The Academy of Medical Sciences

Second submission to the spending review consultation, July 2010

Summary

The positive relationship between world-class medical science and national gains in health and wealth is well established. The UK's superior medical research base, our co-coordinated landscape of private, public and charity funders, and the research potential of the NHS give us an unparalleled global competitive advantage. Retaining and harnessing this competitive advantage is reliant on the Government's continued commitment to the publicly funded science base.

Government should publish a new long-term strategy that outlines its commitment to the UK's science base. At a time of uncertainty, this will help to reassure increasingly mobile researchers and industries about the future of the UK science base in the face of strong investment from our overseas competitors. The strategy should focus on excellence and should protect the autonomy of both universities and Research Councils.

The current balance between the two strands of the dual support system for research has allowed the UK to develop world class, research-intensive universities. We see no reason to change this balance. These universities must be protected, as should the sites of excellence that exist outside these universities; university departments and institutes with the highest Research Assessment Exercise score should continue to be priorities for investment.

Partnerships between academia, industry and the charity sector ensure that the outcomes of publicly funded medical research are translated into outcomes that benefit the UK population and economy; it is vital that the business and charity support elements of higher education funding are protected from cuts.

Very broadly, we consider that the priorities for Research Council investment should be people, followed by programmes, followed by capital. In brief:

- Highly skilled individuals are the UK's most valuable resource, ensuring resilience and enabling our rapid response to future economic recovery. We place particular emphasis on supporting doctoral students, early postdoctoral researchers and clinician-scientists, both as a cost-effective way of sustaining the research base and for their important role in supplying the wider workforce and economy. At a time of constrained resources, incentives to promote mobility of researchers between countries, and between academic, industry and healthcare sectors, will be particularly important.
- With respect to programme funding, we note both the need for continued public sector investment in selected areas of excellence that are on the cusp of translation, and the importance of supporting the long-term pipeline of health and economic benefits via blue skies funding. Major thematic programmes should be carefully scrutinised to ensure they do not sequester money away from more readily soluble research problems, or from new opportunities that arise unexpectedly.
- Given that investment in UKCMRI has been confirmed, we see less need for major investment in new 'bricks and mortar' in the immediate future.

Given the complexity of the UK science base, it is impossible to predict the net impact of different levels of cuts in public funding. As far as possible the total value of cuts should be transparent at the outset. This avoids the danger of 'salami slicing' and allows universities and Research Councils to plan robustly, without the uncertainty of more unknown cuts to come. Ideally cuts should be implemented gradually to allow researchers and funders to adapt their projects accordingly.

An additional paper outlining how investment in biomedical research can provide a platform for increasing UK health and wealth has also been prepared by the Academy.[1]

1 Opportunities and challenges

1.1 The UK has a strong competitive advantage in medical science

The UK has an unparalleled competitive advantage in medical science. Our internationally renowned academic medical research centres include four of the world's top ten universities and we are distinguished by over 30 winners of Nobel Prizes for biomedical research.[2] The UK generates over 10% of the world's clinical science and health research outputs - second only to the US.[3] The formation of the National Institute for Health Research (NIHR), its synergies with the Medical Research Council (MRC) and the investment in NHS research infrastructure are finally allowing the UK to harness the unique research opportunities of the largest single healthcare system in the world. Most importantly, the current partnerships and formal funding relationships between Government, NHS, industry, academia and charities are able to both leverage significant private and philanthropic investment and promote rapid translation of research into health and wealth outcomes that specifically benefit the UK population. These close relationships are envied internationally, but their future success requires continued Government investment and commitment to the publicly funded science base. There is a strong public mandate for this funding, with a recent survey showing that an overwhelming majority of people support substantial investment of public money in medical research.[4]

1.2 Public funding leverages charity and industry funding

One of the UK's strengths is our rich landscape of medical research funders. Public spending on medical research leverages - rather than displaces - private and charitable funding.[5,6] Each year, medical research charities invest £1.1bn in UK health research, and a recent study showed that every £1 increase in public funding stimulates up to £5 investment into research by the pharmaceutical industry.[7,8] Charity, industry and Research Council funding tend to focus on different, but complementary, areas of research. It is therefore a mistake to believe that industry and charities could simply fill the gap if public sector funding were reduced. The MRC, for example, invests significantly in research into the underlying biological mechanisms of disease. The findings of this research underpin much of the follow-on research in different disease areas, which is picked up by charities and industry funders. So, in addition to leveraging increased amounts of investment, close funding relationships between academia, industry and the charity sector ensure that the outcomes of publicly funded medical research are translated into actual health and wealth benefits.

