currently being reviewed by the group chaired by Sir Gareth Roberts, and the Society has submitted its views to this. This review may well propose a satisfactory solution to some of the issues raised in the WP, and the Society urges the Government not to pre-empt this review and the associated consultation period.
- 2.18 One issue of significance to the suggestions in the WP is the fact that the methodology used in the RAE and the subsequent use of research ratings for determining funding did not aim for total comparability in ratings across subject boundaries, apart from the 5* ratings, which were moderated using international referees. It is highly likely that there are discrepancies at rating boundaries, and the ratings are not robust enough to justify the huge difference in unit funding between 4 and 5 rated departments. This certainly has to be borne in mind if funding is removed from 3a or even 4 rated departments. As the Society warned in its evidence to the Roberts review of the RAE, with the arrangements used in the 2001 RAE it was possible for a department with over 50% international quality research to receive a 3a rating. Its submission proposed the use of departmental profiles rather than the problematic mapping of individuals and research groups onto a limited number of rating levels.
- 2.19 The WP identifies the lack of discrimination at the 5 and 5* levels (WP 2.15). While this is a serious issue, commented on in its submission to the Roberts review, the Society does not believe that an emergency designation of 6* at the expense of 3a and 4 departments is a satisfactory way forward. The Society's suggestions for the use of profiles submitted to the Roberts review can be tailored to provide both more discrimination within 5 and 5* rated departments, and also support for research excellence wherever it is located – even within some lowly rated departments.
- 2.20 The WP raises the problem of the funding of those English universities that are able to compete on an institutional basis with the best in the world, and how to provide sufficient support to them for the future (WP 2.17). These universities tend to have the largest departments, and are faced with particular problems:
- they may have a higher proportion of staff who are world leaders and hence, to be competitive, employers face higher than average academic staff costs;
 - they are likely to have larger research teams, with a requirement for stable funding for support staff at all levels from non-graduate technicians to long-term postdoctoral 'research officers';
 - they will tend to have larger capital equipment and building requirements.

The WP has attempted to find ways of amending existing arrangements to increase the income to such universities, which have a predominance of 5 and 5* rated departments. However, this issue should not be allowed to overshadow the needs of the entire sector, and requires further consideration.

Support for emerging departments and subjects, and collaborations

- 2.21 Research is almost always a collaborative exercise of some kind, but it is important to enquire further about the underlying statistics used to support a particular policy line. Academics, especially in science, undertake much of their research with either PhD students or postdoctoral research assistants. The high number of papers with at least two authors is therefore not unexpected, and has long been the case, although in the past some PhD students have merely received an acknowledgement at the end of the paper. Furthermore, postdoctoral research assistants and PhD students very often move on before the paper is published and this inflates the number of papers with two or more institutional addresses, and the apparent level of international collaboration. Nevertheless, there has almost certainly been some increase in more formal collaborations.
- 2.22 There is no recognition in the WP that, without the funding to pay the academic staff salaries and associated indirect costs while they are undertaking research, they would not even be able to undertake research through collaborations. Ceasing the Funding Council support associated with 4 and 3a departments is likely to lead to a number of unfortunate consequences:
- it would make many universities unattractive to high quality staff;
 - it would ossify the system with the present 5 and 5* rated departments, even after the inclusion of some rising 4 rated departments;
 - in many subjects the loss of 3a and 4 rated departments would have major impacts within the English regions outwith the South East and East. Clinical based research is an important area that will be particularly badly hit, and only partially helped by the HEFCE's emerging subjects arrangements;
 - some high quality Research Council funded projects with some outstanding individuals in 3a and 4 rated departments will be put in jeopardy;
 - there are severe implications for medical education and the links between academic departments and the clinical needs of the NHS;
 - unless otherwise supported through another stream, the underpinning of joint projects with the local community will be put in jeopardy. In a study for the HEFCE 2000 review of research funding and policy (HEFCE 2000), admittedly on the basis of the 1996 RAE, the gearing of private sector money by 3a and 3b departments was in some cases higher than for 5 and 5* rated departments;
 - it ignores the need for professional development within departments offering honours degree courses.
- 2.23 One of the purposes for HEFCE recurrent funding is to support emerging areas. It should also be noted that a number of significant breakthroughs have occurred in some departments that at the start of the research might not have received a high rating – eg liquid crystals (Hull), DNA fingerprinting (Leicester), magnetic resonance imaging (Nottingham). Furthermore, some of the research successes in the new universities have been where the department has capitalised on a niche expertise or regional needs.
- 2.24 As an emergency measure, the HEFCE has recently identified seven 'emerging' Units of Assessment (nursing; studies allied to medicine; social work; art and design; communications, cultural and media studies; dance, drama and performing arts; sports related studies) for targeted funding of 3a and 3b departments, subject to satisfactory plans from the universities. This is, however, not consistent with support for 4 rated departments in these subjects being cut. Furthermore, there is now an urgent need to identify other emerging areas, and also promising emerging departments in other disciplines, that should be nurtured.

