

Summary

- The Academy of Medical Sciences welcomes the opportunity to contribute to this consultation. Our response is based on the views of the Academy's Fellows and other experts, many of whom have significant experience of university-business collaboration, primarily in the life sciences sector.
- While the focus of this review is on university-business collaboration, we would also highlight the crucial role to be played by the NHS in facilitating productive, long-term research partnerships in the life sciences sector. Although progress has been made, more remains to be done to make the NHS an attractive place to conduct research.
- The Academy commends the Government's strong commitment to innovation, and our Fellows are optimistic about the future of UK university-business collaboration. However, sustained investment in this goal is required if long-term benefits are to be delivered, and continuity over the coming years will be essential if researchers are to gain knowledge and experience of the available routes to partnership.
- A key barrier to collaboration is the cultural gap that currently exists between researchers working in industry, academia and the NHS. This undermines trust and confounds the development of productive working relationships. Of particular concern is the belief that scientists must compromise their intellectual principles in order to work in a commercial environment and the aspersions frequently cast on the integrity of scientists working in, and with, industry.
- Education, incentives and freedom of movement between industry and academia are key to changing these attitudes. Government, leaders of the scientific community, funders, universities and industry all have a role to play in better communicating the benefits of collaboration and facilitating the flow of personnel between industry, academia and the NHS. Universities must also ensure that their recruitment policies and promotion criteria incentivise, recognise and reward collaboration.
- The concentration of expertise in a single location can be a strong catalyst for collaboration; such clusters can form naturally but can also be encouraged through direct government involvement. The Government should continue to support the development of these clusters, both directly and indirectly, in order to provide an environment in which collaboration and innovation can flourish.
- Current VAT rules are a significant disincentive both to university-university and university-business collaborations. New buildings such as the Crick Institute risk losing their beneficial VAT status if more than 5% of their activity is deemed commercial, and the use of cost sharing groups to prevent VAT being incurred as a result of cross-university collaboration imposes a significant administrative burden. The Government should urgently review the impact of these rules and identify and implement mechanisms to reduce any detrimental effects.
- While recent Government support for innovation has been encouraging, it does not go far enough and is not on the same scale as in other countries such as Finland. We encourage the Government to increase the financial support available to translational academic research and innovative businesses through initiatives such as the Biomedical Catalyst Fund and Innovate UK.

Introduction

1. The Academy of Medical Sciences promotes advances in medical science and campaigns to ensure that these are translated into healthcare benefits for society. Our elected Fellowship comprises some of the UK's foremost experts in medical science, drawn from a diverse range of research areas, from basic research, through clinical application, to commercialisation and healthcare delivery.
2. The Academy welcomes the opportunity to respond to this inquiry. As an organisation that supports research and innovation to improve health and wealth, we are pleased to be involved in discussions on how government can support relationships between industry and the UK's world-leading researchers. **We would also highlight the crucial role to be played by the NHS in facilitating productive, long-term research partnerships in the life sciences.**
3. This response is based on the views of the Academy's Fellows and other experts, many of whom have significant experience of university-business collaboration, primarily in the life sciences sector. It has also been informed by the output of a 2014 FORUM workshop on 'Open Innovation in the NHS' in addition to discussions at FORUM meetings.¹ The Academy's response focuses on the current situation in the medical and biomedical sciences; however, many of the issues raised are cross-cutting and are likely to be of relevance to other disciplines.

Question 1: What experience do you have of establishing, participating in or supporting long-term research collaborations between business and academia?