1.3 Medical science can support economic recovery

In the Academy's recent report 'Reaping the rewards: a vision for UK medical science' we demonstrate the relationship between world-class medical science and national gains in health and wealth. In short,

excellence in research leads to better medical care, attracts investment and industries, and improves the productivity and cost-effectiveness of healthcare, social and public services.[9]

Medical science is a long-term endeavour but it has an exceptional long-term payback. A recent study showed that every £1.00 invested in public or charitable research into cardiovascular diseases in the UK between 1975 and 1992 produced a stream of health and economic benefits equivalent to earning £0.39 per year *in perpetuity*.[10] Our world-class research base has attracted medical science industries that support over 250,000 UK-based high-value jobs and generate a trade surplus of £7 billion from the pharmaceutical industry alone.[11,12] The UK has created nearly one in five of the world's top 100 medicines.[13]

Looking to the future, there is a trend for societies to spend more on health, and medical science will remain a high growth industry.[14] Translating the outcomes of basic medical research into mechanisms to prevent and treat ill health can tackle the estimated £100 billion cost p.a. of sickness absence.[15] Evidence generated by medical research provides the information needed to underpin and evaluate effective public policy (e.g. the link between smoking and lung cancer), and can help to tackle international challenges such as improving global health and the threat of bioterrorism. As with other areas of science, medical science is increasingly recognised as an instrument of foreign and international development policy.[16,17]

1.4 Our competitors are investing heavily in science

The UK's competitors have begun to realise the huge potential of medical research to boost both their economies and public services, and are investing heavily to grow this crucial sector. The experiences of Finland and South Korea in the 1990s demonstrate the importance of investing in R&D to support growth in a recession.[18] Germany, France, Australia, South Korea, Canada, the US, China and India have recently committed to substantial increases in their science budgets.[19,20,21] In contrast, future UK investment across the science base is uncertain, with 25% cuts to public spending announced in the Budget on 22 June 2010. There is a high risk that intrinsically mobile academics and industries will relocate to global centres of excellence where they see long term investments being made. There is also evidence that countries with higher domestic R&D intensity gain more from R&D performed overseas. As such, unless we invest ourselves we will not reap the potential economic benefits (described in 1.3), nor will we have the capacity to exploit the outcomes of the increased R&D investment overseas.[22]

2 A new, long term commitment for science

In response to the current economic uncertainty and the competition from overseas investment, the Government should publish a new long-term strategy that outlines its commitment to the UK's science base. This is vital if we are to retain researchers and life science industries and ensure that disease specific charities continue to invest in UK research. A new science framework, that would update the Science and Innovation Investment Framework 2004-2014 in the context of the current economic climate, should:

- Prioritise excellence, particularly excellent people.
- Safeguard our world-class universities, research institutes and university departments (by concentrating funding on excellence).

- Protect the autonomy of universities and Research Councils (allowing them to respond flexibly and rapidly to a changing international research environment).
- Provide as much stability and certainty as possible by indicating upfront the overall level of cuts.
- Focus on reversibility, allowing the UK to maintain capability to regenerate key areas when future funding becomes available.
- Maintain and grow the essential partnerships between public, private and charity sector funders, which leverage significant private and philanthropic investment and promote rapid translation of medical research into health and wealth outcomes.
- Ensure limited funds are spent most effectively by promoting co-ordination amongst funders and reducing unnecessary bureaucracy in areas such as medical research regulation.

3 Priorities within the science budget – supporting diversity

3.1 Dual support

The complementary strands of the dual support system have allowed the UK to develop and sustain our world-renowned, research-intensive universities, which leverage funding from both industry and the charity sector, train the next generation of skilled workers, provide a stable core funding base for novel research, and attract an increasing number of international students.[23]

The Quality Research (QR) strand allows universities to: develop new pockets of expertise; support exploratory work on high-risk, but potentially high-reward, projects (before seeking further funding from other sources); and support the development of partnerships with users of research, helping to achieve greater impact from research findings. Research Council funding supports excellent directed and response-mode funding and ensures that national capacities are maintained. Together the two strands strike a balance between empowering universities to make financial decisions at the institutional level, while providing overall national strategic direction. Universities have adapted to the current ratio of research funding delivered via the Research Councils and via higher education funding, and we see no convincing case to perturb this system.

