



Engineering and Physical Sciences  
Research Council

## Feedback Form: EPSRC Landscapes

If you would like to comment on the EPSRC Landscape document or the shape and nature of the EPSRC portfolio please complete the following feedback form and return it to EPSRC at: [landscapes@epsrc.ac.uk](mailto:landscapes@epsrc.ac.uk)

### What are your observations and conclusions concerning the EPSRC portfolio?

The following are some specific comments that the Institute of Physics received from its membership regarding the Physical Sciences Programme Landscape document; the information has been included as verbatim, but where necessary, edited for clarity and brevity:

- We are concerned about the robustness of this document in representing the breadth of the Physical Sciences Programme, and in the lack of joined-up thinking between it and other Programme Landscapes. In a number of cases, it is difficult to recognise the research field from the information presented, which raises the issue of how EPSRC identifies and fits fields into its programmes which are often not how the research community views them; this causes problems, not least when proposals are sent to panels or even referees. A case in point is 'Surface science', where the extent to which this field is inextricably linked with nanotechnology is not recognised. Furthermore, in some cases the list of leading centres for doctoral training does not match the list of EPSRC funding below it. In addition, the document does not properly reflect where physics is contributing to the potential for wealth generation within the UK.
- As presented, the document does not appear to have a clear aim of what the Programme is hoping to achieve and there aren't enough observations of what has been achieved by previous programmes. The document also presents SWOT analyses, declaring weaknesses but with no mention of planned remedies. In addition, the strengths are often not explicit enough, and the opportunities are not often presented in a way to show that they are really substantial.
- There is an absence of investment in medical physics-healthcare, in agreement with the table on page 3, where inter-relation with healthcare gets only one tick mark; this runs counter to the recommendation(s) of the RCUK Review of UK Physics. In order to foster links and address challenges in healthcare, from a medical physics perspective, there needs to be better links between funding sources for NHS staff and university staff; currently they cannot be PIs or be funded from other schemes. There is a need to recognise that most medical physics research is undertaken outside of physics departments, so the subject by its nature is interdisciplinary, which is a good

thing. However, this can make it hard to recruit PhD students, etc., as they are not always aware of the availability of places in this area of research.

- It is stated in the 'Condensed matter physics' sub-theme that: "*The UK community in soft condensed matter and biophysics is very small relative to communities in other countries.*" But looking at the document, key soft matter physicists and biophysicists are dotted around all kinds of themes. In addition, synthetic biology is explicitly in the M3E Programme, with signposting there that cannot be carried across to the Physical Sciences Programme, so one cannot write a physics based synthetic biology proposal for signposting. So, of course soft condensed matter and biophysics look weak if EPSRC defines it as condensed matter, but then puts all the research that is funded in other themes or programmes.
- The following comments are specific to the plasma physics area of the sub-theme 'Plasmas, lasers and optics': The plasma physics area is clearly gaining in strength as a result of two Science and Innovation Awards, with very strong appointees helping to secure the future of this critical discipline. This will help counteract the fragmentation in the plasma physics community, as new links and collaborations are forged. It is disappointing that there is a perception at responsive mode panels that plasma physics is less adventurous than other research areas; amongst the possible reasons for this misapprehension could be the fact that some plasma physics proposals need to be multidisciplinary, with simultaneous progress across several fronts required. In some cases this can lead to reviewers commenting expertly only on that fraction of the total proposal on which they feel confident, leading to less emphatic endorsements than proposals in other areas in which the research front is perceived to be 'cleaner' and more self-contained. Therefore, it is a little surprising to find the 'multidisciplinarity' aspect of the sub-theme ranked as 'average', but perhaps this reflects varying contributions from topics across the sub-theme. In fact, such is the strength of the multidisciplinary nature of plasma physics research that it can compete for funds from other research councils and government sources. That said, it is gratifying to note that EPSRC recognises the vital nature of both fusion (magnetic and laser) and technological plasmas to the Physical Sciences Programme, and the UK economy in general. Clearly the immediate tasks ahead are to grow links between research groups in the plasma physics area (recognising that the funding from the Science and Innovation Awards has injected fresh impetus) to encourage fellowship applications (advanced and career acceleration) from within the community and to build on interactions with related disciplines. In terms of the future, leadership concerns will be eased as the new groups grow, and community links develop. Given the top rating for socio-economic impact that this area has attracted we would anticipate significant research growth over the medium term, driven by the influence that for instance plasma-related research can have across many disciplines, ranging from fusion to biophysics. The key to future growth in this essential area is to recognise, and accommodate, the cross-disciplinary nature of research in the plasma physics area. In such circumstances, there is no reason to doubt that the UK could widen its leading role in this sub-theme. Fortunately, EPSRC acknowledges the great potential of research in the plasma physics area, recognising the excellent socio-economic impact and the international standing of the UK's plasma physics activity.