Capital funding for research

- 2.25 One of the major problems over the past few decades has been the difficulty in maintaining the capital infrastructure of the universities, and in particular the buildings. The restoration of a capital funding

stream is welcome, but much remains to be done. Significant amounts of the additional funding have had to be used to satisfy developing legal requirements in the areas of health and safety, disabled access and regulating experimentation with animals.

- 2.26 In the case of research buildings, the situation is complicated by the widely differing current state of buildings, but in principle there may be a case for increasing the selectivity in capital funding, with major facilities being in general housed in the larger higher-rated research departments. The Research Councils fund much of the large research equipment in universities and it is important to ensure that this is appropriately housed. This requires suitable coordination arrangements with all of the Funding Councils.

Research management

2.27 It is important to recognise that there should be strong management for:

- setting overall strategy for the country, institution and department;
- the recruitment and development of staff;
- the use of large central capital resources.

But it is essential that within this strategy researchers should be given freedom to develop their research programme. Management arrangements appropriate to the sector need to be developed together with a methodology for evaluating good management practice in research and widely promulgating these.

Postgraduate training

2.28 The Roberts review of the supply of people with science, technology, engineering and mathematical skills was a crucial input in many of the areas relevant to the WP, and the Society welcomes the Government's positive response to the funding implications set out in *Investing in innovation* (HM Treasury 2002).

2.29 The Society agrees that it is important for PhD students to have a stimulating environment. Again collaboration, perhaps on a more formal basis, can be arranged, whereby PhD students in smaller departments have the opportunity to meet and share courses with a wider community. This was considered extensively during the 2000 HEFCE review of research funding and policy (HEFCE 2000). The Society would caution against inflexible guidelines, and the Research and Funding Councils should consider jointly what appropriate quality control and other measures should be put in place.

Researchers

2.30 Stable and attractive career structures throughout the universities are essential if the UK is to maintain its high standing in research and teaching. This means appropriate arrangements for all staff, not just the top researchers, and also includes adequate provision for technical support.

2.31 The Society welcomes the additional 1000 five year competitive postdoctoral fellowship positions (WP 2.29), with the holders being trained and introduced to teaching duties over the period of the fellowship. It recommends that such fellows should be able to apply for Research Council project grants. These 5 year fellowships complement the Society's University Research Fellow scheme, which provides funding over a longer period to enable top-flight young researchers to establish themselves within the international research community. The Society welcomes the commitment to be consulted over the establishment of these fellowships.

- 2.32 There are about 30,000 postdoctoral researchers in the university system. Some of these will wish to stay in university research while others will move to posts outside the sector. As training for researchers and in order to provide a continual stream of fresh ideas it is essential to maintain a constant stream of postdoctoral researchers. Hence the Society supports the initial appointments on short-term contracts, subject to the universities providing high quality personnel support. Nevertheless, the Society's submission to the Science and Technology Committee's Inquiry into contract researchers (Royal Society 2002b) explained why there was a place for some permanent postdoctoral research posts within larger research teams. There is also a need for more highly skilled technicians (Royal Society 2002d). This mix of permanent technicians and 'research officer' style postdoctoral researchers alongside short-term postdoctoral researchers is normal in research institutes and in US universities, but for financial reasons has been largely lost from universities across Europe.
- 2.33 The WP suggests that there should be more research-only posts as part of the structure of academic staffing at universities (WP 2.28). While there is scope for some research-only academic posts, especially at formative stages of an academic career, care has to be taken not to lose the essential feature of a university-based system. There is a danger of turning the research activity into an institute-based operation. For high flyers, both at senior postdoctoral level and within the Professoriate, such as the Royal Society Research Professorships, there is a case for the opportunity for an extended (several years, but time-limited) sabbatical from undergraduate teaching and administration duties. Such staff should nevertheless still be expected to supervise and mentor PhD students and young postdoctoral researchers. This puts demands on departmental management to ensure that performance in all staff activities is recognised.
- 2.34 On the research side, as has already been stressed, the Society is concerned about the proposals for reducing or eliminating the HEFCE funding associated with 3a and 4 rated departments as this appears to ignore the fact that Funding Council support is required to pay the research part of the salaries of research-active staff.
- 2.35 Measures to address the under-representation of women in scientific research especially at the highest levels are not mentioned in the WP. The Society is committed to a comprehensive programme of action to try to increase the number of women who remain in science and reach senior positions. It has been running the innovative Dorothy Hodgkin scheme for a number of years and will be launching the new UK Relocation Fellowships in 2004.

