

August 2014

Summary

This submission is provided in addition to the response we have submitted jointly with the Royal Society, British Academy and Royal Academy of Engineering. We would like to take the opportunity to provide a few pieces of additional input relating particularly to medical science, whilst reinforcing the points made in the joint submission.

- The strategy should aim to produce a long-term (10+ years) flexible framework that focuses on maintaining a broad, diverse, national research base that can be leveraged over time to address various specific challenges. The framework should comprise overarching principles and proposals for the initial period, to be periodically reviewed, and link to existing initiatives such as the Life Sciences Strategy to ensure coherence.
- The UK should make a clear, long-term commitment to research funding that is attractive to charities, businesses and researchers: funding should be increased to keep pace with global competitors, or if not, at least maintained in line with inflation.
- The UK's status as a world leader in medical research is underpinned by its first-class workforce. The strategy should ensure that this status is retained and particularly that medical training facilitates the development of a cadre of excellent clinical academics as well as ensuring that all healthcare staff support research in the NHS and utilise its findings.
- Improvements in use of research resources, as well as developing, attracting and retaining researchers and private and charitable investment in research, could be attained by facilitative and co-ordinated policy across multiple departments and areas, including:
 - Capitalising on the research opportunities offered by the NHS and the public health system, such as: developing and supporting a healthcare workforce that is capable of undertaking research and absorbing research findings into practice; ensuring proportionate regulation and governance of clinical and pre-clinical research; enabling appropriate researcher access to a range of data including healthcare and clinical trial data; and supporting the National Institute for Health Research (NIHR) in the Department of Health.
 - Supporting translation of medical research into patient impact, including: early access schemes; adaptive licensing initiatives; improved uptake of new innovations into the NHS; and adequately resourcing the activities of the Technology Strategy Board (TSB), such as the Biomedical Catalyst, without redirecting funds away from other parts of the research and innovation system.
 - Developing a strong skills base in the science, technology, engineering and mathematics (STEM) workforce, including facilitating and supporting collaboration and permeability between disciplines and sectors, and addressing barriers to access to STEM careers in all demographic groups.

This response uses the same sectional headings as the joint Academies' response, which are taken from the consultation document.

Scope

We welcome the appetite to develop a science and innovation strategy. The UK is a highly effective and impactful research nation. Our excellent research base is the most productive in the world and includes a higher education sector worth almost £60bn per annum in jobs, exports and added

value.¹ The UK medical research funding ecosystem comprises multiple public, private and charitable sources. This multiplicity provides resilience. A strategy that supports this system and allows it to evolve is essential to ensure a world-class research and innovation environment that is attractive to the brightest talent, and to collaboration and investment from industry and from overseas.

The Strategy should aim to produce a long-term (10+ years) flexible framework that focuses on maintaining a broad, diverse, national research base that can be leveraged over time to address various specific challenges. The framework should comprise overarching principles and proposals for the initial period, to be periodically reviewed.

- A long-term framework (10+ years) would reflect the time taken to translate medical research. Although the translation of research into impact can occur over a short timescale, much research takes longer to translate. For example, in 2011, only a year after research demonstrated that its use reduced deaths from traumatic bleeding by a sixth, tranexamic acid was listed as an essential medicine by the World Health Organisation (WHO) and its use shown to be highly cost effective.^{2,3,4} However, a recent report calculated – using a range of research-derived interventions – that the average time lag between investment in cancer research and patient benefit is 15 years.⁵
- No one can confidently predict exactly what future challenges will arise. However, we can be certain that maintaining a broad research base will best position us to address them. Medical researchers are increasingly working in multidisciplinary teams, as, for example, we move towards greater integration of health and social care or seek to harness the latest advances in bioengineering. Breadth of expertise can only be achieved by supporting a broad range of research training and research activities, and through sustained quality-related (QR) funding that gives higher education institutions the autonomy to deliver knowledge and skilled researchers across a range of disciplines. Furthermore, an interdisciplinary team-based approach needs to be encouraged and prioritised in STEM teaching and research, and it will be important to ensure that individuals can use their collaborative contributions in their future career progression. Finally, the strength and diversity of our research base is one of the reasons that the UK has the highest percentage of funding from overseas sources for R&D in the G8. The UK pharma industry, responsible for 14% of the world top 100 medicines (second only to the US and equivalent to Switzerland), relies on strength in over 20 disciplines.^{6,7}
- A substantial proportion of strategic research is funded through Government departments and Public Sector Research Establishments (PSREs). This research can be world-class in its own right and underpin innovation in other areas. Cross-government research coordination and an appropriate level of funding are necessary to maximise the impact of this strategic research. The ‘science budget’ cannot substitute for reductions in departmental research budgets, and vice versa.