3.2 Higher Education Funding - Quality Research strand

It is vital that we support our world-class research-intensive universities, particularly at a time when other countries are investing so heavily in theirs. [24] Our own universities have seen recent cuts in funding and our overall level of investment in universities, as a percentage of GDP, is lower than many of our OECD competitors. In the biomedical sector, our leading universities have formed productive partnerships with industry, charities, and the NHS, as well as with each other (see Box). These partnerships translate research into health and wealth benefits, develop new technologies that underpin future economic growth, provide consultancy to businesses, generate spin out companies and train the next generation of highly skilled researchers and workers. Over the last decade UK university bioscience departments have generated over 200 spin-out companies.[25] The total estimated turnover of companies spun out of Russell Group Universities was £724m.[26]

A declining return on investment and a lack of risk capital are causing larger pharmaceutical companies to outsource R&D into academia and smaller biotechnology companies. The UK is already home to several impressive industry-academia collaborations that can take advantage of these new opportunities, e.g. the Division of Signal Transduction Therapy (DSTT) (see Box).[27] Industry will often

bring significant scientific expertise to these partnerships, along with training opportunities and access to expensive reagents and equipment. But unless we maintain the quality of our academic research base we will not continue to attract these valuable and productive partnerships.

Examples of university partnerships with industry, charities, and the NHS

University of Dundee. The Division of Signal Transduction Therapy (DSTT) is a unique collaboration between scientists in the MRC Protein Phosphorylation Unit, the College of Life Sciences at the University of Dundee and five of the world's leading pharmaceutical companies (AstraZeneca, Boehringer Ingelheim, GlaxoSmithKline, Merck-Serono and Pfizer). DSTT is dedicated to accelerating the development of specific inhibitors of kinases and phosphatases for the treatment of disease.

University of Oxford. The Gray Institute for Radiation Oncology and Biology is a collaboration between the University of Oxford, Cancer Research UK and the Medical Research Council. It has been created to be the world's largest and most comprehensive centre for research in radiation oncology and biology (a previously underfunded area of research).

The University of Manchester. AstraZeneca and the University of Manchester have developed a collaboration to deliver safe and effective medicines to patients. Joint research areas include cancer, diabetes, imaging, and pharmaceutics and process engineering. The partners will exchange staff, share facilities and encourage joint ventures in a bid better to understand a wide variety of diseases.

Imperial College London. In March 2009, Imperial College London and Imperial College Healthcare Trust became the UK's first academic health science centre. The centre aims to translate excellent research into treatments that will benefit the Trust's patients and the wider health sector.

In a scenario of spending cuts, we believe that university departments with the highest research quality profiles should be prioritised for investment. We note that the strategy of concentrating funding on the universities or groups of universities with the greatest potential to compete internationally has been adopted by our competitors such as Germany and China.[28] We support the continued autonomy of universities and note that other countries are building in greater autonomy to compete more effectively with the UK.[29] The QR block grant allows universities to respond effectively and flexibly to local, regional, national and international opportunities and challenges. However, for the reasons outlined above, we would hope to see universities allocating their QR grant according to excellence, whether this is measured conventionally (i.e. by the Research Assessment Exercise/Research Excellence Framework) or in terms of innovative opportunities for translational research.

The recent report by Lord Wakeham suggests that the income universities receive to carry out research is not fully covering the costs of undertaking this research, which risks their financial sustainability.[30] In this context, we highlight the Charity and Business Support Elements of the QR strand, which provide universities with an important contribution towards the full economic costs of research funding from charities and industry. These small amounts of money exert a significant leverage and must be protected to ensure that these valuable partnerships continue. The removal of this support would lead to charities funding fewer, more expensive, grants and they may find it difficult to explain to donors why their money is being directed into university infrastructure rather than

directly into research. Industry will increasingly seek partnerships where there are more favourable incentives or where overhead costs are lower (e.g. in the US and other parts of Europe).