4. Our Fellows are drawn from a wide range of professions allied to medical science, in academia, industry and the NHS. Consequently, they have extensive experience in leading and participating in active academia-industry partnerships, ranging from short-term, goal-oriented projects to longer term strategic alliances. Examples of collaborations that our Fellows are involved in include: the Cell Therapy Catapult; the Division of Signal Transduction Therapy at the University of Dundee; the Manchester Collaborative Centre on Inflammation Research; the EU Innovative Medicines Initiative; the Stratified Medicine Scotland Innovation Centre; and the Crick Institute in London.
5. One of the Academy's key strategic priorities is to link academia, industry and the NHS in order to foster closer working relationships and greater collaboration in the life sciences. We seek to capitalise on our independence and ability to connect stakeholders from across the life sciences sector in order to meet this objective. Our FORUM programme, for example, provides a neutral and independent platform for individuals from across academia, industry, government, and the charity, healthcare and regulatory sectors to meet and take forward national discussions on scientific opportunities, technology trends and associated strategic choices for healthcare and other life sciences sectors. The question of how to better facilitate collaboration between industry, academia and the NHS has been a frequent topic of discussion for FORUM members.

¹ The '[Open Innovation in the NHS](#)' FORUM event was run in partnership with the Centre for the Advancement of Sustainable Medical Innovation.

Question 2: What are the key success factors for building productive, long-term research partnerships between business and academia and how do these vary across sectors and disciplines?

6. The most important factor underlying successful university-business collaboration is mutual trust between partners, built on a foundation of openness and clear communication. This naturally develops over the course of many long-term collaborations; however, the speed with which trust is built, and therefore the ease with which such collaborations are established, is heavily influenced by underlying attitudes about those working in other parts of the research ecosystem. At present, cultural differences between industry, academia and the NHS can lead to mutual suspicion, mistrust and misunderstanding, potentially confounding the development of productive working relationships. This issue is discussed in paragraphs 13-15.
7. The existence of shared objectives and strong alignment between the mission of the academic institute and that of the business are also key success factors. Collaborating partners must understand each other's aims and aspirations, and must be upfront about the expected outcomes of a partnership if it is to be successful. Effective utilisation, with minimal overlap, of collaborators' areas of expertise can also be important in building a productive partnership. In order to achieve this, it is important for all partners to understand where in the collaboration task-specific expertise lies so that it can be used to its full potential. These elements of success can all be supported by the development of an overarching strategic agreement, which formally details expectations and commitments, and may or may not be contractually binding. The approach taken by university technology transfer offices (TTOs) and contract offices in drawing up such agreements is key to ensuring that these act as an enabler of, rather than a barrier to, partnership. The role of TTOs in enabling collaboration is discussed further in paragraph 19.
8. Finding the right research partner is essential to effective collaboration. This can be particularly difficult for SMEs, which do not have the resources available to dedicate significant time or effort to this task. In contrast, many large organisations will have staff dedicated to searching for and establishing collaborations. While initiatives such as Catapult Centres, Innovation Centres Scotland and the National Centre for Universities and Business are useful in helping potential partners to find one another, the UK innovation landscape is becoming increasingly complicated. **Continuity of effective schemes over the coming years will be essential if researchers are to gain knowledge and experience of the available routes to collaboration.** Additional roadmaps may help to direct researchers towards the most appropriate point of entry. **The Government should also ensure that existing schemes provide SMEs with effective conduits into both leading universities and the NHS,** where it can be particularly difficult for smaller organisations to identify a relevant and accountable individual to make contact with regarding potential partnerships. **All schemes should be subject to ongoing monitoring and evaluation to ensure that they are effective in delivering their objectives.**
9. The concentration of expertise in a single location can be a strong catalyst for collaboration. Large scale facilities such as the Sanger Institute for genome research and the Diamond Synchrotron for structural biology bring together large numbers of

researchers who are leaders in their field, and can act as a single point of contact for industry partners, thus saving them time and money. Clusters can also facilitate cross-sector transfer of personnel – a key factor in bridging the cultural gap between industry and academia – and can foster collaboration through proximity (the so-called 'water cooler effect').

