# House of Commons Science and Technology Committee: Bridging the "valley of death": improving the commercialisation of research

### Response by the Wellcome Trust

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## Key Points

- The valley of death is not merely a funding gap. While funding is important, it is equally important to provide access to the right skills, support and infrastructure to facilitate research commercialisation.
- Commercialisation is particularly challenging in the life sciences sector, due to the long time frames, significant capital requirements, and the higher regulatory barriers associated with products intended for use in humans. However, these difficulties have also allowed innovative models to emerge, such as 'open innovation' models of drug discovery that enable collaboration between industry and academia.
- At a national level there is value in a diversity of approaches to commercialisation, incorporating a mix of 'science-push' and 'business-pull' models.

## INTRODUCTION

1. We welcome the opportunity to contribute to this inquiry. Effective and timely translation of research will enable the UK to capitalise on its track record of excellent basic science to deliver health and wealth benefits.

2. Through our technology transfer division, the Wellcome Trust makes a range of investments designed to bridge the gap between fundamental research and commercial application. The process of developing a research discovery into a commercial product can be enormously complex and expensive, and has traditionally been seen as the role of the private sector. However, public and charitable funders can seed the process by providing a small amount of funding at an early stage to work up the proposition and share the early stage risk.

3. We provide five major types of funding:

    - **Translation Awards:** a response-mode mechanism for applied R&D projects that address an unmet need in healthcare and have a realistic expectation that the innovation will be developed further by the market. The awards are open to UK-based academic researchers and companies and can address almost any area of healthcare.

    - **Strategic Translation Awards**: allow the Trust to invite applications for applied R&D projects that align with our strategic priorities. Compared with the Translation Awards, the Trust is more proactively engaged in project management, working

alongside the institution or company involved. The awards are open to UK and international applicants.

- **Seeding Drug Discovery:** a dedicated programme to facilitate early-stage small-molecule drug discovery. The awards help applicants with a potential drug target or new chemistry embark on a programme of compound discovery and/or lead optimisation. The goal is for funded projects to progress to a stage where there is sufficient evidence to make the project results, intellectual property and outcomes attractive to follow-on developers/investors who may be from the commercial or not-for- profit sectors.

- **Health Innovation Challenge Fund (HICF):** a parallel funding partnership between the Wellcome Trust and the Department of Health to stimulate the creation of innovative healthcare products, technologies and interventions, and facilitate their development for the benefit of patients in the NHS and beyond.

- **R&D for Affordable Healthcare in India:** supports translational research projects that will deliver safe and effective healthcare products for India – and potentially other markets – at affordable costs.

4. We have also developed a number of one-off translation initiatives and partnerships, including:

    - **Hilleman Laboratories** - a joint venture with Merck, based in India, to focus on developing affordable vaccines for diseases that commonly affect low-income countries

    - **Stevenage Biosciences Catalyst** – a £38 million partnership between the Wellcome Trust, UK government, GlaxoSmithKline (GSK), the East of England Development Agency and the Technology Strategy Board, to develop a bioscience park adjacent to GSK's R&D facilities in Stevenage, Hertfordshire. It will provide small biotech and life sciences companies with access to the expertise, networks and scientific facilities traditionally associated with multinational pharmaceutical companies.

    - **Centres of Excellence in Medical Engineering** – in partnership with the Engineering and Physical Sciences Research Council, we have funded four UK centres that provide an environment for mathematics, physical science, engineering and medical research to come together, to encourage exploratory research and its translation into specific product developments of benefit to healthcare.

5. To date our technology transfer division has committed over £304 million to translational projects across 80 institutions and in excess of 50 companies. On aggregate, over £532m has been generated in third-party finance for these projects, which are seeking to develop a range of innovations including new drugs and vaccines; enabling technologies; medical devices and diagnostic tools.

6. Funders of research commercialisation activities must carefully monitor and evaluate the success of their programmes, and be prepared to adjust their strategic approach accordingly. The Trust has evolved its technology transfer strategy over time, developing targeted schemes such as Seeding Drug Discovery and the HICF to address specific identified gaps, while maintaining the more responsive Translation Awards

scheme. This gives us the flexibility to support a range of commercialisation models and opportunities. We have also found it very valuable to partner with other organisations, particularly commercial partners who can provide specific expertise in technology development to complement our experience in funding basic science. While commercial partners may bring funding to the table, they also make valuable 'in kind' contributions that enable access to specialised expertise, equipment and other resources.

## Consultation questions

***Q1. What are the difficulties of funding the commercialisation of research, and how can they be overcome?***

7. Commercialisation of a research discovery will involve a range of activities, which can be grouped under two general categories:

    - Technical proof-of-concept studies (including clinical studies) that demonstrate that a promising technology or compound arising from basic research can be effective in a real world setting.