3.3 Research Council funding

Here we consider the funding that is allocated by the Research Councils to universities, Research Council institutes and to capital and infrastructure projects. We focus particularly on the MRC, but a number of our comments will be equally applicable across the Research Councils. By any means of assessment, our MRC units and institutes can be considered world class. They have been home to many Nobel Prize winners and have been responsible for scientific advances ranging from the discovery of the human influenza virus to the development of therapeutic antibodies. Since 1998 the income from licensing the discoveries made by their employees reached £439.4 million and they have helped to develop twelve drugs, including Herceptin (for the treatment of breast cancer) and Actemra (used to treat rheumatoid arthritis).[31]

It is important that the Research Councils, in partnership and consultation with their key stakeholders (including Government), have autonomy in determining the allocation of the funds provided to them. They (and the research leaders from across the sectors that advise them) are best placed to determine the strategies that will minimise the impact of expected cuts on the UK's research base. In a time of restricted funding, it is vital that the Research Councils have the flexibility to respond quickly to new opportunities and challenges - the funding allocation from Government should be as unconstrained as possible. In allocating their funds in a time of spending cuts, we would advise the Research Councils to prioritise people, followed by programmes, followed by capital (while recognising that a minimum level of investment under each heading is necessary to ensure that the system functions). We regard these priorities as being appropriate both to spend in Research Council institutes as well as that via the universities. We expand on these priorities below.

3.3.1 Funding excellent people

Highly skilled individuals are the UK's most valuable resource, ensuring resilience and enabling our rapid response to future recovery; maintaining the pipeline of researchers should be the highest priority in the coming spending round. We would place particular emphasis on supporting doctoral students, early postdoctoral researchers and clinician-scientists, both as a cost-effective way of sustaining the research base and for their important role in supplying the private and public workforce in STEM and non-STEM sectors.

We are particularly concerned about the risk of losing a generation of clinician-scientists, given that an increasing focus on service delivery within the NHS could make it more difficult for junior doctors to find time for research. Here the MRC's role as the largest single funder of clinical academic doctoral fellowships is vital.[32] Within the biomedical sector it is important that PhD students and junior postdocs are placed in centres (and departments) of excellence where there is a critical mass of senior research staff, experienced postdocs and other students.

We have previously highlighted the importance of promoting mobility of researchers between industry, academia and the NHS – to exchange skills, to forge opportunities for cross sector working and to promote mutual awareness.[33] Initiatives to support mobility should remain a priority in the current economic climate. Given the major investments in science in our competitor countries, international mobility will also be important, and our visa system should encourage and facilitate entry of talented medical researchers to the UK.

3.3.2 Programmes

UK medical research has benefited from a recent uplift in public sector investment (which in turn has leveraged private and charitable sector funding). As a result, many scientific advances are now on the cusp of translation into benefits for patients and society. Important opportunities include: delivering more effective treatments through personalised/ stratified medicines; regenerative medicines including blood alternatives, cell-based therapies and interventions to restore vision and motor function; and medical devices such as robotic surgery, implants and prostheses. [34,35] Continued public sector investment in selected areas of excellence during times of fiscal constraint will ensure that the benefits of their commercial exploitation do not disappear abroad (as happened with much of the UK's semiconductor industry) or get lost altogether. This is particularly important given the rapid decay in the commercial pipeline for new medicines and the need for new products to fill this widening gap. Universities and research institutes play a vital role in incubating the pre-competitive stages of these technologies before the private sector is able to take the risk of investing. The translational medical research agenda has to consider the burden of disease, unmet therapeutic needs and other societal and government priorities that are not attractive to the private sector. Here the partnerships between the Research Councils and NIHR are vital to ensure that public benefits are realised.

Focusing funding on only those areas likely to deliver economic, patient or societal benefits in the near term would be short-sighted, and risks cutting off the scientific and economic pipeline for decades to come. Medical science is a long-term endeavour with an exceptional long-term payback. The UK's history of supporting blue skies research over the long term via the Research Councils has generated considerable, though often unanticipated, health and economic rewards, most notably therapeutic monoclonal antibodies and embryonic stem cells.[36,37] This is a mode of funding that is not supported by industry or charities. Instead it provides these sectors with a pipeline of ideas and attracts their partnership and further funding. It is essential that funding for excellent blue skies research is not disproportionately reduced by any spending cuts.