**What are the themes of research and training:**

**Where the UK has a clear competitive advantage?**

**Where the growth opportunity over the next twenty years is significant?**

**Where the UK has a realistic prospect of being no. 1 or 2 in the world?**

As far as the Institute is concerned, the prediction of the best prospects for future discovery and invention is notoriously difficult, hence it is essential for the UK to support a broad research base and not attempt to pick winners. It is not clear whether focusing on select, narrow areas will result in short-term economic gains, but it is obvious that in the medium- to long-term, it will undermine the UK's ability to retain the highly trained, inventive and innovative scientists and engineers who will maintain and strengthen the UK's international competitiveness. It is these people, particularly those that have been attracted to the UK by a funding system and academic ethos that allows them to pursue curiosity-driven research, who will enable the UK to respond to new discoveries for which the economic and societal impacts are manifold, but which are broader and harder to quantify than for example, profits in a manufacturing company.

In addition, how is EPSRC going to define no. 1 or 2 in the world? Will this be based on the PSA target metrics for the UK research base, which don't accurately reflect the strength of individual disciplines? Furthermore, how is it going to define areas that have a clear competitive advantage? Should we infer that advantage is used here in an industrial, financial, or intellectual sense? One consequence of this drive towards exploiting the UK's 'competitive advantage' is further movement towards directed/thematic programmes (for which there has been a steadily increasing bias in recent years) at the expense of responsive mode support for curiosity-driven research.

**Other Comments (including responses to Programme questions)**

The landscape and environment in which science is being funded is changing with a greater emphasis on interdisciplinarity and alignment to cross-council priority themes at the expense of curiosity-driven research that is traditionally supported by EPSRC through its responsive mode mechanism. A perennial problem for the UK's research councils is that of low responsive mode success rates. This is a real threat to the platform of internationally excellent research that a decade of improved science funding has generated, and that the RAE2008 measured.

The problem, especially for physics in terms of EPSRC, is perfectly stated by the 2005 International Review of Physics and Astronomy Research panel: "...*there is some unease about the current system of 'responsive mode' funding within EPSRC, although the basic idea behind this funding scheme is widely supported. The problem is that when the perceived success rate, for proposals submitted through this channel is very low, the whole system can become unstable: referees are unwilling to make critical comments, proposers are unwilling to propose high-risk research, and as more proposals get rejected, even more are submitted. This situation poses a strain*

*on the organisation of the research councils and it wastes the time of the proposers, referees and grant panel members...It is essential to consider new strategies that would enhance the success rate of excellent high-risk proposals...the research councils should aim to ensure that high-risk research in new topics or entirely new fields should have resources for appropriate funding."*

As a response to the pressures that low success rates place on the peer review system, EPSRC announced a policy to limit repeatedly unsuccessful grant applicants, which caused uproar amongst the physics and chemistry communities. The Institute recognises that EPSRC has a difficult situation to manage, as the continuing increase in the number of grant applications, combined with a real-term reduction in the volume of funding, is threatening to overwhelm the peer review system. Even though the Institute supports EPSRC's underlying aim of safeguarding peer review, which has proved its value over many years as the most effective mechanism for evaluating research proposals, there is a need to monitor the impact of this policy, which will be implemented in April 2010, to ensure that academics who submit high-quality curiosity-driven research proposals are not disadvantaged in favour of those that submit risk-averse proposals.

Furthermore, the research councils need to focus more on increasing the effectiveness of the translational research that brings scientific innovations to the market, building on the strength of the UK's curiosity-driven research. There needs to be more strategic coordination between the different research councils and an increased recognition of the importance of funding for translational research and development. There seems to be a real danger of a widening gap between the research councils and the TSB in this respect, which conflicts with the Sainsbury Review of Science and Innovation recommendation of closer collaboration: *"...to help identify complex, high-value-added production technologies that current and emerging industries require and which are likely to flourish in high-cost economies."*

In addition, the research councils, with a strong steer from the government, are adopting policies which imply that the emphasis is shifting to one of funding research that shows potential, in advance of a research project being undertaken, of economic and societal impact. This is evinced by the request for two-page impact plans for grant applications. The Institute is of the view that there needs to be a clear role for both responsive mode funding and directed/thematic programmes; the balance of the system has swung too far towards directed funding in recent years.

For example, graphene could not have been discovered through directed programme-mode funding, as the researchers based at the University of Manchester did not set out with the target of revolutionising carbon-based electronics – theirs was a curiosity-led investigation of fundamental condensed matter physics – of a type which is now becoming increasingly difficult to obtain funding for. However, that is not to say that there is no value in directed funding – once the importance of the science has been recognised by the research councils.