3 Higher education and business

- 3.1 While the WP concentrates its knowledge transfer proposals largely at the business sector, it should also be recognised that the HE sector also has much to offer the public services, to help make better use of the huge resources devoted to health and social problems.
- 3.2 There are two levels of interaction with users involving:
- new knowledge and skills;
 - existing knowledge and skills.

Research-intensive departments within HEIs need to be involved with both of these, and it is important that all departments are fully involved with the second. Methods of interaction will differ. New knowledge exploitation might involve spin-off companies, collaborative projects in which both parties provide funds and intellectual input, licensing and joint agreements to develop products and services with users, whereas for the second, the interaction will be mainly through consultancy and courses. Such courses

would range from foundation through to postgraduate degrees, and in the provision of shorter specialist courses, tailored to specific identified needs.

- 3.3 The WP proposes a 'clear and crucially important mission in knowledge transfer for the less research intensive universities' (WP 3.5). This involves building up an in-depth understanding of existing knowledge and skills and being able to apply this to problems faced by local businesses. While the Society understands the Government's desire to find a distinctive role for universities receiving only small amounts of research funding, it is concerned that this might be seen as downgrading knowledge transfer as an activity, which should be seen as an essential role for all HEIs, and one where **all** institutions may excel irrespective of their research rating. It should be recognised that many activities in this area are actually 'applied research' or 'development', and can be an important component of scholarship underpinning relevant courses. Hence it is imperative not to compartmentalise activities too strictly and for this work to be properly funded. Although the institution should be able to raise income through consultancies, the staff time and other costs required to maintain the required level of knowledge and understanding are significant and have to be met from institutions' overall resources. The decreasing unit provision for teaching and a lack of research funding has reduced institutions' ability to provide sufficient staff time for such activity.
- 3.4 The WP proposes the funding of 20 Knowledge Exchanges at rates up to £500,000 per annum for each of 5 years (WP 3.7). It is essential that these are used mainly to strengthen the corporate knowledge and skills base within the institution or institutions within a consortium, and not devoted largely to establishing large bureaucracies to over-manage and advertise such activities. If it is to succeed, this style of activity needs to become a normal component of the work of the academic staff within the institutions, rather than a special bolt-on activity.
- 3.5 The Knowledge Exchanges are additional to the previously announced University Innovation Centres and the New Technology Institutes. It is crucial that all these initiatives are properly coordinated, and that they evolve towards sustainable arrangements owned by the academic staff in the sector. Furthermore, such initiatives are no substitute for the proper funding of activities throughout the sector. Indeed, where funding is tight, increased hypothecation can be less efficient in the use of resources across the sector as a whole.
- 3.6 Underlying the concerns about relations with business is the poor perception of the level of exploitation of the discoveries within the UK science base compared with the record of the United States and Japan. However, this appears to be an issue throughout the European Union, where if anything the UK is one of the better performers, with its science base having a similar performance to the US. This problem is being studied further by the Society, but one of the main issues may well be the very low number of researchers within European-based firms, outside of the aerospace and pharmaceutical industries, compared with both the US and Japan, to take forward the bulk of the exploitation.