¹ Figures quoted by Lord Mandelson, ‘The Future of Higher Education’, Dearing Lecture, Nottingham University, 11 February 2010. Full text available at:

<http://webarchive.nationalarchives.gov.uk/+/http://www.bis.gov.uk/News/Speeches/mandelson-dearing-lecture>

² CRASH-2 trial collaborators (2010). *Effects of tranexamic acid on death, vascular occlusive events, and blood transfusion in trauma patients with significant haemorrhage (CRASH-2): a randomised, placebo-controlled trial*. *Lancet* **376(9734)**, 23-32.

³ Guerriero C, *et al.* (2011). *Cost-effectiveness analysis of administering tranexamic acid to bleeding trauma patients using evidence from the CRASH-2 trial*. *PLoS ONE* **6(5)**, e18987.

⁴ World Health Organisation (2011). *17th WHO Essential Medicines List*.

http://whqlibdoc.who.int/hq/2011/a95053_eng.pdf

⁵ Glover M, *et al.* (2014) *Estimating the returns to UK publicly funded cancer-related research in terms of the net value of improved health outcomes*. *BMC Medicine* **12:99**.

⁶ Association of the British Pharmaceutical Industry (2013). *Top 100 prescription medicines*.

<http://www.abpi.org.uk/industry-info/knowledge-hub/global-industry/Pages/Top-100-prescription-medicines.aspx>

⁷ Association of the British Pharmaceutical Industry (2008). *Skills needs for biomedical research: creating the pools of talent to win the innovation race*. <http://www.abpi.org.uk/our-work/library/industry/Documents/skills-biomedical-research.pdf>

Investment in research has been demonstrated to have long-term economic and social benefits, and evidence indicates that research activity scales with level of investment.^{8,9} The rate of return for every £1 invested in research into cardiovascular disease, mental health disorders or cancer (which together account for around 45% of the current disease burden in the UK) is estimated at 37–40p per year in perpetuity.¹⁰ The UK should commit to increased investment in research and innovation to keep pace with other leading scientific nations. Researchers are making their own contribution by working hard to make better use of the current investment through efficiency initiatives. This includes sharing tangible assets such as equipment, but also collecting increasing data to inform process improvement through systems such as Researchfish.¹¹

Further improvement in the use of resources could be attained if policy was facilitative and co-ordinated across multiple departments and areas; for example, regulation of health research (including clinical trials and the use of animals in research), taxation (particularly VAT arrangements), procurement, immigration, education and foreign policy.¹² Specific to the medical sciences, better use of resources could be achieved by:

- Capitalising on the research opportunities offered by the NHS.¹³ The NHS operating framework recognises ‘the promotion and conduct of research continues to be a core NHS function and continued commitment to research is vital if we are to address future challenges. Further action is needed to embed a culture that encourages and values research throughout the NHS’.¹⁴ Necessary actions include:
 - Supporting the NIHR in the Department of Health that has established a world-class clinical research infrastructure for the NHS, analogous to the ‘well-founded laboratory’ provided by universities. Within this infrastructure, the Research Councils, including the Medical Research Council (MRC), as well as industry and charities, can fund specific research projects. The NIHR works in a complementary manner with the pan-disciplinary research, innovation and higher education functions within the Department for Business, Innovation and Skills (BIS), facilitated by the highly effective Office for Strategic Co-ordination of Health Research. This structure of co-ordinated funding from both BIS and DH should be maintained.
 - Ensuring that the regulation and governance of clinical and pre-clinical research (e.g. the use of animals in research) is streamlined and proportionate, thus saving time and money otherwise wasted on unnecessary bureaucracy.¹⁵ For example, ensuring the successful development of the single Health Research Authority approval process for multi-centre studies, the effective implementation of the EU Clinical Trials Regulation, agreeing an appropriate code of conduct for the use of animals in research, and working to ensure that the final EU Data Protection Regulation does not prevent medical research.¹⁶
 - Enabling appropriate researcher access to healthcare data. The NHS offers a unique resource of pooled data which, if used appropriately, can not only improve delivery

⁸ Office of Health Economics and the Science Policy Research Unit at the University of Sussex (2014) *Exploring the interdependencies of research funders in the UK*. <http://news.ohe.org/2014/07/02/interdependence-funding-medical-research-uk/>

⁹ Academy of Medical Sciences *et al.* (2014). *Medical research: what's it worth? Estimating the economic benefits of cancer-related research in the UK*. <http://www.acmedsci.ac.uk/download.php?f=file&i=29924>

¹⁰ *Ibid.*

¹¹ <https://www.researchfish.com/>

¹² See, for example, the following Academy webpages: <http://www.acmedsci.ac.uk/policy/major-policy-strands/using-animals-in-research/>, <http://www.acmedsci.ac.uk/policy/major-policy-strands/streamlining-research-regulation-and-governance/>, <http://www.acmedsci.ac.uk/about/objectives/linking-academia-industry-NHS/>, <http://www.acmedsci.ac.uk/about/objectives/seizing-international-opportunities/>

¹³ Academy of Medical Sciences (2014). *Academy of Medical Sciences response to NHS England Research and Development Strategy consultation*. <http://www.acmedsci.ac.uk/viewFile/535a32f29bfcc.pdf>

¹⁴ Department of Health (2012/13). *The Operating Framework for the NHS in England*.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/216590/dh_131428.pdf

¹⁵ Academy of Medical Sciences (2011). *A new pathway for the regulation and governance of health research*. <http://www.acmedsci.ac.uk/viewFile/publicationDownloads/newpathw.pdf>

¹⁶ <http://www.hra.nhs.uk/news/2014/07/28/hra-approval-programme-underway/>

of healthcare services, but also increase understanding of disease development, progression and spread in a way that is impossible at the individual or small community level. The regulatory framework on data protection must strike a balance between the need to protect individuals' privacy and allowing the use of personal data for vital medical research. Further consideration should be given to mechanisms that allow access to detailed data, whilst protecting patient confidentiality, and systems to ensure that data is intelligible, assessable, reliable and usable.¹⁷

- Linked to the point above, enabling researcher access to clinical trial data. The occurrence, methods and results of clinical and health research involving patients – whether positive or negative – should be made swiftly available for patient, social and scientific benefit.¹⁸
- Ensuring that we have a health service that innovates over time to continually improve care and increase financial efficiency. Developing and supporting a healthcare workforce that is capable of undertaking research and absorbing research findings into practice – including a cadre of excellent clinical academics – is vital to placing research and innovation at the heart of the NHS. It is therefore important to ensure that developing research skills is a key aspect of clinical training and practice.^{19,20}
- Ensuring the UK public health system has research as a central part of its activity, with close integration of public health researchers and practitioners.²¹
- Facilitating and supporting collaboration and permeability between disciplines and between academia, industry and the NHS. Much medical research is multidisciplinary, requiring collaboration between many researchers and institutions. Enhancing the spread of ideas and bringing together novel combinations of skills allows research challenges to be efficiently addressed. The 5% limit on the amount of any commercial activity (including catering contracts) that can be carried out in a building – before VAT has to be paid on the construction of the entire building – currently discourages collaboration between academia and industry, and should be reviewed.
- Enhancing the UK's ability to leverage significant spend by businesses and medical research charities through increased government investment in research and innovation.
- Encouraging and facilitating data capture, such as via Researchfish, for both evaluation and process improvement.

