

Recognizing hollow strengths in research communities

A review of physics in the United Kingdom highlights the usefulness of external scrutiny and the challenge of getting a part of the community to set itself new standards. Who will take the lead?

How best to assess a country's scientific research? Bibliographic indicators are important, but there is no substitute for getting authoritative and, hopefully, wise people to see for themselves and express their views. In fact, the 11 eminent physicists who have just presented a report, *International Perceptions of UK Research in Physics and Astronomy*, had more than just impressions to go on. The Institute of Physics supplied them with data from the UK university research assessment exercise, levels of funding with international comparisons, and demographics. They conducted a survey of 150 physicists outside the United Kingdom. They spent about a week visiting half a dozen labs in the United Kingdom and reviewing the evidence. The results can be found at www.iop.org/Policy/Intrev.html.

As the panel emphasize, their visits were brief. "The word 'perceptions' is apt," they acknowledge. Nevertheless, they doubt that a longer visit would have changed their perceptions significantly. The problems they point to, with the additional benefit of their perspective, are all too glaring.

The panel consisted of six physicists from the United States and five from continental Europe. By all accounts, the lack of UK participants was a strength for the obvious reason: there was no tendency to pull any punches. The presence in the report of some polite but pointed criticisms and concerns adds force to the panel's more positive overview: by and large, astronomy and physics in the United Kingdom are holding their own at the international cutting edge. But there is a clear warning to be gathered from the report: in some critical aspects, that scientific strength rings hollow.

Small physics

According to the wise men (unsurprisingly for physics, there were no women on the panel), worries are most acute in 'small physics', and in three areas in particular: economically strategic physics, the state of infrastructure, and fundamental atomic and molecular physics.

No country interested in drawing economic strength from science can afford to ignore research into the properties and processing of materials at the nanometre scale — as the United States, Germany, France and, for many years now, Japan have perceived. Here, both in science and in its collaboration with engineering, the United Kingdom is seen by the panel as weak. That testifies to a lack of industrial strength, too, and an apparent failure of the government's long-established foresight and related initiatives to stimulate a key area of development. Perhaps the United Kingdom can learn from the United States' new drive in this direction, which is drawing on the strengths and motivation of both defence and civil agencies.

The report also points to dismal infrastructure, highlighting limitations of another notable government development, the Joint Infrastructure Fund, which had originally been intended to renew equipment and labs for current research programmes. Assertions are now emerging that it has instead been devoted too much to new research projects. Moreover, infrastructure for small physics appears

to have failed to attract funding because of the need to spend much larger sums on other sciences. But heads of research funding agencies also report a wealth of excellence in the applications for infrastructure that the money could not accommodate. Clearly, the fundamental message is that the UK infrastructure needs much more by way of renovation if the United Kingdom is to remain internationally impressive.

Derivative work

That said, infrastructure is only worth investing in if the science it will support is world-class. But what if an external review says the following: "In comparison with earlier times when the UK was recognised as a leader and innovative, the work now is regarded as largely derivative"? Officials and competitors for funds could seize on this as an excuse to stop funding in that area. But this comment refers to atomic and molecular physics. This science probes the fundamentals of quantum theory and is creating exciting new states of matter and powerful new applications. There are pockets of forward-looking excellence in the United Kingdom, but one is left in no doubt that, in the eyes of this panel, too many atomic and molecular physicists have allowed the rest of the world to leave them stranded up a backwater.

Who is to blame, and what is to be done? Over recent years the funding agency responsible for that area — the Engineering and Physical Sciences Research Council — has blown lukewarm and, more recently, warm over fundamental physics. But the inward-looking character of UK atomic and molecular physics, as perceived by these outsiders and by some insiders, too, has surely become entrenched over much longer timescales. In fairness, this particular community has yet to respond to the report. But it is not easy in such a situation for a leader to step forward with a rallying cry. There needs to be a combined pressure of top-down reluctance to fund secondary research as judged by international standards, and bottom-up pressure through discussion, leading to community support for sharper funding criteria. This will take years unless leading groups can be supported strongly at the expense of others.

But there are broader lessons, too. Countries who haven't tried similar exercises should consider doing so in the light of this example. Meanwhile, in the United Kingdom, for the institutions that steered this exercise — the Royal Astronomical Society, the Institute of Physics and the relevant funding agencies — the report is well timed: the British government is reaching a critical moment in a review of government spending. The government can be pointed to an independent assessment of the country's great potential in physics and astronomy, as well as critical shortages in funding and, yet again, to the need for more support for younger scientists. But they and UK industry need to do a better job of convincing government that physics is worth supporting for its own fundamental and exploitable aspects — provided everyone can see that truly world-class science will be the outcome. ■