4 Teaching and learning

- 4.1 It is important to recognise the diversity of education provision that is covered by the terms 'higher education' and 'undergraduate education'. Within the UK the usual major distinction is between 'first degree' and 'other undergraduate' courses, but the latter cover a wide range. In the Higher Education Statistical Agency (HESA) definition it includes HND/HNC and DipHE courses and all of The Open University's courses. The OECD defines two classes of tertiary education. Type A courses are largely theory based and designed to provide sufficient qualifications for entry to advanced research programmes and professions with high skills requirements such as medicine, dentistry, engineering or architecture, and a minimum duration at tertiary level of 3 years (OECD 2002, pp. 375–376). Type B courses are typically

shorter than type A courses and focus on practical, technical or occupational skills for direct entry to the labour market, although some theoretical foundations may be covered in the respective programmes, with a minimum of 2 years' full-time equivalent at tertiary level. Type A includes the UK first-degree courses. When developing policies to widen participation and to broaden access to existing courses, it is important to consider what component of HE is being considered.

- 4.2 It is also important to take into account that the normal route for young people into certain professions is through approved and regulated first-degree courses, which often include minimum entry requirements as well as specified course contents.
- 4.3 There is an underlying assumption in this chapter (and the whole of the WP) that standards in HE will increase if teaching standards improve. However, the Society maintains that the Government's emphasis should be on achieving the highest quality *learning environment*, which includes not only teaching but also '*a culture of intellectual enquiry, sustained by continuing familiarity with original research*' (Royal Society 1997a, p. 2). Teaching standards will also be improved by a better understanding of the needs of the learner (i.e. students) and enabling these needs to be fulfilled. This requires in turn better appreciation of the different skills of research and teaching and the need for initial training to be available to new lecturers. Not all researchers are able to deliver high quality undergraduate teaching, especially at an introductory level where fundamental communications (including linguistic) skills are crucial. Conversely, not all teaching staff are suited to research. It is important for the overall work of the department that undergraduate and postgraduate teaching, curriculum development, research, and outreach to the community are distributed appropriately.

Information and advice on higher education courses

- 4.4 The *Guide to higher education* (WP 4.5) being produced by the National Union of Students is a good idea in principle, but its value depends on the measures of teaching quality that are used. It should be subject to the same scrutiny as any other public document for its 'accuracy, integrity, completeness and frankness' (QAA 2002, p. 4). However, important as written information is, other advisory arrangements need to be developed, especially for those who have lost direct contact with any educational institution.

Measuring and recording student achievement

- 4.5 The Society wishes to restate its conviction, voiced in 1997, that the honours classification system should be revised to create one that gives 'greater information on achievement' (Royal Society 1997b, p. 1), and it supports the proposal that there should be a review of the current system, but this must be owned by the institutions themselves, not imposed by a Funding Council. It must obviously also take account of the overall UK situation and arrangements being developed to take forward the Bologna agreement.
- 4.6 It also supports the use of transcripts and personal development portfolios (WP 4.8–4.10) for students and employers. These transcripts, if sufficiently detailed, will provide a measure of achievement that can usefully be compared with standard methods of assessment. They will also encourage the pursuit of lifelong learning and may, depending on employers' attitudes, help to balance assessment of students with unclassified degrees. They should build on the record of achievement being developed in schools and colleges. Employers will find such materials helpful in short-listing candidates, particularly if a national system for measuring individuals in an ever-broadening learner institutional population is developed, but they will not replace interviews as the ultimate decision-making tool. For posts in

research and development, evidence of practical training and independent practical research projects will be particularly important.

Professional standards and staff development

- 4.7 The Society welcomes the proposal for the Teaching Quality Academy (WP 4.14), provided that it subsumes rather than becomes an adjunct to existing agencies. It must actively promote continuing professional development (CPD) (cf. Royal Society 1997b, pp. 4–5) and promulgate best practice throughout the system. It is notable that as membership of the Institute for Learning and Teaching in Higher Education is voluntary it does not provide any indication of teaching competence. Teaching can be effectively evaluated by various subjective and objective measures, including performance management. Also, CPD as conducted by all institutions will need to be carefully planned in order to promote good practice throughout the system.

Degree standards

- 4.8 External examiners have a vital role to play in maintaining degree standards across the sector. There is a case for a thorough review of the present arrangements to see whether there is scope for improvement. The Society supports the Cooke recommendations (HEFCE 2002) for the publication of a summary of external examiners' comments, which should result in greater transparency and confidence that standards are being maintained. It is imperative that the UK plays its full and united role in discussions taking forward the Bologna agreement.

