

22 September 2017

## Submission to HM Treasury consultation into financing growth in innovative firms

### Summary

1. The Royal Society welcomes the Government's aim to increase productivity by addressing the challenges young, innovative firms have in accessing long-term investment.
2. The Society works to ensure that research should have the widest possible benefit to society and the economy. A vibrant system to translate research, with a principal focus on delivering these benefits is essential for this to occur. This includes the need to invest across the system from small amounts of concept funding to patient capital that backs propositions over the long-term and has realistic expectations about returns.
3. In this response, we focus on investment in science and technology based companies, in particular those spun out from UK universities (Question 25 in the Treasury consultation), and how access to patient capital can affect their growth and ability to innovate. However, the information contained in this response will be applicable more broadly to the UK economy, including the importance of business leadership to company growth and the role EU funding plays in supporting UK research and innovation.

### General

4. The Royal Society is the National Academy of science of the UK and the Commonwealth. It is a self-governing Fellowship of many of the world's most distinguished scientists. The Society draws on the expertise of the Fellowship to provide independent and authoritative advice to UK, European and international decision makers. As the UK's academy of science, the Society is concerned with the health of the UK's research, innovation and education system as a whole.
5. This response has been informed by the Society's Science, Industry and Translation committee<sup>1</sup> and reflects the views of individual Fellows, specifically those involved in the commercialisation of research and investment into technology based firms. Those Fellows also sought input from a limited number of others with expertise in this area. This response builds upon previous work at the Society, including our responses to select committee consultations on Access to finance (February 2016)<sup>2</sup> and Managing IP and technology transfer (September 2016),<sup>3</sup> policy reports into

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<sup>1</sup> <https://royalsociety.org/about-us/committees/science-industry-and-translation-committee/>

<sup>2</sup> <https://royalsociety.org/~media/policy/Publications/2016/02-10-16-royal-society-response-to-the-bis-select%20committee-inquiry-on-access-to-finance.pdf>

<sup>3</sup> <https://royalsociety.org/~media/policy/Publications/2016/09-15-16-response-managing-IP-and-technology-transfer.pdf>

cybersecurity<sup>4</sup> and machine learning<sup>5</sup> and research into the role of EU funding in UK research and innovation.<sup>6</sup>

6. Company success is dependent on the strength of its ideas and intellectual property, the ability to access capital to start-up and grow and the quality of its management team(s). The strength of the UK's research base and growth in the amount of early stage finance available, such as via angel investors has meant that the UK has some strengths as a place to start a company, including spinning-out from a university.
7. As the Treasury review describes, the strength of the UK's research base makes it a "fertile ground for world-leading innovation". The pharmaceutical industry produces exports worth £24 billion a year and our digital sector is growing 32% faster than the wider economy. In the 2017 Global Innovation Index, the UK was ranked 5th overall out of 127 countries.<sup>7</sup>
8. However, our Fellows have informed us that there remain issues that prevent the full translation of the UK's research strength into new technologies and companies that maximise its benefit to the UK economy and society. These include barriers that slow down and inhibit investment into early stage companies, such as University spin-outs; a lack of patient capital to help science and technology companies grow into "unicorns" with market valuations of at least £1bn, and a shortage of credible management teams in the UK, particularly for leading scale-up companies.
9. Increasing the amount of patient capital invested into innovative firms with the potential for high growth will help stimulate greater investment into research and innovation in the UK. As we stated in our response to the Industrial Strategy Green Paper, across both the public and private sector, the UK should aim to invest 3% of its GDP in research and innovation by 2025.<sup>8</sup> The Government's commitment to reach 2.4% within 10 years is welcome, although it is worth noting that there is a long way to go to reach the 2.4% target and countries such as Germany and the US are already investing more than 2.4%. To deliver on this aim, we need to create a vibrant environment that fosters research and innovation throughout the UK's public services, universities and businesses and attracts global investment, incentivising companies to locate their R&D here.
10. A strategic approach, alongside an Industrial Strategy, will be key to realising our ambition and improving access to patient capital to finance growth in innovative firms has been rightly identified as a key part of this. With the other National Academies, the Society is embarking on a major evidence commission to understand more how best to measure economic and social benefits of investing in research and innovation to provide new insights into how the UK can achieve the R&D public and private investment target of 3% of GDP. Research will be published in summer 2018.