10. Successful clusters are characterised by a critical mass of academic and commercial scientific activity, an exchange of personnel and skills across the academic and industry sectors and a supportive legal, financial and capital infrastructure. Strong international examples include the Bay Area in California, the San Diego cluster and the cluster around Boston. Emerging geographical clusters in the UK, such as MedCity and Northern Health Science Alliance, also have the potential to act as catalysts for growth in their respective regions. The Academy has recently hosted a FORUM event on challenges and opportunities to the development of such clusters, and will make the report of this meeting available to the Review team in due course.²
11. Geographical clusters often form naturally around existing hubs of research activity; for example, around the Babraham Research Institute and the wider Cambridge area (see paragraph 36). Others are formed through more active involvement from government and its agencies; for example, Innovate UK's creation of the Cell Therapy Catapult on the 12th floor of Guy's hospital. **The Government should continue to support the development of such clusters, both directly and indirectly, in order to provide an environment in the UK in which collaboration and innovation can flourish.**
12. In order to support successful collaboration when it occurs, **the Government must also ensure that mechanisms are in place to identify effective partnerships and provide financial assistance to them when needed to ensure that they are long-lasting.**

Question 3: What barriers do academics and individual businesses face in developing long-term research collaborations with each other and how can these be overcome?

13. A major barrier to the development of long-term university-business collaboration is the cultural gap that currently exists between researchers from industry and academia. As described in paragraph 6, this cultural misalignment can make it difficult to build the requisite trust and can also lead to expectations and objectives being poorly communicated. There remains a lot of nervousness about industry collaboration.
14. Historically, academia and industry have tended to have differing goals, timelines, and priorities. Misconceptions about these continue to exist, in part because of the lack of a two-way flow of researchers between the two sectors. It is often assumed, for example, that researchers from industry are focused entirely on commercial ends and place less value on basic scientific research, while academic researchers can be characterised as curiosity-led and publication-driven. Of particular concern is the still prevalent belief that scientists must compromise their intellectual principles in order

² <http://www.acmedsci.ac.uk/more/events/geographical-clusters-date-tbc/>

to work in a commercial environment. These caricatures arise as a result of people's assumptions and stereotypes, and are not borne out by reality.

15. This situation is not aided by aspersions cast by the media on the integrity of scientists working in, and with, industry. For example, a recent *BMJ* article claiming to reveal "the extraordinary extent to which key public health experts are involved with the sugar industry" strongly implied that scientists who had received funding from industry could not be trusted to provide objective advice to government on the subjects of nutrition and population health.³ Similar allegations have been directed at scientists involved in research to assess the benefits of drugs such as statins⁴ and antivirals,⁵ despite such research in many cases being conducted at arms' length from industry funders.
16. Education, incentives and freedom of movement of individuals between industry and academia are key to changing these cultural attitudes. Greater permeability between sectors can be achieved through secondments, short placements and mentoring of post-docs and academic students in industry settings. PhD students based at the Division of Signal Transduction Therapy at the University of Dundee, for example, have learned how the pharmaceutical industry works and, as a result, many more have seen a career in industry as an attractive prospect than was the case before the collaboration started (see paragraphs 31-34). Industry-based elective placements for medical students are also highly valuable and could be more effectively promoted. Placements at pharmaceutical companies, for example, can provide clinicians with an opportunity to see the clinical trial process from a commercial setting and may encourage more positive attitudes to working with industry. The Academy supports a number of clinical fellows seconded to GSK's research and development sites through its highly respected one-to-one mentoring scheme.⁶ **The Government, alongside leaders of the scientific community, funders, universities and industry itself all have a role to play in better communicating the benefits of collaboration and facilitating the flow of personnel between industry, academia and the NHS.**
17. Current measures of academic success do not sufficiently recognise the value of university-business collaboration. The Research Excellence Framework (REF) has started to address this issue with the addition of the 'impact' criteria. However, more can be done by universities to nurture entrepreneurship and put open innovation at the heart of their culture. Career progression is considered to be one of the most powerful incentives to behavioural change, and **universities should ensure that their recruitment policies and promotion criteria incentivise, recognise and reward successful commercial interactions.**
18. Although progress has been made, the NHS remains, at times, a difficult place to conduct research, for both industry and academia. The creation of the Health Research Authority (HRA) has led to a simplification of the regulation and governance

