

RCUK Response to the Review of UK Physics

October 2008

1. Introduction

- 1.1 This response is made on behalf of Research Councils UK (RCUK)¹. As part of its continuing oversight of the health of the research base, RCUK commissioned this cross-Council review of actions that might be taken to ensure the continued health of physics research and postgraduate training in the UK.
- 1.2 Whilst this is RCUK's response to the review that it commissioned, the response also incorporates the responses from other bodies to whom recommendations are addressed, including DIUS and DCSF. The Funding Councils² have also contributed to the RCUK response. The Funding Councils welcome the general thrust of the recommendations directed to them and see them as broadly aligned with their own objectives. The Funding Councils look forward to working with RCUK on detailed development as appropriate.

2. General comments

- 2.1 RCUK welcomes the report of the review, and would like to express its thanks to the Panel for the considerable time and effort expended on the task, and for the thorough and detailed consideration of the issues which has clearly taken place. The review has confirmed that physics in the UK is a strong, healthy and internationally respected discipline producing world-class scientific outcomes of real benefit to the UK and global community. The review has made a series of recommendations for strengthening and expanding physics, particularly in relation to the diversity of physics.
- 2.2 As is recognised in the report, excellence in physics education, training and research is not only necessary to ensure the UK maintains a healthy research base but is also fundamental to the economic prosperity and social well-being of the country. RCUK fully supports the Panel's observations that trained physicists are ubiquitous throughout the research community and that physics and physicists contribute strongly to advances across a wide range of other disciplines, for instance playing a crucial role in environmental and medical sciences, and in support of many important industrial and commercial sectors.
- 2.3 The Review Recommendations are targeted to a range of stakeholders, and some of the recommendations are not for RCUK to address. This document represents RCUK's initial response to the recommendations. A full response to

¹ RCUK is a strategic partnership between the seven UK Research Councils. RCUK was established in 2002 to enable the Councils to work together more effectively to enhance the overall impact and effectiveness of their research, training and innovation activities, contributing to the delivery of the Government's objectives for science and innovation. Each of the Research Councils is an equal partner in RCUK, and each uses its best endeavours to identify and pursue opportunities for mutually beneficial joint working with one or more of the other Councils. Leadership of the partnership is provided by the Research Councils' Chief Executives working together through the RCUK Executive Group

² Funding Councils is taken in this document to mean HEFCE, HEFCEW, SFC and DEL (Department for Employment and Learning in Northern Ireland)

some recommendations will need further work and thought, and/or further consultation with other stakeholders.

3. Detailed response to recommendations

3.1 Recommendation 1: The Panel recommends that the UK Government should continue to fund research in both basic and applied physics across a broad spectrum of sub-disciplines, at the level required to retain international competitiveness.

3.1.1 The Government accepts this recommendation, and intends to continue to provide funding to the Research Councils at a level that would allow them to fund research in both basic and applied physics, and other major disciplines, across a broad range of sub-disciplines. It is for the Councils themselves to determine how precisely they deploy this funding.

3.2. Recommendation 2: The Panel recommends to the Funding Councils and Research Councils that they work together to consider how they can encourage physics departments to reclaim the intellectual leadership in the broader spectrum of physics supported across the full science base.

3.2.1 RCUK accepts this recommendation and notes that, in order to be successful, a partnership approach will be necessary which will also need to include the universities and professional institutions. We will consider this to be a particularly priority as we engage with the research community.

3.2.2 As a first step, RCUK will initiate discussions with the Funding Councils and will aim to provide initial options to the meeting of the Research Base Funders Forum (chaired by the DGSR) in January 2009.

3.3 Recommendation 3: The Panel recommends to the Funding Councils that they work closely with Research Councils to ensure that physics that may be currently conducted outside physics departments and that has application in other disciplines, and in industry and commerce is fully recognised in the post-RAE environment. This also has important implications for the correct sign-posting (to prospective A level and Scottish Highers students or physics undergraduates) of this broader role for physics.

