THE ROYAL SOCIETY

Policy document: 25/03

Supporting basic research in science and engineering: a call for a radical review of university research funding in the UK

November 2003

1 The dual support system has served basic researchers in Britain well over many years. There is, however, a widespread and growing belief that, with continuing growth in research activity in an expanding university system, the increasing burdens imposed by two distinct streams of evaluation and competition – one for the research proposals as such, the other for indirect costs and infrastructure – are becoming insupportable. The current multiplicity of reviews of pieces of this machinery, component by component, prompt the suggestion that it is time for a fundamental, meta-level review. Can we achieve the same aims, placing proper resources in the hands of the best people wherever they are, in a less cumbersome way?

2 Before amplifying this suggestion, it is well to acknowledge the virtues of the dual support system. Fifty years or so ago, in a simpler and smaller world, when the number of UK universities was about one quarter of today's and when the number of researchers was proportionally even smaller, the flexibility attendant on providing essentially everyone with a "well found laboratory" (the first strand of the dual), and then letting individuals compete for project funding (the second strand), worked well. As the number of universities roughly doubled in the 1960s, and doubled again with the abolition of the "binary line" a decade ago, it became increasingly impractical to provide every aspiring researcher with the contemporary equivalent of the earlier well found laboratory.

3 The Research Assessment Exercise (RAE) thus began in 1986 essentially as a technical solution to the problem of maintaining the dual support system (itself sanctioned both by its manifest past virtues and by the fact that very few UK researchers had experienced anything else), but with the first, infrastructure strand of dual support broadly directed to the stronger departments in any given area of assessment. And, indeed, there is both anecdotal and bibliometric evidence that these early days of the RAE tended to have a salutary effect, prompting some individuals to, as it were, focus on writing that long-postponed research paper. On the negative side of the balance sheet, however, the RAE has been perverted by many into a unidimensional totem of a department's, and ultimately a university's, prestige (never mind that different units of assessment have arguably tended to adopt different standards for their grading curve, a fact which was essentially irrelevant to the RAE in its original concept as a technical exercise for appropriately competitive distribution of infrastructure funding among Departments in a given discipline). More generally, the RAE's status as a totem of merit, overshadowing equally important measures of teaching quality or general usefulness to local or regional communities or industries, is an unfortunate unintended consequence of a basically sensible idea.

4 Subsequent RAEs have arguably become more and more burdensome and bureaucratic. Not surprisingly, they also have promoted behaviours that play to the rules of the game, which may be different from those which best serve research excellence. Other problems are the coarse boxes, with cliff-like discontinuities in the rewards from one ("4") to another ("5"), resulting from condensing much effort and information into a handful of discrete boxes. The recent Roberts' Report on the RAE is a most constructive and thoughtful attempt to deal with these problems, and is greatly to be welcomed. Despite its many merits, however, it is not entirely clear that implementation of the Roberts' Report will counter the trend to narrowing the research base into relatively few institutions, nor that it will diminish the bureaucratic burdens currently imposed. Addressing this latter point, the Roberts' Report helpfully suggests extending the interval between RAEs to six years. The price, however (and one can guess at the underlying pressures), is a mid-term review at the three-year point "with a light touch". Experience suggests the lightest touch of the bureaucratic lash draws blood.

5 Dual support's second strand, project grants, is the subject of a recent study on "sustainability" produced by the Director General of Research Councils (DGRC) in the Office of Science and Technology (OST). Prominent features of this Report are, first, the suggestion that each individual grant should be accompanied by a full account of all its individually attributable indirect costs and, second, that the fraction of the Principal Investigator's (normally a full-time academic staff member) time devoted to the project be treated as a direct cost, itself in turn attracting indirect costs. This study, understandably, seems to have taken the UK Dual Support System as given, and so did not look at how other countries deal with similar questions. Acquaintance with the complexities of the USA indirect cost system (where indirect cost rates are assessed for individual institutions, most certainly not at the level of individual grants) might have resulted in modifying the first proposal. For the second point, in the USA Principal Investigators' salaries are usually regarded as cost sharing, not as indirect costs (of course, summer salaries and practices in medical schools are a different question).

6 What is clearly shown by these two Reports, one on each of the increasingly elaborately regimented strands of dual support – not to mention a substantial number of broadly related studies and reports – is that the UK is saddled with a system which worked very well in a simpler and very different world, but which surely deserves a fresh look in the round: a look unconstrained by past history.