Teaching

- 4.9 If HE standards are to be maintained and improved, it is essential that the UK sector is able to recruit and retain staff of the highest calibre; this requires that salaries are commensurate and competitive. The Society agrees with HEFCE that recruitment in Science and Technology (S&T) related subjects is of especial concern, particularly in regard of the urgent need for mathematics, chemistry and physics teachers with a first degree in these subjects.
- 4.10 The Society endorses the view that teaching is 'a valuable and high-status career in its own right' (WP 4.17), but within an academic research environment the staff contribute in many ways to the work and success of their individual department and the institution as a whole. Their contribution to all these components should be properly recognised. Staff engaged solely in teaching will contribute to curriculum development and non-research aspects of scholarship such as liaison with employers, developing quality control measures, etc. In S&T subjects particularly, where there is a shortage of teachers, recognition of their contribution and achievements is especially important.
- 4.11 While the WP stresses an intention to enhance the status of teaching and learning, this will require sufficient funds. The new money resulting from differentiated fees will not become available until 2006, and even if universities charge the maximum fee, the amount generated is unlikely to be sufficient to support enhanced teaching needs.
- 4.12 The Society supports the intended expansion of the National Teaching Fellowship Scheme, but believes that this expansion should be carried out within 2 years if it is to have real impact.

Centres of teaching excellence

- 4.13 The Society approves of the designation of departments as 'Centres of Excellence' (WP 4.28). However, their particular value will lie in their spreading of good practice to other departments and other institutions. In this way, teaching and learning practices can be improved more widely. However, the widely differing pedagogic requirements for the differing courses within HE must be fully taken into account if the centres are not to cause tensions within the system.

University title

- 4.14 While the Society understands and supports the Government's wish to increase the status of HEIs that do not have research capability, it believes that extending the use of the title 'university' may not achieve this end and could have other undesirable consequences. It is not advocating that every individual department or school within a university should have its own PhD programme (paragraphs 2.15 and 2.29). However, there needs to be a consistent policy across the UK, and the proposals also have to be seen in the context of the Bologna agreement to harmonise qualifications across Europe.

5 Expansion of higher education to meet our needs

- 5.1 The Society does not believe that there is any 'right' figure for the percentage of the 18–30 year age group that should participate in HE, but strongly supports the Government's stance that all who could benefit from HE should be able to do so, provided that output standards do not drop and funding levels are sufficient. Since the present English participation rate (43%) is lower than that in Scotland (53%), about 50% would appear to be a reasonable target. However, this must not be seen as the only target. It is more important that all students choose the right course and start it at an appropriate time. Better advice, preparation and support should reduce the danger of unacceptable levels of dropouts. There is also no particular reason for specifying the upper limit of the age range to 30 years of age, and care must be exercised to ensure that those over 30 years of age are not disadvantaged by attempts to meet particular targets.
- 5.2 The Society accepts that some contribution from students or a graduate tax is unavoidable, but this must be truly additional and not a substitute for public provision. However, while there are some highly popular courses that could sustain a significantly higher fee than the capped £3000, for some HE courses such fees could result in a significant reduction in an already weak demand. This includes some science courses, which although being more expensive to provide than some humanities courses may not attract sufficient students at fees much higher than the present £1100 course fee. The Society also has concerns about the effect of differential fees on widening access to those institutions attracting the highest qualified students. Although maintenance grants will be paid to students from lower-income families, these will not be sufficient to offset the increased debt. In particular mature students may be unwilling to increase their family debt with significant course fees. Ethnic minorities are another group that may be more disincentivised by the introduction of these fees.

Changing the pattern of provision

- 5.3 The Society believes that the Government is correct in identifying OECD tertiary type B courses as the main expansion area with the highest likely demand coming from employers. It is vital that the new foundation degrees meet the specific needs of industry, and provide the technicians that are so

desperately required in industry, the classroom and research laboratories. Student demand is the main unknown over the proposal to significantly expand the foundation degree. Certainly there is a need to turn around the significant fall off in the number of students taking S&T HND/C courses, as the traditional intake to these courses has now opted for first-degree courses. The Society is concerned that particular effort needs to be made to design attractive and appropriate S&T foundation degrees of the required quality. It draws attention to the fact that of the 65 foundation degree programmes now in operation, only three are in science, just two are in engineering and there are no programmes in mathematics; like modern apprenticeships, they have yet to prove themselves.

