Government science ambitions require greater funding and wider public understanding

Ian Taylor (Planit Ventures, UK)

Following the outbreak of COVID-19 and facing the challenges and opportunities of a post-Brexit world, the UK government must deliver on the vision of its innovation strategy with increased funding for scientific research. The success of the life sciences sector will be key to the delivery of the government's scientific superpower ambitions. Boosting public funding will depend on continued political, and therefore public, support. With reference to his career in politics and industry, Ian Taylor shows how effective communication with the public, providing reassurance and dispelling myths, is central to the sector sustaining success in the long term.

The outbreak of the COVID-19 pandemic has meant that the importance and profile of UK science, both to policy makers and public, is at the highest it has ever been. This is particularly true about the life sciences sector and its success in rapidly developing effective and safe vaccines to combat COVID-19. The regular televised appearances of the prime minister standing shoulder to shoulder with the government's chief medical officer and the chief scientific adviser reinforced the linkage between scientific advice and our daily lives, even if sometimes the tension showed. Fame is, however, precarious, and so every effort needs to be made to enhance public understanding of science, of the risks involved in scientific enquiry and the requirement for increased long-term funding for research.

Life sciences has now become a key sector and a story of success. The industry employs more than 250,000 people in the UK and generated over £81 bn in 2019.[i] The report, Life Sciences Innovation: Building the Fourth Industrial Revolution (2021)[ii], provides further detail that, in 2020, life sciences companies completed £20 bn of corporate investment, placing the UK fourth in global ranking, and predicted that by 2025 life sciences will add an extra £8.5 bn to the economy and over 31,000 jobs.

I have been fortunate to work directly around the interface between government and UK science. As a Member of Parliament, I was Parliamentary Private Secretary to William Waldegrave when he was science minister in the early 1990s. Later, I took over as science minister after the Office for Science and Technology moved to the then Department for Trade and Industry (the precursor to the current Department for Business, Energy and Industrial Strategy).

In 1993 the government published the 'Realising our Potential' white paper on the reorganization of the Research Councils that provide funding to academic institutions for scientific research. Amongst its recommendations was the creation of the Biotechnology and Biological Sciences Research Council (BBSRC), now the largest public funder of non-medical bioscience, through the incorporation of the former Agricultural and Food Research Council (AFRC) with the biotechnology and biological sciences programmes of the former Science and Engineering Research Council (SERC). Then, as now, ensuring the most effective structure of our public sector research base was a priority and key to delivery of objectives.

This was an interesting period for bioscience, with several important breakthroughs capturing the imagination – if not the understanding – of the public. As minister, I supported the funding of the Roslin Institute's research which led to Dolly the sheep, the first mammal cloned from an adult somatic cell. The objective was to find ways to lessen the impact of debilitating diseases such as Parkinson's and Huntington's. This news garnered global attention and significant concern from many quarters on the implications. Prior to the announcement, I sought to help allay such concerns through the establishment of

[i] Life Science Competitiveness Indicators 2020: Annual report on the UK life Science Sector – HM Government https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/977265/Life_Science_Competitiveness_Indicators_2020_report.pdf

[ii] Life Sciences Innovation Building the Fourth Industrial Revolution – Perkins&Will, Blackstock https://blackstock.co.uk/insights/life-sciences-innovation-building-the-fourth-industrial-revolution/

the Human Genetics Advisory Commission, reporting to ministers on new developments in human genetics which could have further wider social, ethical and/or economic consequences.

In addition, we confronted the bovine spongiform encephalopathy (BSE) crisis and with it the politically difficult public anxiety about food supply chain transmission to humans as variant CJD (vCJD) was likely to be caused by consuming meat from a cow that had BSE (or 'mad cow' disease), a similar prion disease to CJD. Huge publicity was given to the supposed risks of eating beef. In the face of that, we had to make high-stakes policy decisions which could not wait for any final scientific assessment. This happened in the face of uncertainty with the primary purpose of protecting the public rather than the economics of an industry, political alliances or other considerations.

There were also arguments over the deployment of genetically modified crops against fierce opposition, and the beginning of the Human Genome projects with a then unresolved debate about public or private ownership (settled in favour of the former eventually), all of which augured a new age and higher profile for bioscience. In theory these issues should have contributed to the development of a better understanding of risk and impacts, but sadly the public debate showed how controversy can over-rule calm scientific explanation. I was guided as minister by the calm analytical expertise of the then chief scientific advisor, the late (Lord) Bob May, who had a stellar academic background in ecosystem ecology, mathematical biology and epidemiology. He issued in 1997 a report on scientific advice in policy making, which argued that 'there should be a presumption of openness in explaining the interpretation of scientific advice'. He advocated engagement with opponents of GM crops or animal experimentation, rather than dismissing them as anti-rational. "Our values will indicate what questions we should be asking about the natural world and humanity's impact on it," he said. "Our science will ensure that the answers have a solid foundation."