    - Work to develop the technology into a commercially attractive proposition – developing a business case, identifying potential customers and markets for the product, conducting market research, manufacturing and testing prototypes etc.

8. Commercialisation will be most effective if these two types of activities are allowed to co-evolve. Historically, one of the difficulties of funding the commercialisation of research has been the tendency of public and charitable funders to focus primarily on the former activity, with the expectation that the private sector will step in to fund the latter. In many cases this is not realistic, as potential private sector partners are unlikely to want to invest in a technology until they can determine whether it represents an attractive business opportunity.

9. While more needs to be done to develop, and assist researchers to access, appropriate funding streams for early stage commercialisation, it is important to recognise that bridging this gap is not merely a matter of funding. It is equally a matter of the research team having access to the right skills, support and infrastructure to enable them to develop a promising research project into a fully-fledged commercial opportunity. Research funders are increasingly recognising this, and attempting to integrate the necessary support as part of technology transfer funding. For example, within the Trust's technology transfer schemes we provide academic applicants with a range of mechanisms such as project steering groups, advisory committees, and supporting consultancy costs for troubleshooting or project management.

10. Despite this, the scarcity of individuals with the skills to bridge the research-business divide remains a major barrier. Such skills are usually gained from working in large R&D-intensive firms. Given the UK's relatively low levels of business R&D investment, and the trend for large firms to move their R&D offshore, it is likely that access to skills, rather than funding, will remain the most significant barrier to improving the UK's track record in commercialising the world-class science conducted here.

11. It is extremely difficult even for established businesses to value research concepts and their potential return on investment at an early-stage. This is particularly so in the life

sciences. A new technology may provide, for example, diagnostic information in real time, but how much a customer will be prepared to pay for the extra speed of information will not be known until late in the product development process. In drug discovery, return on investment estimates typically are not used until phase 2 human trials, which is usually after £10-15m of investment has already been risked.

***Q2. Are there specific science and engineering sectors where it is particularly difficult to commercialise research? Are there common difficulties and common solutions across sectors?***

12. The difficulties of commercialising research in the life sciences are well recognised. Where products are intended for use in humans, there is a need for comprehensive testing in a clinical environment – a lengthy and expensive process which often requires input from multiple regulatory authorities. The fast pace of technology development in some areas (for example mobile health technologies) means that a technology can be out-of-date by the time this process is completed. Products used in humans also tend to have complex and specialised manufacturing requirements. Transforming a promising research discovery into a viable product may take 10-15 years, with significant and sustained capital investment required over that period. Such opportunities are seldom attractive to venture capital and angel investors, who typically look for a return in 5-7 years.

13. From an investment perspective there is also the issue of risk. It is often observed that UK and European venture capitalists are more risk averse than their US counterparts. Life sciences investments are seen as high risk by investors due to the technical uncertainties and the significant regulatory hurdles that must be overcome. A good example of this is the recent European Court of Justice decision that products derived from human embryonic stem cells cannot be patented – while in theory there are other mechanisms to protect the associated intellectual property, in practice investors are unlikely to invest in the development of such technologies within Europe unless there is much greater certainty that a successful product will result. As a result, it is likely that the public sector will need to take on a greater share of the early stage risk for the development of these types of technologies.

14. There are a range of interventions that have the potential to assist research commercialisation in the life sciences. Some of these are specific to the life sciences, and some are more broadly applicable across sectors.

15. With regard to life sciences-specific solutions, possible areas of action include:

    - *Improving funding for clinical research*, particularly research that addresses unmet clinical needs or enables clinical experts to engage with research at an earlier stage of the development process;

    - *Streamlining regulatory processes*. Securing the necessary regulatory approvals can add significant time and cost to the commercialisation process. While it is important to retain robust regulatory safeguards for products that are intended for use in humans, the recent Academy of Medical Sciences (AMS) review suggested that the process for getting clinical studies underway in the UK is particularly slow and complex. The UK's share of global patient recruitment into clinical trials fell from 6% to 2-3% between 2000 and 2006, while the share of the core EU Member States fell less dramatically from 21% to 14% during this

period.[1] While we have seen significant progress from the Government in implementing the recommendations of the AMS review, there are a number of areas where more could be done – for example, in streamlining the process for researchers to seek NHS R&D permissions.

- *Creating the right infrastructure* by deploying electronic patient records to support research within an appropriate governance framework, reducing costs by sharing services (e.g. laboratory services, testing facilities) and data. For example, in the drug discovery area the UK has considerable expertise in identifying potential drug targets, but needs to improve access to screening facilities, such as chemical libraries, which are normally based in industry.