3.3.1 The funding that flows from the RAE (and in future from its successor) is an essential part of the research environment and it is therefore vital that its outcomes are consistent with the strategic needs of the UK. RCUK therefore strongly supports this recommendation to the Funding Councils.

3.3.2 RCUK strongly encourages interdisciplinary research and is keen to see researchers from UK physics departments working with others in tackling important interdisciplinary questions. There is a growing need for interdisciplinarity in most research (e.g. medical physics and biophysics). The Councils' policy has always been, and will continue to be, to support the

science wherever it is best carried out to achieve an outcome, rather than any focus on individual university structures.

3.3.3 RCUK welcomes the positive and inclusive way in which the Funding Bodies have engaged with the wider research community as they develop the Research Excellence Framework (REF) that will replace the RAE. In this respect RCUK is already working closely with the Funding Bodies to ensure that excellence in applied research (including user-valued research) is appropriately rewarded. RCUK's position on this is reflected in RCUK's response to the REF consultation³.

3.4. Recommendation 4: The Panel proposes

- a) **to DCSF that physics should be taught by those trained in the subject, and the same successful ideas that were applied to raising mathematics take-up in schools by improving mathematics teaching be extended to physics; and**
- b) **that research is undertaken by RCUK and DCSF to identify factors influencing non-take up of physics in post-compulsory schooling amongst those from wider social and ethnic backgrounds and from women.**

3.4.1 Regarding part a) of this recommendation, DCSF and RCUK recognise that the quality of the educational experience provided by teachers⁴ plays a critical role in the take up of and success in STEM⁵, and RCUK has recently commissioned a pilot phase of STEM teacher continuing professional development (CPD) courses that supports teachers' subject specialisms by providing access to contemporary research and researchers. Following successful evaluation of the pilot phase, RCUK hopes to commission scheme continuation in 2008.

3.4.2 RCUK notes that Government is actively encouraging greater participation of young people in STEM subjects and allied fields through an extensive array of national and regional bodies, initiatives, programmes, schemes, academics, new qualifications and diplomas, and that DCSF has recently increased, substantially, its STEM education budget to £140m in order to support positive trends in uptake and achievement⁶. This includes (from 2009) CPD courses for teachers without a physics specialism, and a range of support for physics teacher trainees, such as mentoring schemes and subject enhancement courses.

3.4.3 DCSF also notes that the Government's ambition is to create an education and training environment that delivers the best in science teaching and learning at every stage. The Science and Innovation Investment Framework 2004-2014: Next Steps set out ambitions to ensure that by 2014 entries to A level physics stand at 35,000 and to step up recruitment, retraining and retention of physics,

³ <http://www.rcuk.ac.uk/cmsweb/downloads/rcuk/consultations/ref.pdf>

⁴ In this, good quality teachers are more important than any other factor (e.g. Darling-Hammond 2007, Haladyna & Shaughnessy 1982, Myers & Fouts 1992)

⁵ Science, Technology, Engineering, Maths

⁶ see http://www.dcsf.gov.uk/pns/DisplayPN.cgi?pn_id=2008_0017 for further details

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chemistry and mathematics specialist teachers so that by 2014, 25% of science teachers have a physics specialism. DCSF notes that work towards these targets is well underway.

- Following a successful pilot, the Department is working with the Training and Development Agency for Schools (TDA) to roll out CPD courses leading to accreditation for teachers without a physics specialism nationally from summer 2009, giving science teachers without a physics specialism the deep subject knowledge and pedagogy they need to teach the subjects effectively.
- The DCSF is improving the state of physics knowledge of potential teacher trainees, by offering six month full-time enhancement courses, which enable a wider pool of people to begin Initial Teacher Training (ITT). The Gatsby Charitable Foundation is also funding mentoring arrangements to help newly qualified physics teachers through their first year of teaching, run by the Institute of Physics (IoP).
- The Department is working in partnership with the TDA to implement a national mentoring scheme for new teachers as recommended in Lord Sainsbury's Race to the Top report published in October 2007. The scheme will roll out in early 2009.
- The Secondary National Strategy provides continuing professional development for science teachers focused on raising pupils' attainment.
- Research suggests that post-16 progression to STEM subjects including physics is encouraged when pupils study triple science. Triple science provides a more extensive range of subject matter and the best preparation for entry to A level. In view of this, all pupils achieving at least level 6+ at key stage 3 are now entitled to study triple science GCSE, for example through collaborative arrangements with other schools, further education colleges and universities and from September this year, all specialist science schools will offer triple science at least to all pupils achieving level 6+ at the end of key stage 3.