7 In calling for such a fresh look, one point must be strongly emphasised. Whether indirect costs or infrastructure funding comes attached to individual grants, or to assessments of the strength of individual departments (as in the RAE), or whatever, such resources must be placed in the hands of the university's central administration. Universities are increasingly expected to reward staff for performance, and consistency suggests this be reflected in the income stream to their academic cost centre. Nevertheless, changing emphases in science and engineering, no less than changing priorities in individual universities, require that there be no automatic presumption of "juste retour" to individual research groups or Departments. In the USA, this condition, and its associated tensions ("my group – or my department – brought the money in"), is well appreciated from decades of its development. In the UK, it may be that earlier worries about "who owns" any indirect cost or other infrastructure funds has inhibited fundamental consideration of the dual support system; Vice-Chancellors may have felt that the "block grant" history behind the RAE funds made the money belong more securely to the University as such. We believe these earlier, often unconscious, prejudices have been softened by experience, not least with the RAE, and that the fundamental review proposed here would be widely welcomed.

Some of the Major Problems for Such a Fundamental Review

8 Any radical change from today's dual support system may take some years to implement, but this should not inhibit an early study of alternative models. The dynamics of research funding processes necessarily involves longish timescales. This is not a problem as such, but rather an important consideration to be kept in mind.

9 Whilst calling for fundamental review, this paper makes no attempt to discuss detailed models. Nevertheless, most schemes for avoiding the huge human and institutional costs of the dual support system's two entirely separate strands for supporting an ultimately unitary enterprise are likely to involve some transfers of funds between Government Departments or Agencies and, if properly implemented, a reduction in the accompanying administrative staff numbers at both national and local levels. You need to be a behavioural ecologist, or perhaps an anthropologist, fully to appreciate how much such things count in Whitehall, and how much skilled effort will resist such change.

10 Currently, the Research Council strand of dual support embraces the UK as a whole, and it seems highly desirable that this should continue. But the RAE strand, although the evaluation is UK-wide, feeds into disbursement of funds by the four distinct countries (England, Scotland, Wales, Northern Ireland), which act independently in principle and somewhat differently in practice.

11 In the UK, as elsewhere, the dominant funder of the universities is public money (about 74% in 2000-01, including EU funds), mainly through the Funding and Research Councils. Charities are also significant funders (15% in 2000-01, although somewhat less now) of the UK science base, especially in biomedical area ; 15% is a very large fraction compared with other countries. Whilst some charities make notable contributions to science base infrastructure – particularly the Wellcome Trust, the funder of buildings and other contributions to public/private joint infrastructure funds – research grants from charities are usually focused primarily on the direct costs of the research itself. This has been allowed for, to a degree, by some of the Higher Education Funding Councils (HEFC) and is the subject of ongoing debate. Any major restructuring of the dual support system should take charity funding into account.

12 By the same token, UK business makes significant contributions to science based funding (about 7%). Again, there can be problems with recovery of associated indirect costs. The Higher Education Reach Out Fund (HERO), analogous to the RAE funds, can help in some cases. More generally, however, the remarks in paragraph 11 apply here too.

13 As made explicit in its initial heading, the main emphasis in this paper is on basic research in science and engineering, with the implicit assumption that Economics and the Social Sciences are included under "science" (as betokened by the Economic and Social Research Council, ESRC). Whether a radical restructuring of the dual support system can or should be carried out for science and engineering, thus defined, without parallel action for the arts and humanities, is a question not pursued here.

14 Passing reference has been made in paragraphs 5 and 7 to science base funding in the USA. Any such comparisons are, of course, beset with many difficulties, caused by funding differences between the two systems. For example, almost all Higher Education Institutions (HEI) in the UK are publicly funded; in contrast, only 40% of the more than two thousand HEIs in the USA are public. But more than three quarters of all students are to be found in these public institutions in the USA (and, on a different subject, at these 40%of HEIs total funding from state legislatures is, on average, roughly matched by tuition fees paid by students). These complications notwithstanding, there are many aspects of science base management and funding where parallels can be drawn, and useful comparisons made.