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<sup>4</sup> <https://royalsociety.org/~media/policy/projects/cybersecurity-research/cybersecurity-research-report.pdf>

<sup>5</sup> <https://royalsociety.org/~media/policy/projects/machine-learning/publications/machine-learning-report.pdf>

<sup>6</sup> <https://royalsociety.org/topics-policy/publications/2017/role-of-EU-funding-in-UK-research-and-innovation/>

<sup>7</sup> [http://www.wipo.int/edocs/pubdocs/en/wipo\\_pub\\_gii\\_2017.pdf](http://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2017.pdf)

<sup>8</sup> <https://royalsociety.org/~media/policy/Publications/2017/17-04-17-submission-industrial-strategy-green-paper.pdf>

## Technology transfer

11. The strength of the UK's research base leads to new technologies and innovations that form the basis of innovative, high growth start-up firms. In 2015/16 the Higher Education Business and Community Interaction survey reported that there were 1876 active spin-outs and staff start-ups from UK Universities, which employed over 20,000 FTE, turned over £1.8bn and received £1.2bn in investment.<sup>9</sup> The introduction of the impact element into the Research Excellence Framework has also encouraged greater involvement by universities and academics in commercialisation activities.
12. However, as reported in the Treasury review, the overall performance of and investment received by university spin-outs has remained relatively static since 2009/10, despite a growth in the total number of active firms. While the practice of technology transfer offices (TTOs) is the subject of another review commissioned by BEIS, issues with University technology transfer can inhibit investment and discourage inventors from founding a company.
13. The approach universities take towards technology transfer varies across the sector. Although this variation is understandable given the histories, strategic objectives, research profiles and experiences of each university, it can add complexity to the system, slowing down the process of commercialisation and increasing the time and cost needed to negotiate investment.
14. In our response to the House of Commons Science and Technology Select Committee consultation on Managing IP and Technology Transfer,<sup>10</sup> we noted the following concerns of our Fellows, which can affect investment into University spin-outs:
- Unrealistic equity demands and overvaluation of intellectual property by some universities and academic inventors;
  - Delays in negotiations between the university, academic inventors and investors, exacerbated by slow administrative processes within the university;
  - A lack of expertise within the university, or accessible by it through its networks needed to effectively advise on and support technology transfer.
  - Non-transparent and inflexible aims, policies and practice of TTOs.
15. Some universities take equity shares of 50% or more when a company is founded, and our Fellows described how this can have knock-on effects for the business, the founders and investment. It raises the bar for investors, who may see up to 100 propositions for every one they invest in and need to ensure a return across their portfolio of companies. As a consequence, they may only invest in university spin-outs where the business and scientific proposition is very strong and not in riskier propositions that still have the potential to grow into successful companies. This can impact both early stage and later rounds of follow-on investment.
16. It was suggested to us that investment into University spin-out companies, both initially and in subsequent investment rounds, could be made more attractive by Universities taking smaller shares of equity. This will help encourage investors to make investment in riskier spin-out propositions,

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<sup>9</sup> <https://www.hesa.ac.uk/data-and-analysis/publications/hebc-i-2015-16>

<sup>10</sup> <https://royalsociety.org/~media/policy/Publications/2016/09-15-16-response-managing-IP-and-technology-transfer.pdf> (accessed 5 September 2017)

growing the number of companies started and subsequently turning into high growth, innovative firms. The development and use of efficient, simple, harmonised and transparent IP policies and practices across the sector, which can be adapted on a case-by-case basis, would also help by speeding up the time needed to negotiate investment.