16. More general solutions include:

- *Improving tax incentives for R&D*. In general the UK has a favourable tax environment for business R&D, particularly given the recent introduction of the patent box. However, the tax system does not always encourage the collaboration and interaction between research and business which is critical to effective commercialisation. This is particularly the case with co-located facilities. A zero rating for new charitable buildings can only be retained if the building is used 95 per cent for non-business charitable purposes. In the case of the new Francis Crick Institute, this will restrict the ability to conduct on-site technology transfer and commercialisation activities.

- *Improving links between research organisations and business* through exchange of staff; sharing of resources and expertise.

- *Developing more flexible intellectual property structures* to enable academia and industry to work together on the early stages of commercial development.

17. The drug discovery sector provides a good case study of both the challenges of research commercialisation and the way models of commercialisation are evolving to address it. The current commercial model for bringing new drugs to the market is becoming unsustainable, with increasing costs (the cost of taking a new drug to the market is now estimated to be over £1 billion), fewer drug targets, and lower returns from new drugs which do make it onto the market. These challenges have increasingly led the pharmaceutical industry to explore 'open innovation' models which allow new drug targets to be identified and validated in partnership between academia and industry. While the number of academic drug discovery units based within universities is growing, a workshop hosted by the Wellcome Trust in June 2010 identified a number of barriers to the expansion of this approach, including: a shortage of the appropriate technical skills (for example in target identification and validation) and entrepreneurial skills amongst academic researchers; the need to develop appropriate systems to store and share data; and the need to facilitate research in IP-free environments.

[1] Kinapse (2008). Commercial clinical research in the UK: report for the Ministerial Industry Strategy Group Clinical Research Working Group. http://www.ukcrc.org/index.aspx?o=2873

***Q3. What, if any, examples are there of UK-based research having to be transferred outside the UK for commercialisation? Why did this occur?***

18. Funders of technology transfer activities can adopt a range of strategic approaches. Where basic science funders invest in technology transfer activities, they tend to adopt a 'science push' approach that begins with an opportunity arising from basic science and seeks to develop the project to a stage where appropriate business partners can be attracted (or a new spin-out business created). This contrasts with 'business pull' approaches where a funder works with businesses to identify research opportunities and problems and harness scientific knowledge and expertise to solve them. Both approaches have merit, and at a national level there is a value in a diversity of approaches. However, it is important to recognise that a science push approach will not necessarily prioritise research opportunities on the basis that they can be commercialised within the UK. A technology transfer funder with an explicit mandate to deliver economic benefit to the UK will need to identify potential UK-based partners at an earlier stage in the commercialisation process, and take this into account in decision-making about which projects to invest in.

19. The majority of the successful research commercialisation processes the Wellcome Trust has been involved in have involved the transfer of intellectual property to foreign partners. The main reason for this has been the need for significant follow on funding, and the lack of appropriate funding sources and commercial partners within the UK. As a charitable funder with a global focus, we focus on projects that are likely to deliver a tangible benefit to human or animal health – our technology transfer programmes do not explicitly aim to deliver an economic benefit to the UK. However, we are certainly aware of cases where opportunities for economic co-benefits have been missed.

20. Examples of research and technology transfer activities we have funded that have resulted in overseas licenced deals include:

    - **CardioDigital**, a spinout company from Napier University, Edinburgh, was established in 2001 to develop tools for monitoring patients to help doctors make better informed clinical decisions. The Wellcome Trust provided funding in 2002 and 2006 to support CardioDigital to develop its software analysis techniques to be applied in a clinical context and to prepare the resulting technologies for the market. This funding enabled the company to develop software to adapt existing pulse oximeter monitoring devices to assess respiration rates. In 2008, the US healthcare provider Covidien acquired the technology and will shortly announce that the product is now being made available in Europe with a limited market release following regulatory approval. This technology allows doctors to detect early warning signs of patients' breathing problems and provide more effective treatment.

    - The Wellcome Trust provided career support to Professor David Wraith at the University of Bristol from 1989. In 2002 he established a biotechnology company, **Apitope**, to develop targeted therapies to suppress the inflammatory responses causing autoimmune conditions. With funding from a Wellcome Trust Translation Award, Apitope developed a peptide therapeutic (ATX-MS-1467) for the treatment of multiple sclerosis. An initial clinical study was completed in 2008, and the following year Apitope announced a licensing agreement with Swiss-based Merck Serono to develop and commercialise ATX-MS-1467. Merck

Serono has now taken responsibility for all development activities from the beginning of phase II clinical trials, and is providing funding for Apitope to continue research into other therapeutic peptides for the treatment of multiple sclerosis. Apitope has also raised €10 million from European funders, including LRM, Vesalius Biocapital, Vinnoff and Hasselt University.