³ <http://www.bmj.com/content/350/bmj.h231>

⁴ <http://www.independent.co.uk/life-style/health-and-families/health-news/statins-row-critics-are-biased-says-doctor-who-warned-of-drugs-sideeffects-9388337.html>

⁵ <http://www.theguardian.com/society/2014/oct/07/millions-of-australians-given-flu-drugs-with-little-or-no-benefit-study-finds>

⁶ <http://www.acmedsci.ac.uk/careers/mentoring-and-careers/mentoring/>

pathway for health and social care research, and this should be further improved by the forthcoming introduction of a single HRA approval process.⁷ However, more remains to be done to make the NHS an attractive place to do research for academia and industry. We considered aspects of this issue in our 2011 report, 'A new pathway for the regulation and governance of health research', and we continue to monitor this issue.⁸

19. Universities are increasingly trying to capture the value of intellectual property (IP) associated with research collaboration, but there are concerns about the ability of these institutions to effectively negotiate with industry partners. University technology transfer offices (TTOs) play a key role in this process. When they are adequately and appropriately staffed and driven by an entrepreneurial ethos, TTOs can be an important partnership enabler; however, when this is not the case they can act as a significant block, with extended negotiations slowing down or sometimes stalling potential collaborations. **Universities should work to ensure that TTOs are staffed and set up in a way that encourages and enables collaboration, while protecting the university's legitimate financial interests.**

20. Individual academics often have a poor understanding of intellectual property, making initial conversations about the potential terms of collaboration difficult. **Experienced business engagement teams should lead knowledge exchange in universities and work to improve the provision of IP education amongst university academics.**

21. Current VAT rules are a significant disincentive to research collaborations of all forms, both university-university and university-business. Under current arrangements, newly constructed charitable buildings such as the Crick Institute risk losing their beneficial VAT status if commercial activity (including catering contracts) exceeds 5% at any point in their first ten years, providing a significant disincentive to collaboration with industry. Similarly, the use of cost-sharing groups to prevent research services supplied between universities from incurring VAT, while effective, leads to an additional administrative burden that deters cross-university collaboration. **The Government should urgently review the impact of these VAT rules on research collaboration and promptly identify and implement mechanisms to reduce any detrimental effects.**

22. University-business collaborations are built on expertise and talent. The UK is a centre for talent development, but is competing in an increasingly global market for both international and domestic students and researchers. Global competition for excellence makes it essential that the UK remains an attractive place for the most talented individuals and teams to work, whether they are from the UK or from elsewhere in the world.⁹ **Clear messages and policies are crucially needed to counter perceptions that recent changes to immigration policy mean the UK is not open to international researchers.**¹⁰

⁷ <http://www.acmedsci.ac.uk/viewFile/51dd839626e27.pdf>

⁸ <http://www.acmedsci.ac.uk/viewFile/publicationDownloads/newpathw.pdf>

⁹ <http://www.acmedsci.ac.uk/viewFile/53da520c6904e.pdf>

¹⁰ <https://royalsociety.org/~media/policy/Publications/2015/building-a-stronger-future-research-innovation-growth.pdf>

23. The delivery of increased commercial output from basic research and the growth of the biotechnology sector rely on the availability of financial investment in translational research. Several Fellows identified the government's failure to match or adequately leverage industry input as a key barrier to university-business collaboration. While recent Government support for innovation has been encouraging, it does not go far enough and is not on the same scale as many competitors. The Finnish economy is one-tenth of the size of the UK's, but in 2013, TEKES (the Finnish innovation agency) invested €542.3 million, compared to Innovate UK's £440.9 million.¹¹ In addition, the level of private sector investment in R&D is comparatively low in the UK.¹² Both of these areas present opportunities for improvement and must be tackled if we are to match international competitors. **We encourage the Government to increase the financial support available to translational academic research and innovative businesses through initiatives such as the Biomedical Catalyst Fund and through Innovate UK¹³.** However, investment in innovation should not come at the expense of other parts of the research base.
24. A truly collaborative ecosystem, as exists in countries such as the US, will only develop in the UK if barriers to collaboration are removed (for example, issues related to VAT and immigration, as described above). However, the resolution of cultural challenges will also be crucial to creating a more collaborative environment. **The Government should have a stronger voice in debates about the benefits of collaboration and, in particular, about the value and integrity of the science conducted by, and with, industry.**
25. Other barriers to collaboration raised by Fellows include:
- excessive government focus on IP as the key measure of value, at the expense of other potential benefits to society (e.g. the undervaluation of collaborations aimed at embedding and adapting existing technologies rather than developing new ones);
 - increasing 'top down' direction from government with regard to priority areas for research funding;
 - the continued gap between very early stage 'seed' funding for promising academic spin-outs and later stage venture capital/private equity funding;
 - the lack of a 'pull' from the NHS for new innovations, leading some companies to question the existence of a home market for their products (this is a particular issue for SMEs);
 - the failure of Regulators to adopt modern digital surveillance techniques and statistical analysis to make clinical trials shorter, more efficient and safer for the patient; and
 - the poor practical abilities of UK science graduates.