3.4.4 RCUK and DCSF will work together to identify whether further action in this area is necessary.

3.4.5 Regarding part b) of this recommendation, RCUK notes that the ESRC, DCSF, Gatsby Foundation and Institute of Physics have recently co-invested £3m in a new science and mathematics initiative to identify a number of issues that affect uptake in post-compulsory schooling in mathematics and science. As part of its remit to address, through its research activities, policy-relevant issues in this area, ESRC will, on behalf of RCUK, bring this recommendation to the attention of the initiative funders for their consideration.

- 3.4.6 There may also be benefit in considering a Research Synthesis⁷ in the first instance to allow exploration of findings from existing research outputs and policy measures. RCUK will work with DCSF to consider whether this or other further action is required by March 2009.
- 3.4.7 Finally, RCUK notes that DCSF, in conjunction with the Institute of Physics, has commissioned an action research project involving the Science Learning Centres to investigate good practice initiatives in schools which encourage girls to study physics.
- 3.5 **Recommendation 5: The Panel proposes that DIUS works closely with the Institute of Physics and Universities UK to ensure compatibility of current physics qualifications with the Bologna process.**
- 3.5.1 DIUS will continue to work closely with the relevant bodies on the issue of physics qualifications.
- 3.6 **Recommendation 6: The Panel recommends that:**
- a) **the STFC be required at each CSR to bid for and allocate specific funds to former PPARC facilities and grant funding together. This would avoid the undesired tensioning of these grants and facilities support against national facilities and the project for the development of science and innovation campuses.**
 - b) **the existing structure should be allowed time to develop, given it was founded on the basis of extensive positive consultation. However, at an appropriate point following the review of STFC management currently being conducted by Dr David Grant, DIUS should commission a review to examine STFC operations.**
- 3.6.1 In relation to part a) of this recommendation, DIUS already requires Research Councils to identify clearly as part of their Spending Review bids the funding they propose to allocate to major activities under different funding scenarios. In the case of STFC, DIUS would expect these to include the proposed funding for facilities and associated grant expenditure. DIUS would expect that Councils would normally implement spending plans as set out in their Delivery Plans published at the time of the Research Budget allocations; but all Research Councils need to manage their expenditure as a whole in such a way as to ensure that they live within their allocated budgets, and this requires all Councils to tension their expenditure across the whole range of their activities.

⁷ The Research Syntheses are part of a wider activity by ESRC, working with RCUK, aimed at aiding policy-makers and practitioners operating across the areas of Science and Society as defined by the Government's Framework for Science and Innovation. Their purpose is to identify the need and scope for particular areas of research relating to the public engagement and STEM skills agendas. In its pilot phase during 07/08, the scheme has already co-funded a synthesis with DCSF - *Improving take-up of science and technology subjects in schools and colleges*. The prime purpose of this Research Synthesis was to identify and report on successful interventions and practices that are used by schools and colleges to reduce drop-out rates in science, technology, engineering, and mathematics (STEM) subjects.

3.6.2 In relation to part b) of this recommendation, DIUS welcomes the report's recognition of the positive support given to the creation of STFC at the time of the public consultation in 2006. It agrees that the existing structure should be given time to develop, but that, in due course, a review of progress would be appropriate.

3.7 Recommendation 7: The Panel recommends to DIUS that the membership of STFC's Council be broadened to include more of the stakeholders in the science activity at the highest level, and to redress the balance between executive presence and non-executive oversight.