Currently, approximately 15% of Research Council budgets goes on cross-cutting themes or 'Grand Challenges' such as the digital economy, energy, food security, living with environmental change, and lifelong health and wellbeing.[38] These themes are important to society and the economy, but they only represent a good use of public money if they can deliver. In a climate of spending cuts, the choice of themes and the strategies that underpin them must be carefully scrutinised to ensure that they do not sequester money away from more readily soluble research problems or new opportunities for progress that arise unexpectedly. It is important that researchers play a central role in the development of these themes and programmes. For example in 2009 the Academy published a report on ageing, commissioned by MRC, which identified the steps that should be taken to improve the UK's performance and international standing in ageing research.[39]

3.3.4 Capital

The plans for a unique £600 million medical research partnership to create a world-class centre for medical research in London - the UK Centre for Medical Research and Innovation (UKCMRI) - highlight the potential of the cross-sector partnerships that are so important in the biomedical sciences.[40] We welcome the Government's recent commitment to this project, alongside investment from other funders including the Wellcome Trust and Cancer Research UK. Overall, medical science has benefited from significant investments in infrastructure in recent years and we see less need for investment in

new 'bricks and mortar' in the immediate future. Of course, ongoing support will be required to maintain and 'bed-in' previous national investments in research resources and infrastructure.

3.4 Sustaining a broad knowledge base

Given our constituency, we have focused primarily on medical science in our submission. However, many of the immediate challenges facing society today, such as ageing or obesity, require expertise from across the full range of medical, natural science, engineering, humanities and social science disciplines. For example, within the medical sciences, understanding the genetic basis of disease is increasingly reliant on mathematics and computing; medical imaging depends on physics and engineering; and the insights provided by the social sciences are essential in translating the findings of medical research into public health benefits. In short, support is required across the research base to safeguard the valuable advances that benefit patients and society.

3.5 Promoting stability, reversibility & resilience in a difficult economic climate

Medical science is a long-term endeavour, and areas of research that are cancelled before they can deliver represent wasted investment. Moreover, subsequent loss of staff and expertise mean that projects and research areas cannot easily be resumed if funding subsequently becomes available.

The complex interdependencies between different parts of the science base means that it is impossible to predict with any certainty the net impact of different levels of cuts to the science budget. For illustrative purposes, cuts of 25% to the MRC's 2008/09 budget of £704.2 million would be equivalent to the entire MRC spend on neurosciences and mental health, plus its awards to translate the outcomes of research. It is likely that cuts of this magnitude would affect both intra- and extra-mural programmes, and would have a severe impact on the MRC's ability to fund high quality science; we would expect response-mode funding rates (in relation to applications) to fall significantly.

We stress that, wherever possible, irreparable damage to particular disciplines or research areas should be avoided, and we hope that a focus on excellent people will help to build in an element of reversibility. However, we fear that some important areas (in terms of health and wealth) that that are moving very rapidly will become vulnerable. These include genomics, bioinformatics and imaging, i.e. platform technologies where the science is moving very quickly and where we would be unlikely to recover the ground lost if these areas were stopped.

4 Maximising the effectiveness of investment

4.1 Co-ordinating health research

Within medical research, advances are made and exploited by an iterative cycle of ideas between laboratory, clinical and population sciences. The UK offers one of the few environments where leaders from Government, industry, academia and charities can jointly plan for the future of medical research across this cycle: the Office for the Strategic Co-ordination of Health Research has ensured that the allocation of public funding for health research is coherent and provides value for money.[41] This has resulted in an unprecedented level of partnership and a level of trust across the sectors not seen before. Medical charities and life science industries have made it clear to us that these partnerships depend on the Government's continued commitment to funding the science base.

4.2 Reducing bureaucracy

In our report 'Reaping the rewards: a vision for UK medical science', we highlight the need to reduce the regulatory burden on medical research as the most important step in ensuring that commercial and non-commercial clinical research is cost-effective and efficient.[42] We are currently undertaking a review of this area and it is clear from the evidence that we have received that there are real opportunities to streamline the regulatory and governance framework around medical research. Reducing unnecessary bureaucracy will save costs, increase health benefits, and make the UK a more attractive location in which to undertake research. We welcome the support given to this study by the Minister of State for Universities and Science and would see the implementation of its recommendations as an important part of a new framework for science.[43]

The Academy of Medical Sciences

The Academy of Medical Sciences promotes advances in medical science and campaigns to ensure these are converted into healthcare benefits for society. Our Fellows are the UK's leading medical scientists from hospitals and general practice, academia, industry and the public service.

The Academy seeks to play a pivotal role in determining the future of medical science in the UK, and the benefits that society will enjoy in years to come. We champion the UK's strengths in medical science, promote careers and capacity building, encourage the implementation of new ideas and solutions – often through novel partnerships – and help to remove barriers to progress.

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