¹¹<https://royalsociety.org/~media/policy/Publications/2015/building-a-stronger-future-research-innovation-growth.pdf>

¹² 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>

¹³ <http://www.acmedsci.ac.uk/viewFile/publicationDownloads/134184596847.pdf>

Question 4: How effective are current incentives, policies and funding streams for promoting this type of collaboration? How could these be improved in order to scale up the range and impact of collaborations being undertaken nationally?

26. We believe the Government's recent Science and Innovation strategy represents progress towards a long-term approach to research and innovation.¹⁴ We also commend initiatives such as the creation of the Biomedical Catalyst Fund, for small but economically important biotechnology companies, and efforts to foster productive links between the NHS, industry and academia through the setting up of technology and innovation centres.¹⁵ Incentives such as the Patent Box and R&D tax credits have also made a difference in promoting collaboration. However, we believe that there is an opportunity for the Government to go even further in supporting university-business collaboration.¹⁶
27. The Catapult Centres have made a promising start but it is too soon to comment on the impact of this network. If it is to deliver sustained benefit, **the Government must make a long-term commitment to invest in, strengthen, and adequately resource the existing network.** In doing so, it is essential that resources are not spread too thinly and that future expansion does not come at the cost of redirecting funds from existing centres. The subjects and locations of these centres should be selected on merit in order to ensure that the UK does not forgo its first mover advantage in many competitive new areas of biomedical innovation.
28. The National Centre for Universities and Business has been recognised by our Fellows as doing valuable work in developing and supporting collaboration between universities and business across the UK. Higher Education Innovation Funding is also considered to be very valuable. **These initiatives should be regularly evaluated and, if shown to be effective, maintained and strengthened over the coming years.**
29. Academic Health Science Networks (ASHNs) have the potential to act as accelerators for innovation, and represent a major opportunity for further increasing collaboration across academia, industry and the NHS. However, these networks are still in development and need to become more established if they are to deliver rewards. It is also important that they have a clearly defined role in the innovation landscape which complements the work of existing organisations and networks. **They require appropriate support if this is to be achieved.** Supporting and growing these networks will help them act not only as a hub for innovation, but as a framework for applied health research, diffusion of evidence and research-informed education.

¹⁴ <http://www.acmedsci.ac.uk/viewFile/54d4acafd18ea.pdf>

¹⁵ <http://www.acmedsci.ac.uk/viewFile/publicationDownloads/134184596847.pdf>

¹⁶ <http://www.acmedsci.ac.uk/viewFile/publicationDownloads/134184596847.pdf>

Question 5: Which models of collaboration have proved most successful for stimulating SME engagement with the research base in the UK? What additional action needs to be taken to strengthen UK performance in this area?

Question 6: Which approaches/sectors/organisations – in the UK or internationally – would you identify as examples of good practice in university-business collaboration with the potential to be applied more widely?

30. We offer three models of collaboration from the UK life sciences sector which could potentially be applied more widely.