Infrastructure

The Academy's position on infrastructure was articulated in the joint National Academies submission to the consultation 'Creating the future: a 2020 vision for science and research – a consultation on proposals for long-term capital investment in science and research'.²² The Academies detailed how decision-making about capital investment should be guided by the following principles:

- Balanced capital investment guided by excellence.
- Long-term vision for national and international capital investment spanning at least a decade.

¹⁷ Academy of Medical Sciences (2014). *Data in Safe Havens*.

<http://www.acmedsci.ac.uk/viewFile/53c7d8a7567db.pdf>

¹⁸ Academy of Medical Sciences (2013). *Response to the House of Commons Science and Technology Select Committee inquiry into clinical trials and disclosure of data*.

<http://www.acmedsci.ac.uk/viewFile/51cda703df859.pdf>

¹⁹ Academy of Medical Sciences (2013). *Response to the Shape of Training Review*.

<http://www.acmedsci.ac.uk/viewFile/52ab1c85c8742.pdf>

²⁰ Academy of Medical Sciences (2014). *Response to the Health Education England (HEE) Research and Innovation Strategy*. <http://www.acmedsci.ac.uk/viewFile/539ee9f5c2d4c.pdf>

²¹ Academy of Medical Sciences (2013). *Public Health England and research*.

<http://www.acmedsci.ac.uk/policy/policy-projects/public-health-england-research/>

²² National Academies (2014). '*Science and research: proposals for long-term capital investment*': joint Academies consultation response. <http://www.acmedsci.ac.uk/viewFile/53bbfcb5d998c.pdf>

- Systemic approach considering the essential interdependence of capital and resources, and the broader landscape of research funding.
- Comprehensive operational planning including:
 - Ensuring future viability through maintenance, operational provisions and upgrades.
 - Ensuring the provision of skilled staff to extract maximum value from capital investments.
 - Achieving efficiencies and maximizing returns by ensuring collaboration and business access.
- Disciplinary mix: investing in research capital to support a broad range of disciplines.

Fellows of the Academy of Medical Sciences were particularly concerned about the following points:

- Preserving the Haldane principle and protecting grass-roots innovation in the balance of funding between Research Councils, higher education funding councils and large-scale national and international infrastructure.
- Capital maintenance: finding a balance between the funding of new infrastructure projects and maintaining the viability and productivity of established facilities. The varied current mechanisms through which maintenance funds are secured must be reviewed, including the use of consumables budgets to cover ongoing maintenance through 'user pays' arrangements.
- Human capital: investing in people to ensure a world-class work force that can maximise the potential of the UK's research infrastructure. Investment must be made in the skills and training of staff to: populate our research facilities; run and maintain equipment; design experiments; capture and analyse data; distribute and disseminate knowledge; and drive progress from hypotheses, through experimentation and into knowledge and practical application. It is necessary to continually develop operator knowledge and training to ensure that equipment is not under-utilised.
- Incentivising sharing and collaboration: improving the efficiency and impact of research infrastructure. Mechanisms of assessing and funding higher education institutions must align with this agenda to further develop a culture of shared resources and shared reward at the administrative as well as the individual level.
- Whilst funds must be distributed based on competitive application processes to ensure excellence, further effort is required to minimise the bureaucratic burden associated with such processes.