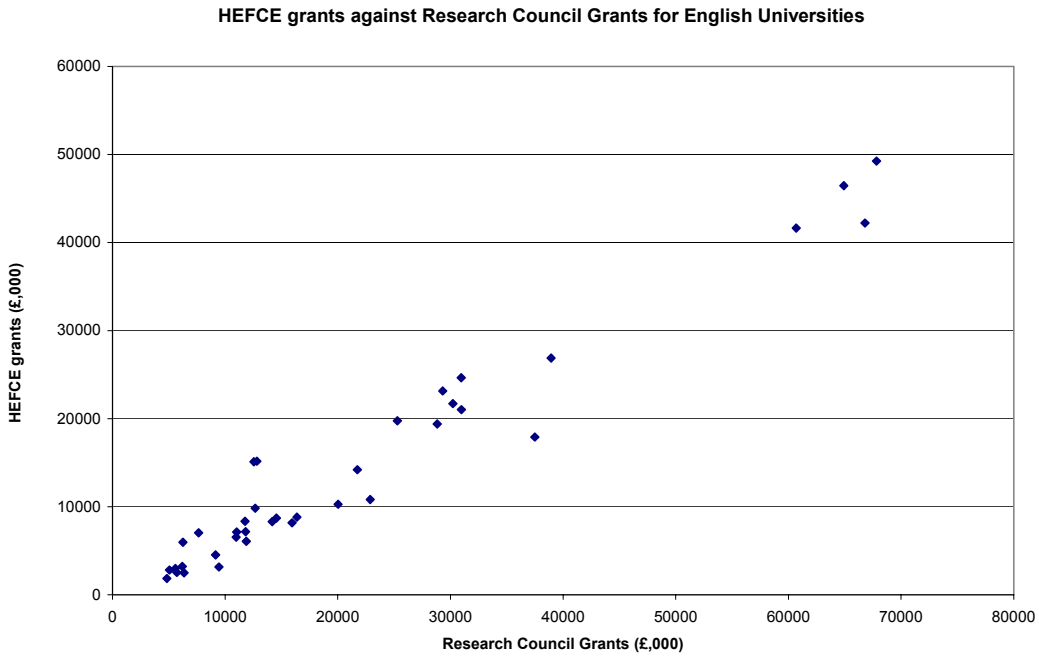
Reasons for, and Potential Benefits from, Such a Fundamental Review

15 The essential reason for fundamental review of funding arrangements is that the current dual support system uses two admittedly different, but certainly burdensome, processes to serve the same end result : putting both direct and infrastructure funding into the best hands. It would be very helpful to have more information about the increasing administrative costs in HEI, over the past decade and more, much of it driven by these kinds of demands by Whitehall and its Agencies. Anecdotal evidence is abundant, but analysis of the potential savings, in money and time, would be a helpful part of any such fundamental review.

16 Figure 1 shows that, at least for HEIs receiving more than a few million pounds in Research Council and HEFC funding, there is a fairly tight correlation between the two (some of the complications with any such comparisons are indicated in paragraphs 11, 12, 13 above). This, in turn, strongly

suggests that a unitary mechanism – possibly based on the outcome of competitive funding of research proposals by Research Councils and other funders – could indeed achieve very much the same overall result as currently achieved by the dual support system, but with very much less time, trouble and expense. Indeed, given some of the problems listed in the following paragraphs, who is to say that the relatively small fluctuations about a straight line in Figure 1 are signals rather than noise, or even that a straight line might approximate some mythic "fair result" better!

Fig 1 Research Council Grants against Funding Council Grants



17 There are, arguably, structural problems inherent in the existing dual support system. In the UK, Research Council grants and other forms of competitive project-based funding typically result in papers in refereed journals. Bibliometric data compiled by the Institute for Scientific Information in Philadelphia (ISI) show the UK to be a very collaborative place, with roughly half of all published papers in science, medicine and engineering involving collaborations between two or more **different institutions**. In contrast, the RAE focuses not on individuals, not on groups, but formally on university Departments or appropriate aggregations thereof. So here we have the RAE, a technical exercise aimed at placing indirect costs and infrastructure funding at those places whose actual research output demonstrates ability to use such money well, being determined at the level of university Departments, whereas the actual work to be supported is half the time involving collaborations not just between different Departments, but between different institutions.

18 It has, indeed, been argued that the pathologies indicated in paragraph 17 inhibit multidisciplinary research in the UK. Again, many anecdotes support this belief. To the contrary, a study by the Higher Education Council for England (HEFCE) suggests multidisciplinary work fares just as well under HEFCE aegis as other, more mainstream, work. Interestingly, the above-mentioned ISI rather arbitrarily partitions the entire waterfront of science, medicine and engineering into 21 boxes. These boxes embrace areas of varying magnitude, but most are conventional categories (physics, chemistry, clinical medicine, and so on). A less well defined box, arguably used as a catch-all for undefinable papers, is "multidisciplinary". Questions can then be asked about the quality of the UK papers in this category, compared with other countries, as measured by the average citations per paper as a ratio to the world average citations per paper in this category. Different questions can be asked about the UK's average investment in this category, as roughly measured by the proportion of UK papers that are in this category, as a ratio to the corresponding proportion of the world's papers. It turns out that, of the ISI's 21 categories, multidisciplinary is one in which the UK's output is both of exceptionally high quality, and also shows a pattern of more than average investment. So, returning to the HEFCE study, the fact that this area – in which Britain by international comparisons performs exceptionally well – does more or less as well as other subjects for RAE based funding can be taken to suggest that indeed the RAE is structurally biased against multidisciplinary work, although not hugely so. But all this is only one amongst several problems that arise naturally as a result of the mismatch between intention and execution, as outlined in paragraph 17.