***Q4. What evidence is there that Government and Technology Strategy Board initiatives to date have improved the commercialisation of research?***

21. The business-led focus of the Technology Strategy Board (TSB) brings a different perspective to the research commercialisation process from other funders, such as Research Councils and charities. As discussed above, it is helpful to have a diversity of approaches to research commercialisation. It will be important to ensure that the outcomes of TSB funding are monitored and evaluated over time to ensure that the most appropriate mechanisms are being used.

***Q5. What impact will the Government's innovation, research and growth strategies have on bridging the valley of death?***

22. The Government is increasingly acknowledging the need to take a strategic approach to life sciences innovation which seeks to coordinate action across the research, education and health sectors and address finance and regulatory barriers to innovation. This approach was articulated in the Strategy for UK Life Sciences, Sir David Nicholson's review of the adoption and uptake of innovation in the NHS, and the Innovation and Research Strategy for Growth. The Wellcome Trust contributed to the development of these strategies and we appreciated the consultative process adopted by the Government. We are also optimistic that the announcements will have a positive impact on innovation in the life sciences.

23. The new £180 million Biomedical Catalyst Fund is intended to directly address the valley of death, with a focus on enabling collaboration and on providing a "seamless set of support and funding options". The success of this fund in achieving its objectives for growth of the UK life sciences sector will depend on its ability to achieve strong engagement and buy-in from the business sector, as well as from researchers. Companies will need to be engaged in the early decision-making to identify projects and technologies which best align with the strategic priorities of UK-based businesses. If this is not achieved it is likely that the Catalyst Fund will repeat the experience of other technology transfer funds where many projects rely on international partners for commercialisation. Similar arguments can be made in relation to the Catapult Centres (Technology and Innovation Centres), which are a positive evolution but need to be run in close partnership with industry in order to succeed.

24. A number of the actions from the recent Government strategies seek to develop an innovation culture in the NHS, for example through promoting the use of patient data for research, investing in workforce training and building on research centres of excellence to increase collaborations between industry, academia and clinicians. These actions will also assist in bridging the valley of death as they will create incentives for private companies to invest in R&D in the UK and to partner with the NHS to ensure that discoveries arising from publicly-funded research are able to benefit UK patients. The forthcoming NHS Procurement Strategy (expected 1 March) will also assist the NHS to

send stronger and clearer demand signals and improve pull through of locally-generated innovations into the NHS.

25. The Government needs to think carefully about the messages it sends about the role of universities in the commercialisation and knowledge transfer process. In his speech on 5 January David Willetts announced the Government's ambition for university knowledge exchange income from external sources to grow by 10 per cent over the next three years. Such a target will encourage universities to see their interactions with businesses within a context of short-term revenue generation, rather than sharing knowledge for longer-term public benefit. It may dissuade them from seeking out local partnerships that will create jobs and see intellectual property retained within the UK, if greater profit can be made from licencing technology internationally. Universities should be recognised for the broader value they add to the economy, for example through tacit knowledge and the provision of skilled graduates, rather than just the external revenue they generate.

***Q6. Should the UK seek to encourage more private equity investment (including venture capital and angel investment) into science and engineering sectors and if so, how can this be achieved?***

26. It is likely that venture capital and angel investment will remain difficult to attract in the life sciences as angel or venture investors are typically looking for a return in 5-7 years. Most life sciences projects are seen as too risky and unlikely to deliver return within this timeframe. If the UK is serious about encouraging venture capital investment in the sciences it will need to develop a range of measures that both reduce the risk (for example through funding more of the business development in the public sector) and increase the potential pay-off (for example through tax incentives) of such investment.

***Q7. What other types of investment or support should the Government develop?***

27. The Government has the opportunity to look at higher education policy signals to enable research assets to be nurtured and developed in the protected environment of a university. The lack of funding mechanisms to do this within higher education, and the expectations that are placed on universities to generate external revenue (paragraph 25 refers) mean that universities are forced to look for external funding too early.

*28.* Technology transfer funders could consider developing more of a portfolio approach to investment. At the moment they tend to focus on developing single products or technologies, often conceived, developed and evaluated in isolation. As a result, the know-how and learning experience is not shared and often lost. Indeed, as the number of major industrial R&D sites in the UK declines, centres of technological and applied scientific excellence, such as the Clerk Maxwell centre, could help provide the necessary skills and experience to help sustain an innovation culture and be a source of product concepts.