Business and charity investment

Public investment in research leverages significant funding from industry and medical research charities. Every £1 increase in public funding for medical research stimulates up to £5 of investment into research by the pharmaceutical industry.²³ In 2011, UK pharmaceutical R&D expenditure was almost £5bn, about the same size as the science ringfence. Similarly, every £1 of government spending via the Charity Research Support Fund (CRSF, £198m in 2011, administered by the Higher Education Funding Council for England (HEFCE) in BIS as part of QR funding) is matched by about £5 of spending from UK-based medical research charities, which constitutes approximately 15% of research income at UK universities (over £1bn per year in recent years).²⁴

As stated above, the UK should make a clear, long-term commitment to research that is attractive to charities, businesses and researchers, within which funding should be maintained at least in line with inflation, and ideally increased to keep pace with global competitors. Coupled with long-term support for the CRSF, this would stimulate continued charity and private investment.

²³ Mestre-Ferrandiz J & Sussex J (2009). *Forward together: complementarity of public and charitable research with respect to private research spending*. <http://www.ohe.org/publications/article/forward-together-complementarity-of-public-and-charitable-research-28.cfm>

²⁴ The Association of Medical Research Charities, et al. (2010) *Government support for charity funded research in universities: a joint statement from universities and charities in the UK*. http://www.amrc.org.uk/sites/default/files/doc_lib/2010_06_30%20Government%20support%20for%20charity%20funded%20research%20in%20universities.pdf

Despite considerable investment by business, the Academy acknowledges that the level of private sector investment in R&D is comparatively low in the UK, as indicated in a recent report by BIS.²⁵ In order to unlock greater investment, we must understand why the level of private sector investment lags behind our competitors. The UK's superior medical research base, our co-ordinated landscape of private, public and charity funders, and the research potential of the NHS give us an unparalleled global competitive advantage. We should seek to maximise this potential to stimulate more private sector investment. We welcome the Life Sciences and the Innovation, Health and Wealth strategies as initiatives to address this issue, which leverage our broad research and innovation base: the strategy should link to these initiatives without rewriting them, or being written by them.^{26,27}

Public sector investment in research underpins and attracts private and charitable investment in R&D. A strong public research base supported by stable, long-term strategy and associated investment is, therefore, a key foundation for business investment.²⁸ The UK should aim to support a full range of industrial activity, comprising start-up, medium-sized and large multinational enterprises. Attracting private sector investment will require facilitative and co-ordinated policy in multiple areas and departments relating to regulation, taxation, procurement, immigration and education. Necessary actions include:

- Supporting early access schemes, adaptive licensing initiatives and improved uptake of new innovations into the NHS. The Academic Health Science Networks will play an important role in these areas. The emerging geographical clusters, such as MedCity and Northern Health Science Alliance, have the potential to act as catalysts for growth for their respective regions.²⁹
- Developing a strong, sustainable skills base in the STEM workforce, including the ability to attract and retain researchers from overseas. The Academy supports the principles contained in the Concordat to Support the Career Development of Researchers, which aims to improve the attractiveness and sustainability of research careers.
- Facilitating good connections and mobility between academia, industry and the NHS.
- Enabling access, under proportionate governance regimes, to NHS data for research purposes.
- Supporting specific mechanisms, such as those administered by the Technology Strategy Board (TSB), for aiding translation of research into business applications. The strategy should ensure that the TSB is adequately resourced without redirecting funds away from other parts of the research and innovation system.

Talent

Highly skilled individuals are the UK's most valuable research resource, ensuring resilience and enabling our rapid response to future challenges and opportunities. The UK's status as a world leader in medical research is underpinned by its first-class workforce.

Our world-class higher education system underpins the UK's success in developing, attracting and retaining the brightest talent from across the world. Undergraduate education at our universities remains among the best in the world. For example, four of the top ten, and 25 of the top 200

²⁵ Allas, T (2014). *Insights from international benchmarking of the UK science and innovation system*. <https://www.gov.uk/government/publications/science-and-innovation-system-international-benchmarking>

²⁶ Department for Business, Innovation and Skills (2011). *Strategy for UK life sciences*. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/32457/11-1429-strategy-for-uk-life-sciences.pdf

²⁷ NHS (2011). *Innovation, health and wealth*. http://webarchive.nationalarchives.gov.uk/20130107105354/http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_134597.pdf