That challenge persists today. Further transparency and public consultation are needed to downplay conspiracy theorists' non-factual disinformation on risks.

Seed investment

In 2013 I became Chair, for 7 years, of the UK Innovation and Science Seed Fund (UKI2S), which provides seed funding, strategic mentoring and support for science companies in their early stages as they emerge from the public sector research base. Nurturing and growing startup technology ventures which have the potential to become leaders in their field generates skills, high-quality jobs and exports and contributes to the longer-term productivity improvement we need to stay competitive as a nation. The fund involves public sector research establishments as partners including BBSRC, STFC, NERC and DSTL. UKI2S also collaborates with Innovate UK and the Catapult Network, helping to catalyse and de-risk innovation by road-testing new technology applications that are at pre-return-on-investment. These types of partnerships can help cover the gap between R&D and industry, to provide 'translational infrastructure' that allows the most innovative ideas to be commercialized.

In 2013, as part of the then Science Minister David Willetts' 'Eight Great Technologies' initiative, the government gave UKI2S a specialist £10 mn Synthetic Biology Fund with the purpose of helping companies in the early stages of their journey towards sustainability, through investment, strategic support and leveraging private capital. Synthetic biology or engineering biology is the design and construction of entirely novel biological systems or the re-engineering of existing biological systems. Its applications can serve a wide variety of markets and it has the potential to solve many of the environmental and societal challenges of this century – major global issues with sustainability including environmental health, energy shortages, pollution, hunger and disease are all being addressed now by synthetic biology. UKI2S identified and invested in several ground-breaking companies in this space including Synthace (automating synthetic biology for speed and repeatability), Quethera (ocular gene therapy), Tropic Biosciences (improving tropical crops) and Nemesis Bioscience (combatting anti-microbial resistance).

With an overall portfolio of 57 companies, created with £15 mn of capital invested, UK2IS companies have attracted over £500 mn of later stage investment and have a combined market value of over £750 mn. For every £1 of UKI2S investment, portfolio businesses have received £3 of other public investment and £29 of private investment according to independent expert analysis by SQW. On the more human side, our seed investment has released the enthusiasm of scientists and enabled them to advance their research and deploy their efforts for the benefit of society.

Public attitudes versus political, scientific realities

All discoveries and developments raise questions, but synthetic biology is perhaps on the front line when it comes to tricky ethical dilemmas. There will always be some distance between public expectation and scientific, political realities and timing. As with Dolly the sheep,

it is not unusual for generalists at first to over-estimate the speed (and risks) of impacts, which can then transmute into frustration with the slow and challenging applications of breakthroughs.

It is often difficult to explain scientific procedures and terminology for public debate, much though that it is necessary. One example is the distinction between genetic modification and gene editing. Here in the UK we have at least started to explore how to deploy the gene editing (CRISPR) technique a little more, but the consumer will be the decider as we look to post-Brexit opportunities. There will be research and export issues if UK practice is not aligned with the EU. At the time of writing this article, the government has announced legislation to better enable field trials in England on crops that are gene-edited (as opposed to genetically modified) for environmental and nutritional benefits.

Carefully monitored, synthetic biology has the potential to help solve some of our biggest global problems, but clearly there are political factors which always impinge on scientific discovery. The current science minister, George Freeman MP, brings with him a life sciences and related venture capital background and appreciation. He had a leading role on the Taskforce on Innovation and Regulatory Reform (TIGGR) that identified and developed proposals across a range of areas that will drive innovation, growth and competitiveness through regulatory reform, in connection with the UK's post-Brexit Regulatory Framework, and in which life sciences received favourable consideration.

With funding allocations, we also need to ensure support is available for wide-ranging potential impacts of applied science, especially around genetic modification. The power of today's science brings great responsibility. Other discoveries have had serious consequences recognized too late in the day, with microplastics providing a useful case study.

The contribution of biology, chemistry and synthetic biology to the understanding of effective multidisciplinary research is also worth recognizing. Researchers and practitioners from many fields can draw inspiration from work taking place elsewhere. This is especially the case with architecture, the built environment more generally, design and the biomanufacturing and biomarking fields. Dr Melissa Sterry, the transdisciplinary design scientist and complex systems theorist, makes the case that to answer challenges such as computer-aided biology requires more dialogue between scientists and those that are embracing biology as a creative and production agent.