3.7.1 DIUS accepts this recommendation. Details of an open competition to recruit two additional scientists as non-executive members of Council (the maximum permitted by STFC's Royal Charter) will be published shortly.

3.8 Recommendation 8: The Panel recommends to RCUK that in developing large facilities priorities, consideration should be given to distinguish between those that serve a range of Councils, and those which are germane to a single Council.

3.8.1 RCUK accepts this recommendation and agrees that distinguishing between these types of facilities should help build confidence in relevant stakeholders concerning the strategic decisions made by RCUK.

3.8.2 In the most recent large facilities prioritisation exercise consideration was given to the diversity of the research community to be served by the proposed facilities. Following the prioritisation exercise, RCUK conducted an internal review of the process. One of the recommendations was that facilities that are relevant to several Councils should have a separate evaluation criterion. RCUK will discuss with DIUS the implementation of this and other proposals from the review.

3.9: Recommendation 9: The Panel recommends:

a) **that given this interaction of the science policy with regional policy that DIUS and BERR should consider a restatement of the Haldane Principle for the modern era; and**

b) **that the Director General of Science and Research (DGSR) would benefit from advice from a small, but well informed, advisory group from outside DIUS during the CSR allocation process to ensure there are no unintended consequences of allocations and to ensure appropriate accountability to the science community. This does not need to be a large bureaucratic body.**

3.9.1 In relation to part a) of this recommendation, John Denham, Secretary of State for Innovation, Universities and Skills, restated the Government's position on

the Haldane Principle in his speech at the Royal Academy of Engineering on 29 April. He made clear⁸ that:

- it is researchers, through their participation in peer review, who are best placed to determine detailed research priorities;
- the Research Councils act as the "guardians of the independence of science"; and
- the Government's role is to set the over-arching strategy and framework.

The Haldane principle protects the role of the research community in determining which research and researchers should be funded. The Government's role is to set the overarching strategy and framework. As explained in the speech on 29 April, this responsibility can (and does) cover the overall strategy for investment in the two national Science and Innovation campuses as key national research assets.

3.9.2 In relation to part b) of this recommendation, DIUS accepts this recommendation. In future Spending Reviews the DGSR will formally seek the advice of a number of national bodies able to provide a high-level strategic overview of a broad range of science and research funding issues. An announcement of the details of this process will be made in due course.

3.10 Recommendation 10: The Panel recommends that:

- a) physics departments through their own endeavours and those of the Institute of Physics continue their valuable work to publicise all activities of physicists after graduation so as to enhance intake. Companies that employ physicists need to promote the value of a physics training, and this should be reflected in schools career advice.**
- b) universities, Funding Councils and Research Councils should seek to develop, with the finance sector, Masters courses that exploit the synergy between these apparently disparate areas. The possibility should also be explored of running joint Masters courses between universities and the financial sector that exploit the particular skills that physicists have that are germane to finance in areas where such training is not currently available.**
- c) the Panel recommends to university physics departments that they should re-consider the provision of practical skills for their students perhaps in conjunction with the large facilities in the UK and perhaps with industry. The Panel was pleased to learn of the recent RCUK initiative on skills for international competitiveness, and urges RCUK to work with all stakeholders to encourage the development of transferable practical skills into the curriculum at all levels of undergraduate and postgraduate training.**