31. **The Division of Signal Transduction Therapy (DSTT) at the University of Dundee.**¹⁷ The DSTT was established as part of the Medical Research Council's Protein Phosphorylation and Ubiquitylation Unit (MRC-PPU) in 1998. It is now Europe's largest and longest-standing collaboration between academia and a basic research institution. It operates as a unique collaboration between scientists in the MRC-PPU, signalling researchers at the University of Dundee's College of Life Sciences and six of the world's leading pharmaceutical companies (AstraZeneca, Boehringer Ingelheim, GlaxoSmithKline, Janssen Pharmaceutical, Merck Serono and Pfizer). The DSTT is widely regarded as a model for how academia should interact with industry.

32. The DSTT is based on a simple model in which industry partners share all of the results, ideas, reagents, technologies and know-how of the participating academic laboratories and the first right to licence the IP that these generate. Knowledge, technologies and reagents introduced to the DSTT by the participating companies are not shared if these are for the purpose of commercial development. The collaboration delivers benefit to its industrial partners by providing access to a critical mass of expertise (200+ scientists and support staff) for relatively minimal cost. It delivers benefits to its academic partners by providing insight into current issues in drug development and a translation outlet for research findings.

33. An unusual characteristic of the DSTT is that all DNA cloning, protein and antibody production are carried out by dedicated support teams, rather than by students and postdoctoral researchers based in the research laboratories. This has resulted in the DSTT being able to offer its industry partners many of the basic reagents that they need for their in-house research. Many of these are not available commercially and would be far more expensive to purchase or produce elsewhere, providing companies with a considerable incentive for their continued involvement in the programme. In addition, this has benefited academic research teams, which also have access to industry-standard reagents. Funding for these types of services can be difficult to obtain under the grant system, despite the vital role they can play in underpinning collaboration.

34. Government support has been vital to the success of the DSTT. Industry partners often look to leverage a high and consistent level of public funding in their collaborations, and long-term funding through the MRC-PPU allowed a critical mass of researchers to build up at the unit over time. This initial funding commitment was

¹⁷ <http://www.ppu.mrc.ac.uk/overview/DSTT.php>

made before it became clear that the unit's work would be directly relevant to drug discovery, demonstrating the value of Government support for basic science. A further injection of £10 million by the Scottish Government in 2008 came at a key point in the unit's development and enabled further expansion.

35. **The MRC/ABPI Rheumatoid Arthritis Consortium.**¹⁸ The Rheumatoid Arthritis Consortium is a successful large-scale collaboration with partners in industry, academia and the NHS. The motivation for its development was the clinical need to develop stratification tools in rheumatoid arthritis, in order to identify early those people at risk of disease and progression, and to provide accurate prognoses for patients suffering from the disease. A major output has been the Towards a Cure for Early Rheumatoid Arthritis (TACERA) study: a longitudinal observational study funded by the consortium, which is taking place across approximately 30 sites in the UK.
36. **The Babraham Bioincubator.**¹⁹ Located on the Babraham Research Campus, alongside the Babraham Institute, the Bioincubator provides around 100,000 square feet of serviced facilities and expertise to support new bioventures and catalyse the commercial exploitation of biomedical research. It was established in 1998 and facilitates access to technical facilities, administrative, IT and corporate services, as well as the world-class research of the Institute itself. These services are designed to help early-stage companies by providing both a way to reduce 'cash-burn' during their formative years and a supportive environment in which nascent scientific enterprises can flourish. Around 50 early-stage life sciences companies are currently located at the Babraham bioincubator. Many successful partnerships are flourishing between academic research groups and resident companies on the campus.

This response was prepared by Dr Mehwaesh Islam (Policy Officer) and was informed by the Academy's Fellows and the 'Open Innovation in the NHS' FORUM workshop held by the Academy in April 2014. For further information, please contact Victoria Charlton (victoria.charlton@acmedsci.ac.uk; +44(0)20 3176 2168).

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¹⁸ For more information on this consortium, see <http://www.acmedsci.ac.uk/viewFile/53eb4d80e4aed.pdf>.

¹⁹ <http://www.babraham.com/availability/concept.html>