- 5.4 The Society is concerned that a 2 year foundation degree course may lack the flexibility necessary to accommodate students who may need remedial training in mathematical skills. Standards and usefulness may also be in jeopardy if insufficient time is spent on developing the significant practical and analytical skills that are key to understanding the nature of scientific study, stimulating students' interest, and motivating people to pursue careers in science. This highlights the tension between establishing the foundation degree as a qualification in its own right as well as a step towards a first degree. This tension presents a huge challenge in terms of course design.
- 5.5 The quality of foundation degrees, in terms of academic standards, will have to be monitored strictly, and they will need to gain full recognition among professional science and engineering bodies. The Society advises against foundation degrees being designated as a 'sub-degree', as this immediately downgrades the perceived value of having such a qualification, and is only too likely to deter potential students from enrolling on such courses. It is essential that it gains recognition as a high standard and robust qualification in its own right, as is the highly regarded HND, and the Society supports the concept of Foundation Degree Forward to ensure that this happens.
- 5.6 In many cases major employers or consortia of employers will be involved in developing and funding foundation degrees, but the curriculum must strike an effective balance between specific skills training and academic studies.

Delivering higher education in further education

- 5.7 Many students considering a foundation degree will be mature and will be attracted by provision at the local FE college with links to an HEI. It will be important to strengthen these links and to ensure that there is sufficient funding and quality control.

6 Fair access

- 6.1 The Society welcomes the Government's desire to encourage a broader cross-section of the community to experience and benefit from HE. This is important both for social justice and to ensure that the country is able to make full use of all available talent. It welcomes the Government's commitment to reforming the provision of 14–19 education and improving the continuing participation of young people in education. Such provision needs to be planned and regulated as a coherent, integrated whole. It supports the Government in its subsequent proposals set out in *Widening participation in higher education* (DfES 2003b) that the key to achieving this is not by regulating HEIs' admissions policies, but through sufficient support of the primary and secondary school and FE college system so as to ensure entrants to HE reflect the diversity of the population and meet the appropriate admissions standards. However, given that the removal of social inequity in tertiary education is a stubborn problem, and that its solution will be a lengthy process, the Society agrees that HEIs have an important role to play in the short-term, including

developing relationships with schools and other initiatives to raise the aspirations of talented pupils that have no history of participating in HE.

- 6.2 The root problem of widening access lies in school where, from an S&T perspective, the low take-up of post-16 qualifications (AS levels, A levels, AVCEs and AMAs) increases recruitment difficulties to S&T courses in FE/HE. Progress requires a coherent, integrated system in which secondary and tertiary education systems are properly articulated. If, under the proposals given in *14–19: opportunity and excellence* (DfES 2003c), secondary education is to be structured into distinct academic and vocational channels flowing into the tertiary sector (universities, further education, skills provision, lifelong learning), then a consequent matching restructuring of provision in HEIs should be considered.
- 6.3 While the use of ICT to enhance learning in school science has over the past 15 years begun to pay dividends, schools are suffering from a lack of laboratory equipment and technicians (Royal Society 2001a). Further, the acute need for high quality science and especially mathematics teachers at secondary school level must be satisfied to prepare sufficient numbers of students for further study. In this regard the Society welcomes the establishment of national subject-specific Centres of Excellence for teachers of science and mathematics in schools.

7 Freedoms and funding

Management and leadership

- 7.1 The Society supports the objective of improving management and leadership in the HE sector, but new management styles and techniques must be tailored to the needs of the sector rather than simply imported from elsewhere. The satisfactory development of good practice in HE would be greatly helped by the proposed creation of a Leadership Foundation. The Society will be considering and if appropriate commenting on the findings of the Lambert and Roberts reviews.
- 7.2 The Society welcomes the establishment of the VandeLinde review of bureaucracy within the sector, and hopes that it will be successful in reducing the burdens imposed from the centre. The WP raises the issue of the Privy Council oversight of governance arrangements. While there might be some small savings possible here, the Government needs to recognise that it is more important to have the correct governance arrangements, coupled with appropriate reporting of statistical and other output information, than to be constantly trying to steer and micromanage HEIs from the centre.