⁸ www.dius.gov.uk/speeches/denham_science_290408.html

- 3.10.1 RCUK supports part a) of this recommendation and recognises that Research Councils also have a role to play in promoting physics through, for example, their public engagement activities. The Research Councils will continue their endeavours in this area.
- 3.10.2 RCUK accepts part b) of this recommendation in that it supports moves by the sector to establish courses of training that meet the needs of employers, but recognises that it is a matter for universities to identify the needs and develop the courses. The relevant Councils (ESRC, EPSRC and STFC) are happy to engage in discussion, however the Councils have a limited role with respect to Masters training. RCUK notes that the Councils' support for Masters training is subject to clearly published strategic considerations and that, for example, taught Masters courses are no longer supported by STFC. It further notes that Masters training can be of such direct benefit to the individual and the employer that it is inappropriate for Council funding.
- 3.10.3 RCUK supports part c) of this recommendation which should ensure a better and more relevant training experience for many students. RCUK will highlight this recommendation to relevant departments as part of the engagement process with the research community.
- 3.10.4 RCUK has placed significant emphasis on the development of transferable skills for postgraduate researchers through its UK GRAD programme and is extending this to research staff through its recently launched Vitae programme. Although RCUK does not have direct responsibility for undergraduate courses, it does have a direct interest in effective development of research awareness and research and practical skills at undergraduate level. RCUK will keep under review any perceived deficiencies in undergraduate education which are highlighted by the sector and will continue its dialogue with sector partners to understand how addressing these can help enhance the UK's international competitiveness.

3.11 Recommendation 11: The Panel recommends:

- a) **that that universities consider their internal funding models and structures to make sure they consider physics more broadly than simply at the level of the department of that name, and encourage working between departments. They should also be careful to distinguish between cost and price in working with business, particularly perhaps in physics where the business base of applicability is wide; and**
- b) **that DIUS and RCUK work together to develop mechanisms which enable the easy flow in both directions between industry and academia (though this point is not specific to physics).**

- 3.11.1 RCUK supports part a) of this recommendation and notes in particular its relevance to multidisciplinary approaches and the need for universities to consider their proposition for research funded by business. RCUK will highlight this recommendation in its engagement approach.

- 3.11.2 RCUK and DIUS accept part b) of this recommendation and RCUK and DIUS will continue their dialogue on this topic. Research Councils are keen to promote greater use of existing schemes for academic-industry exchange (see below) – in particular for industry researchers moving to universities. However, it is important to note that the issue of the easy flow between the academic and business communities is a generic issue that applies to all disciplines, not just physics. Equally, it is also important to ensure the easy flow of people between the academic and policy-making communities.
- 3.11.3 RCUK notes that the Council for Science and Technology made a similar recommendation in its 2007 report ‘Pathways to the future: the early careers of researchers in the UK’ with reference to schemes offering placements in industry, the media or the public sector. That recommendation was “We recommend that HEIs, in partnership with funders, ensure that there is greater consolidation, publicity and targeting of existing schemes and resources.”
- 3.11.4 RCUK and DIUS will assess the benefits of doing more in this area but would wish to flag some of the current opportunities which are already available.
- RCUK has taken specific actions under the Roberts and Leitch skills agenda to encourage the development of researchers’ skills which make them more employable and has plans to encourage further enhancement of skills underpinning enterprise, outreach and research-policy linkages.
 - The Research Councils support a significant volume of research collaboration between HE and business through their normal grants and studentship mechanisms and these may in turn lead to inter-sectoral mobility of students and staff. Specific schemes such as CASE studentships, Industrial Doctorates and Royal Society/Research Council Industrial Fellows require researchers to spend time working in business as part of their research/training.
 - EPSRC’s new Knowledge Transfer Accounts (closing date 8 November 2008) and STFC’s PIPPS scheme both encourage placements and movement between business and universities with the particular mix and disciplinary relevance being determined by the institution through the bidding process. In addition the STFC Knowledge Exchange Service can help broker partnerships between Science and Technology Facilities Council-funded research groups and UK industry.
- 3.12 Recommendation 12: The Panel recommends that responsibility be transferred to the Natural Environment Research Council for those parts of solar terrestrial physics research which are most relevant to the NERC mission. This transfer should be accompanied by sufficient funds to enable NERC to administer and support the current level of research.**
- 3.12.1 RCUK agrees with the issue raised by the Review Panel with regard to solar terrestrial physics. As a result NERC and STFC will need to consider the implications of the recommendation and evaluate options for the way forward. NERC and STFC will publish the results of these deliberations later this year.