²⁸ Haskell J, et al. (2014). *The economic significance of the UK science base*. <http://sciencecampaign.org.uk/UKScienceBase.pdf>

²⁹ <http://www.medcitylondon.com/>, <http://www.thenhsa.co.uk/>

medical schools in the world are in the UK, a record second only to the USA.³⁰ From our universities come the academics who drive the excellence of the UK's biomedical research base, and the clinicians who will translate this research into better healthcare outcomes for their patients. A culture of collaborative working and permeability between disciplines and sectors – key for the development, translation and adoption of modern medical interventions – will be aided by continued adjacency and strong links between the cross-disciplinary research, innovation and higher education functions of government.

We must build on these strengths to ensure that postgraduate training and education of the entire healthcare workforce are similarly world-leading. Necessary actions include:

- Supporting universities to deliver excellent research, and research-informed teaching. In part, this will involve improving the status and valuation of teaching in academic careers.³¹
- Fostering a multidisciplinary research culture in all clinicians entering the NHS, not just those with an interest in pursuing a career in academic medicine. Academic values and a spirit of enquiry and innovation must pervade the whole medical workforce. Medical education must continue to be undertaken in the multi-disciplinary, research-rich environment of the university to prepare clinicians for their later role as innovators and adopters of new best practice. We understand that major non-governmental funders such as medical research charities and the pharmaceutical industry place great value on having a clinical workforce with the experience to lead or participate in research programs, informing their choice to invest in UK R&D.
- Enabling clinical and non-clinical researchers to gain maximal benefit from their participation in collaborative research, including through appropriate reward and recognition for team working.
- Addressing barriers in all demographic groups to accessing STEM careers. The Academy has undertaken work regarding access to STEM careers among women.^{32,33} Improving the representation of senior female STEM professionals will require broad cultural and structural changes across academic institutions. Initiatives such as mentoring and Athena SWAN must be encouraged and supported. In order to identify effective practices, comprehensive data should be collected on the representation of women in academic STEM careers across institutions. The Academy is currently exploring initiatives aimed at addressing the underrepresentation of women in academic biosciences.
- Minimising real and perceived barriers to the flow of talented people by broadly articulating and supporting the need for inward researcher migration, and ensuring that migration and visa regulations do not prevent researchers from accessing the best research across the world.

Reaping the benefits

Researcher mobility, both globally between nations and domestically between sectors, is key to reaping the benefits of research investment. Having a strong, broad, well-resourced research base which has the long-term support of the Government will be attractive to researchers.

We are concerned by barriers that impede our world-class universities from capitalising on the substantial international market for higher education. In this regard, we propose that the current cap of 7.5% overseas medical students should be reviewed.

The Academy recommends that government continue to ensure that evidence and research are placed at the heart of policymaking. We are pleased to see Chief Scientific Advisors in all

³⁰ <http://www.topuniversities.com/university-rankings/university-subject-rankings/2014/medicine>

³¹ <http://www.acmedsci.ac.uk/policy/policy-projects/redressing-the-balance-the-status-and-valuation-of-teaching-in-academic-careers/>

³² Academy of Medical Sciences (2013). *Representation of women within the Academy's Fellowship*. <http://www.acmedsci.ac.uk/viewFile/publicationDownloads/136118550861.pdf>

³³ Academy of Medical Sciences (2013). *Response to the House of Commons Science and Technology Select Committee inquiry 'Women in STEM careers'*. <http://www.acmedsci.ac.uk/viewFile/525d5fc94c201.pdf>

government departments; however, more must be done to ensure that they are adequately resourced and consulted at the highest level of decision-making. Government must actively seek and encourage authoritative, independent scientific advice at the earliest stages of policy development. National Academies are well placed to assist with this process. Several key principles that underpin scientific advice to government should be adhered to. First, the academic freedom of scientists who provide advice to government should be safeguarded; second, the advice scientists give should be protected from political or other interference in their work; and third, the process of government's consideration of scientific advice should be transparent.

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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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