***What are the three most significant research challenges facing the physical sciences community over the next 10-15 years?***

One issue of concern is the long term sustainability of research with pressures on government funding and the results of the RAE2008 that revealed that research excellence is widespread throughout the UK; over successive exercises, the RAE has improved the quality of UK research, but we are facing a situation where there

aren't sufficient funds to support that quality. Therefore, either funds need to be increased or there needs to be proper planning for the future UK research base, i.e. informed and transparent debate about the possibility of condensing research activity into a smaller number of universities.

In addition, a major issue facing physics, as stated in the RCUK Review of UK Physics, is that it needs to reclaim the intellectual leadership in the broader spectrum of physics supported across the full science base, i.e. areas such as medical physics, environmental physics, etc. This was a challenge posed by the Review panel to the research councils and the funding councils; representing RCUK, EPSRC attended a meeting at the Institute in early July on how to take this recommendation forward. Some of the main outcomes of that meeting were that EPSRC and the Institute will work together to help broaden the outlook of physics departments, particularly to align them better with the grand societal challenges, and that EPSRC will freshen up its peer review college system to recruit those with greater experience/appreciation of interdisciplinary areas (e.g. biophysics); the funding of which can be disadvantaged due to differences in the pigeon-holing of such areas of research between the research councils and the community. On this point of pigeon-holing, one simple solution would be for the research councils and funding councils to coordinate how they define areas; for instance, the RAE physics sub-panels' list of areas listed under the physics unit of assessment has a huge influence on how the community labels its work.

***What role can physical sciences play in tackling major global societal challenges, e.g. energy (affordability, production, storage and distribution), sustainable resources, personalised healthcare, etc. ?***

It is clear that physics, in collaboration with other disciplines, will continue to make vital contributions to the major problems of our age, such as improvements in energy generation, energy efficiency, public transport, crime prevention and the quality of life of an increasingly ageing population.

For example, the fields of medical physics and biophysics have strengthened greatly in recent decades, with new physics-based technologies applied to medical diagnosis, therapy and problems in fundamental biology. The interface between physics and chemistry has also recently led to major developments, including nanotechnology, energy generation and efficiency, atmospheric research, surface science, smart materials and novel plastics.

However, the only issue the Institute has is that the funding for these directed areas should not be at the expense of curiosity-driven research, as they are not the same things, i.e. directed research is dependent on curiosity-driven research having taken place, but not vice versa. On this point, the RCUK Review of UK Physics reported that: *"...it is absolutely vital that fundamental, curiosity driven research continues to be conducted within all the sciences, engineering, mathematics and medicine. An important observation made within a variety of different evidence sessions was that there is a clear need to adequately fund core research within the [physics] discipline in order to maintain the capacity to innovate and propel future interdisciplinary activities. There is a substantial body of evidence that demonstrates that many technical aspects of the modern world have their origin in fundamental research conducted without any such applications in mind. Demanding and fundamental challenges can drive developments that then find application in a much wider (and sometimes radically different) context. The recent report by Lord Sainsbury illustrates*

*this vividly and also points out the long timescale often associated with such developments.”*

In addition, the amount of money that the UK is allocating to directed programmes is not actually sufficient. For example, solving the energy and climate change issues of today and for future generations will require far more money than the entire Science Budget. Furthermore, the current directed programmes suffer from a lack of scale both in terms of scientific breadth and timescale. It would be better to have fewer programmes of a larger scale so that good ideas developed over a greater period and a broader scientific range could be funded.

***What can EPSRC do to foster links between disciplines within the physical sciences and links with other disciplines e.g. life sciences?***

The most obvious thing EPSRC can do is to continue to fund existing, and following community input, further cross-disciplinary interface research initiatives. It should consider reviving programmes such as the former Life Sciences Interface programme, which had its own peer review panel; this would send a strong message to the community about EPSRC’s support and ambition for cross-disciplinary research and remove uncertainty about grant proposals not being adequately dealt with by more discipline specific review panels.

Physicists have always been willing to collaborate with colleagues in other disciplines. A striking indicator of the enthusiasm of their interdisciplinary activity is that the representatives from the former EPSRC Physics Programme on many occasions reported that only half of the research funds that EPSRC put into physics departments came through the Physics Programme; the other half was from a wide range of other programmes including Materials (15%), ICT (8%), Chemistry (3%), Engineering (3%), etc.

***What could the Physical Sciences Programme do to improve communication with researchers in the physical sciences?***

The Institute is pleased with the interactions the Programme has with the physics community with EPSRC staff being willing and happy to attend meetings such as the Standing Conference of Physics Professors and the Science Board.