Critical moment for delivery of UK scientific superpower ambitions

As the consequences, difficulties and opportunities of Brexit play out uncertainly, it is vital that industry and government make every effort to promote the UK as a place to do work and do business. Encouraging visiting scientists/technologists is not merely about economic growth, but an expression of the UK as an open, enquiring, culturally diverse society. Above all, we should be welcoming rather than hostile, inclusive not just by exception. We have leading scientific researchers punching above our comparative weight in terms of citations – but this cannot be taken for granted and we must always recognize that open access to research conducted elsewhere is vital.

The UK government has published its Innovation Strategy, and its associated strategies on place, people and culture either have been or are soon to be published. The coming years will have to be about delivery of these plans and ambitions. At the same time, the review of R&D innovation by Sir Paul Nurse, as well as a BEIS 'major review' of UKRI and its strategy should also be closely followed as they seek to further increase impact.

As all countries face an uncertain pandemic and economic outlook, it will be the level of British success with the skills and innovation agenda which will determine UK competitive advantage for critical growth sectors like life sciences. As William Hague recently put it, "Innovation will determine if we soar or stumble." This refrain is shared by successive science ministers, including my successor David Sainsbury, who has just published a stimulating book on the subject 'Windows of Opportunity'.

The government has committed to achieving 2.4% of GDP on R&D by 2027, contributing £22 bn towards that target by 2026/2027 (formerly 2024/2025). However, public contribution to R&D spending has determinedly hovered around 0.7% of GDP over the past three decades (as it was when I ceased to be minister in 1997). Hence the latest Spending Review's emphasis on the contribution of amended R&D tax credits to ensure that they better support cutting-edge research methods, supplementing this figure to 1.1% of GDP. As always, the key variable will be private sector investment, currently still the largest contributor to UK R&D intensity.

The UK government has placed a huge emphasis on innovation delivering productivity improvements necessary for economic readjustment post-pandemic and post-EU. That requires a commitment and delivery of ambitions – not least on increasing R&D contribution from UK businesses – which have proven elusive for a long period. While the current UK

upward trajectory of government science funding is demanding, it is the least ambitious target of all the G7 countries. German expenditure in relation to its GDP is already 3.2%. The UK will be competing for globally mobile R&D investment, hence the recent announcement to give cash to international companies with 'strategically important' investment proposals, albeit after due diligence to ensure value for the taxpayer, to start, grow and invest in a business. The new fund includes £354 mn to support investment in life sciences manufacturing.

As Sir Paul Nurse said to the Commons' Science and Technology Committee in October: "We have been underfunded in science for decades… and we bump around at the bottom of the OECD figures at around 1.6% or 1.7%... The truth is that if we had money, we would be absolutely spectacular at science. Let me just say that again: spectacular at science." ■

Further reading and listening

- Windows of Opportunity: How Nations Create Wealth, Lord David Sainsbury
- "Innovation will determine if we soar or stumble", Lord William Hague, The Times, 18 October 2021
- Impact of Life Science Industry: https://www.sciencecampaign.org.uk/resource/the_economic_contribution_of_the_uk_life_sciences_industry-abpi.html
- Dr Melissa Sterry on Computer-Aided Biology podcast hosted by Fane Mensah - https://anchor.fm/cabtalk/episodes/CABTalk-S2E5-The-Future-of-Research-with-Melissa-Sterry-e11ftpj/a-a5lp6m2
- References to the late Lord May's views taken from https://www.theguardian.com/science/2020/apr/29/robert-may-bob-may-lord-may-obituary
- UKI2S impact: https://ukinnovationsciencseedfund.co.uk/impact/economic-value/
- UK scientific achievement in global context: https://www.elsevier.com/connect/report-compares-uks-research-performance-with-key-nations#
- Comparative R&D Spend by country: http://uis.unesco.org/apps/visualisations/research-and-development-spending/
- Comparative R&D Expenditure by country: https://en.wikipedia.org/wiki/List_of_countries_by_research_and_development_spending
- UK Business Investment: https://on.ft.com/3dIlhtg

Ian Taylor is a partner at Planit Ventures which is focused on technology venture capital, R&D and innovation. He is an advisor to several other companies in the UK, EU and USA. Email: ian@fentimanconsultants.com. Twitter: @iancolintaylor. Single line for social media: Former Science Minister, @iancolintaylor, writes about the importance of the sustained success of the science sector of government funding and private investment as well as wider public understanding and support.