17. High university equity shares can also demotivate the academic founders and discourage potential management teams, who may determine that the potential long-term financial reward, once diluted across subsequent funding rounds, is not sufficient for them to become involved in the spin-out.
18. In response to concerns about the process of translation in the UK, the Society, alongside the Academy of Medical Science, Royal Academy of Engineering and Wellcome, recently launched “Transforming UK Translation”, a series of commitments aimed primarily at universities and focussed on increasing the ease with which great ideas, discoveries and inventions can be transformed to generate real benefits for society and the economy.<sup>11</sup>
19. In order to help deliver these benefits, the governance and resourcing of university technology transfer should prioritise longer term aims over generating revenue or meeting metrics in short term revenue generation.
20. As a recent example, we note the “Founders’ Choice” programme being piloted at Imperial College. Based upon the two-tier model operated at Stanford and MIT, this separates the licensing and business support functions of technology transfer. With academic founders who only want the former, the University takes a small equity share (5-10%), giving the founders greater freedom to develop the company.<sup>12</sup>
21. The Treasury review mentions technology transfer funds that invest in spin-out companies and considers the option of using a public instrument to cornerstone such funds to increase their size or the number present in the marketplace. These funds can play an important role in making riskier investments in spin-out companies developing new and untested technologies that are too early to attract investment from other funds.
22. A number of these funds have signed agreements with universities allowing them first-refusal access to any IP generated at the institution. Some of our Fellows expressed concern that if these agreements were overly restrictive, it could prevent spin-outs accessing investment from other funds more suited to the business model.
23. Furthermore, misalignment between the business models of technology transfer funds investing at the seed stage and those of follow-on investors can make companies less attractive propositions for investment at Series A and subsequent rounds. Technology transfer funds either need to be able to provide long-term patient capital that can support company growth, or seek levels of return that are more aligned to follow-on funds that will provide this capital.

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<sup>11</sup> <https://royalsociety.org/news/2017/07/innovation-science-engineering-leaders-pledge-improved-support-for-research-translation/> (accessed 5 September 2017)

<sup>12</sup> <https://www.imperialinnovations.co.uk/venture-support/founders-choice/>

## Financing company growth

24. We have previously reported that the time taken to bring new technology-based innovations to market can be longer than ten years, and longer than the expected periods of return for some investors (3-5 years).<sup>13</sup>
25. While our Fellows believe that there was more finance available to start-up in the UK, acute difficulties and gaps in funding can still occur at the early stages of the commercialisation process, when investment propositions are riskiest. Small or short-term investments may mean a company's business model becomes focused on securing further investment or sale, rather than investing in the research and innovation necessary for long term growth. Therefore, even at early stage, companies need a realistic, long-term plan for growth to understand what patient capital they need to access and when.
26. Access to investment can and does vary between sector and technology. For example, investors are excited about the affordable access to and scalability of machine learning technologies and products, and there does not currently appear to be a shortage of risk capital to support early-stage start-up companies in this field.<sup>14</sup> In contrast, there is a scarcity of funding available for cybersecurity companies, in part due to investors' limited expertise in the technology, such that specialist funds may be required.<sup>15</sup> The length of time needed to bring biotech and pharmaceutical products to market and the problem of securing patient capital to do so in the UK has been reported extensively, including in Sir John Bell's recent Life Science industrial strategy.<sup>16</sup>
27. Another challenge facing companies introducing disruptive technologies that span sectors, such as new digital products, can be the time taken for existing industries to adopt the technology at large enough scale to make the company profitable. Slow adoption can result in a funding gap for these companies, which then need access to patient forms of finance and investors who understand the barriers and timescales involved.
28. There is an opportunity to use the new Industry Strategy Challenge Fund to support disruptive innovation that has the potential to found the industries of tomorrow, as the President of the Royal Society set out in correspondence with Greg Clark, the Secretary of State for Business, Energy and Industry Strategy. By funding projects that draw heavily from multiple elements of the UK research, innovation and industrial base, the ISCF could also make it more likely that the resulting products and capabilities will 'stick' here in the UK. The challenges should build partnerships spanning a number of centres within and across regions to create fledgling industries with the potential to scale. This would provide an opportunity to generate economic opportunities and returns in places where

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<sup>13</sup> <https://royalsociety.org/~media/policy/Publications/2016/02-10-16-royal-society-response-to-the-bis-select%20committee-inquiry-on-access-to-finance.pdf>

<sup>14</sup> <https://royalsociety.org/~media/policy/projects/machine-learning/publications/machine-learning-report.pdf>

<sup>15</sup> <https://royalsociety.org/~media/policy/projects/cybersecurity-research/cybersecurity-research-report.pdf>

<sup>16</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/640696/life-sciences-industrial-strategy.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/640696/life-sciences-industrial-strategy.pdf)

they are most needed. By developing and demonstrating new products in the market place, it will make them more attractive to investors and incumbent industries.