19 Another problem with the current RAE, which the Robert's Report recognises and seeks to ameliorate, is its increasingly formulaic rigidity. One among many such formulae is the restriction that forbids individuals to list more than four published papers, no matter what. More serious is the recurring suggestion that maybe "top end" Departments be excluded from routine review : a Premier League you can move into, but not be relegated from. Most serious are increasing suggestions that a "top tier" of universities might be singled out – a revisiting of the "RTX" suggestion of a decade and more ago. Against all this we need to keep in mind that pockets of outstanding excellence are to be found where some may not expect them, and conversely some remarkably good universities can have areas of weakness. Again, bibliometric data give specificity to this, albeit with data from around ten years ago. Let us take the ISI's 21 categories within science, medicine and engineering, and ask which universities are the UK's top three in each category, as measured by average citations per paper published from the Department (thus, incidentally, scaling out effects of pure size). There are consequently 63 medals to be won. In principle, as few as three universities could take the lot, 21 each. But, in fact, within the UK no fewer than 26 universities take at least one medal, whilst the top performer takes fewer than half the 21 medals possible. It is arguably easier to recognise truly excellent, if small, groups in unlikely places, and to support them with appropriate infrastructure funding, in a unitary system based primarily on success in competitive research project funding, than in the current complexities and rigidities of the dual support system : departments, as such, do not do research ; research is done by individuals and groups, frequently collaborative and/or multidisciplinary.

20 This being said, there is also need to provide incentives for individual universities to shape different profiles of strength, within a system not so dominated by the unidimensional incentives of the RAE. The HERO funding goes some way in this direction. But a unitary funding that automatically gave appropriate recognition to involvement with local and regional business and industry could be an alternative, equally effective but again with less oppressive duplication of effort.

21 It is interesting to note that in the USA, the number of institutions giving Ph.D.s is around 250. In the UK, with one fifth the population and one seventh the GDP, it is around 120. One of the underlying differences is that in the USA much excellent undergraduate education takes place in four-year teaching-only colleges, which have no Ph.D. programmes (however, such colleges supply roughly half the input to Ph.D. programmes in the Ivy League and other major private universities). But some of the faculty at such colleges do have first rate, competitively funded, research programmes. And they have Ph.D. students working with them, but necessarily enrolled elsewhere, under co-operative arrangements. The relatively unitary funding arrangements in the USA mean that such research can be recognised and supported, with both direct and indirect costs funded, in such places. This is an additional, if peripheral, argument for fundamental review of our current dual support system, against the possibility that at such future time as it may be decided that we have an excessive number of Ph.D. programmes, we can retain the flexibility of appropriately funding excellent people at places, or in Departments, without Ph.D. programmes.

Towards Such a Fundamental Review

22 The purpose of this paper is not to propose any detailed alternative to the present dual support funding system. Rather, it is a strong suggestion that the time has come to stop rearranging the deck chairs, no matter how thoughtfully and carefully, on two entirely different ships which ultimately have the same destination. Should this suggestion be taken up, the Royal Society will be an energetic participant in the subsequent discussion, and doubtless will bring specific models forward for consideration.

23 Amongst the many details in which devils lurk, if such a fundamental review is undertaken, are related but distinct questions of funding for new buildings, and other truly large items of capital expenditure. Turning again to the USA, but looking at a facet rather different from those above, much funding for new buildings comes from tax free municipal loans, which have much in common with the use to which many universities put the earlier UK Business Expansion Scheme (BES). It seems sensible to flag this issue up here, whilst recognising that it is a somewhat separate question.

24 In short, cutting across all the details of potential benefit and difficulties sketched above (and recognising that the difficulties will loom large in arguments to do nothing), this paper asks why the two distinct strands of the dual support system cannot be replaced by something essentially as simple as : for any given HEI add up all the Research Council funding, all the charity money, all the funding from business and industry, multiply by some factor (probably different for the three components), and thence determine the infrastructure/indirect cost grant analogous to that currently assessed by the HEFC/RAE process. Figure 1 suggests that such a simple process will be a sound starting point on which to build an efficient system to support research in the diversity of UK HEIs, with allocations not all that different from the one currently arrived at with so much expenditure of time and energy. At very least, it would be worthwhile exploring the relationship between project and infrastructure funding for particular groups of disciplines.