Funding

- 7.3 The Society welcomes the Government's recognition of the significant financial difficulties being faced by the FE and HE sectors, especially with the additional demands required to increase participation and expand access.
- 7.4 While institutions should increase their current efforts to build up their endowments, even optimistic forecasts of success are such that these can at best only be seen as a long-term and relatively minor component of future funding. Nevertheless, such funds will be extremely valuable in providing flexibility to the institution, for example in being able to offer bursaries to students and support in kind, such as subsidised housing for new staff in high-cost areas. The Government needs to review tax incentives to individuals and companies donating endowment funds and to publicise these extensively.
- 7.5 With the many calls on the funding available for education, the Society recognises that additional funds will have to be raised from students. Many, but by no means all, graduates benefit significantly from their

HE qualifications, and some of the funds for their courses will have been raised from those who did not benefit from HE. Hence there is an argument for raising additional funds either from a graduate tax or from the repayment of loans to pay for differential fees. However, it is essential that such funds are seen as additional to at least the current unit costs maintained in real terms.

- 7.6 The proposed arrangements for a differential fee, replacing the current blanket £1100 fee with an automatic entitlement to a real-term interest-free loan on the full amount, has the advantage of decoupling students from their parents' income. Where the full differential fee is charged, the Society has concerns that there will be a disproportionate cost to S&T students on 4 year courses, and the accumulated debt after four years may discourage such students from pursuing postgraduate studies; this would have a consequential negative effect on the UK's research base.
- 7.7 The Society's concern about the effect of increasing fees on encouraging wider access to first-degree courses, and in particular its effect on ethnic minorities, has already been voiced in paragraph 5.2.
- 7.8 The proposals to improve the support to part-time students are welcome as this mode of study will be important for improving access to HE and also for mature students.

References to Royal Society documents cited

Royal Society 1997a *Response to the Report of the National Committee of Inquiry into Higher Education*. October 1997. London: The Royal Society.

Royal Society 1997b *Submission to the National Committee of Inquiry into Higher Education*. May 1997. London: The Royal Society.

Royal Society 2001a *Survey of science technicians in schools and colleges*. July 2001. London: The Royal Society.

Royal Society 2001b *Review of the supply of scientists and engineers*. July 2001. London: The Royal Society.

Royal Society 2001c *Research policy and funding*. Submission to HEFCE Review of Research Policy and Funding, January 2001. London: The Royal Society.

Royal Society 2002a *Submission to the Roberts review of the Research Assessment Exercise*. November 2002. London: The Royal Society.

Royal Society 2002b *Submission to the House of Commons Science and Technology Committee inquiry into the contract researchers*. June 2002. London: The Royal Society.

Royal Society 2002c *Submission to the House of Commons Select Science and Technology Committee inquiry into the Research Assessment Exercise*. January 2002. London: The Royal Society.

Royal Society 2002d *Supporting success: science technicians in schools and colleges*. January 2002. London: The Royal Society.

References to other documents cited

DfES 2003a *The future of higher education*. January 2003. London: The Stationery Office.

DfES 2003b *Widening participation in higher education*. April 2003. Annesley, UK: DfES.

DfES 2003c *14–19: opportunity and excellence*. Annesley, UK: DfES.

European Commission 2002 *Towards a European research area. Science, technology and innovation. Key figures 2002*. Brussels: European Commission.

Hattie, J and Marsh, H W 1996 The relationship between research and teaching: a meta-analysis. *Rev. Educational Res.* **66**, 507–542.

HEFCE Review of Research Funding 2000. See <http://www.hefce.ac.uk/research>

HEFCE 2002 Information on quality and standards in higher education. Final report of the Task Group. Ref. 02/15, March 2002. See http://www.hefce.ac.uk/pubs/hefce/2002/02_15.htm

HESA 2003 *Students in higher education institutions 2001/02. Reference volume*. Cheltenham, UK: HESA.

HM Treasury 2002 *Investing in innovation. A strategy for science, engineering and technology*. July 2002. London: The Stationery Office. (See <http://www.hm-treasury.gov.uk/>)

OECD 2002 *Education at a glance. OECD indicators 2002*. Paris: OECD.

QAA 2002 *Handbook for institutional audit: England*. Gloucester, UK: QAA.

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