3.13 Recommendation 13: The panel recommends that an investigation into balance between QR and RC funding in supporting physics infrastructure should be completed so that it is clear to the entire community what amounts are being spent in total on which branches of science. The Panel does not advocate a redistribution of the funding (as noted in the report, there are logical reasons for this), merely transparency.

3.13.1 DIUS will convene a working group involving RCUK and the Funding Councils to identify comprehensive and consistent data on public expenditure on the main areas of research

3.14 Recommendation 14: The Panel recommends to the HEFCE that it should consider the long term implications of strategic support for funding consortia of physics departments in more detail, and that clear criteria be developed for measuring and ensuring quality and sustainability in all the different components of consortia.

3.14.1 RCUK supports the need for clear success criteria in establishing strategic initiatives such as those promoting regional consortia. RCUK would, however, note that the consortia approach in physics has already produced tangible benefit in some cases and that in other cases the consortia are too newly established to determine objectively whether they will prove successful.

3.15 Recommendation 15: The Panel recommends that RCUK develop a review of the priorities in nuclear physics research to ensure they best match the needs of the UK.

3.15.1 RCUK accepts this recommendation, and over the next year STFC and EPSRC will jointly review the research portfolio in nuclear physics, engineering and related areas to assess how they can best support the skills needs of the UK.

3.16 Recommendation 16: The Panel recommends that Universities, Funding Councils and Research Councils work together to develop the research concordat so that realistic career advice is given to junior scholars and that mechanisms to ensure early career opportunities are maximised in strategic areas of the research base.

3.16.1 RCUK accepts this recommendation, which will be taken forward through the existing mechanisms for the implementation of the Concordat to Support the Career Development of Researchers. The Concordat is a partnership between the sector and funding organisations and Principle 3 (Support and Career Development) explicitly addresses the issue of career advice and states that: “All employers will wish to review how their staff can access professional, independent advice on career management in general, particularly the prospect of employment beyond their immediate discipline base, or offering training and placements to broaden awareness of other fields and sectors.”

3.16.2 RCUK notes that the responsibility to develop research staff lies with the university as employer; nevertheless a key aim of its Research Careers strategy

is to “help Research Organisations manage their staff and develop their careers”. Career information and other forms of support for researchers are available through the Vitae Programme which is funded by the Research Councils and which will play a major role in implementation of the Concordat (www.vitae.ac.uk).

- 3.16.3 Early career opportunities are provided by the Research Councils through research grants, studentships and fellowships, and researchers working in strategic areas are encouraged to take advantage of the opportunities that already exist to further their research and careers. Research Fellowships in particular offer a form of early independence for researchers.
- 3.17. **Recommendation 17: The Panel recommends that RCUK should promote the use of HPC in physics and more generally by**
- a) **continuing a programme of sustained investment in HPC facilities and**
 - b) **co-ordinating activity across all the Research Councils that support both physics and other disciplines, taking account of the needs and aspirations of the various constituent communities. The Panel endorses EPSRC's efforts to develop a strategy for replacing HECToR in a timely fashion. STFC should, as a matter of urgency, likewise develop and implement a long-term, sustainable policy for HPC for its community within the overall context and strategy of RCUK.**
- 3.17.1 RCUK accepts this recommendation. On behalf of RCUK, EPSRC is currently developing options for future investment in high-end computing services and looking to develop a plan over a 10 year horizon. The strategy will be to extend the successful partnership model that has already been developed with NERC and BBSRC for the existing services. Following the successful bid for £65m to the Large Facilities capital funds, the detailed development of the future support of HPC services post-2010 will be overseen by the cross-Council High Performance Strategy Committee which includes representatives from across the research base.
- 3.17.2 In relation to part b) of the recommendation STFC is in the final stages of a new round of HPC support for its communities. Once this is in place, STFC will work with those communities to develop a roadmap for HPC in the science areas it supports. This task is included in the terms of reference for the new advisory panels that STFC has established.