29. At the early stage, grant funding can be an important financial support for innovation within companies, and recent evidence shows grant funding can help increase productivity, particularly in small firms.<sup>17</sup> However, if companies become overly reliant on grant funding, they may not develop the commercial aspects of the business that would make it profitable over the long term. We note Innovate UK's new Investment accelerator pilot and its aim of connecting companies seeking grant funding with private investment.<sup>18</sup>
30. Our Fellows confirmed the Treasury review's findings on the UK's relative lack of scale-up companies and so-called "unicorns", noting how many companies are sold at the £100m-1bn size. Investors at this stage, who want to see large returns on their investment, need to be better incentivised to invest. With a specific focus on science and technology based companies, the funding limit and minimum share holding period for the Enterprise Investment Scheme could be increased to create a stronger incentive for holding equity over a longer term of company growth, eg as recommended in the life science industrial strategy.<sup>19</sup>
31. In Europe, including the UK, public market valuations are believed to be too low and there is a lack of expertise of science and technology companies among institutional investors, who may be wary in investing in riskier technologies and businesses they do not fully understand. As a consequence, returns on investment in companies going through an initial public offering (IPO) in the UK are lower than in the US. However, as and when science and technology companies do successfully launch on the public markets, investors will be attracted to similar companies further down the chain, encouraging more to launch on the public markets.

## People

32. While our Fellows reported improvements in finance available for start-up and spin-out companies, a major challenge remained in identifying and recruiting credible management teams, in particular CEOs and general managers. Venture capital fund managers are often unwilling to invest in unproven managers, preferring to invest in companies whose management teams have a track record of success. The numbers of such individuals are growing in the UK, particularly for start-up companies and in the Golden Triangle, but shortages remain at later stages and for companies undergoing faster rates of growth (eg at IPO).
33. While the "hands-on" running of a business will always be the best form of growing management experience, other approaches could be taken to "de-risk" management teams and make them more credible to investors. These can include business training and mentoring for scientists and engineers involved in starting-up companies and increased mobility and secondments of individuals between academia, industry and investors. For example, venture capital funds use industry experts as

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<sup>17</sup> <https://www.enterpriseresearch.ac.uk/wp-content/uploads/2017/09/ERC-ResPap61-VaninoRoperBecker-Final.pdf>

<sup>18</sup> <https://www.gov.uk/government/publications/funding-competition-investment-accelerator-pilot>

<sup>19</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/640696/life-sciences-industrial-strategy.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/640696/life-sciences-industrial-strategy.pdf)

entrepreneurs in residence to help carry out due diligence on companies that are potential investments, who may then later join the company as CEO.

34. The Royal Society will be launching a new Entrepreneur in residence scheme in late 2017. The scheme will second industry experts into Universities, who will be, in part, responsible for evaluating the commercial potential of research and advising and mentoring researchers seeking to found, manage and grow spin-out companies.

35. Inventors, including academics, may lack understanding of the process of investment and how to accurately value their IP. Accelerators, incubators and schemes, such as The Royal Academy of Enterprise Hub, Entrepreneur First, and the ICURe programme can help by bringing together founders with entrepreneurs, investors and business leaders to develop new enterprises by supporting prospective founders with (pre-)seed funding, bespoke mentoring and/or training.

36. The Treasury review discusses the need to attract and train fund managers in the UK, eg by creating new programmes such as the Kaufmann Foundation's "venture capital fellowship". In terms of investing in science and technology based companies, our Fellows' have reported a low level of understanding of science and the innovation process within some sectors of the investor community.<sup>20</sup> Therefore, such programmes could include elements that explain the time scales and business models involved in growing science and technology-based companies.

37. Although outside the scope of the current review, a company's growth can also be inhibited if it cannot recruit researchers, technologists and technicians with specialist expertise as well as those with entrepreneurial and management skills. In both respects, it will be important to ensure that any new immigration arrangements continue to enable us to recruit those with these strategically valuable skills.

## Europe

38. Our Fellows raised concerns that loss of the European Investment Fund (EIF) could have significant negative impacts on the availability of capital in the UK. The UK government must seek to replace any investment lost if the UK no longer has access to the EIF.

39. Earlier this year, the UK's National Academies commissioned research into the role European funding plays in supporting research and innovation across the UK, which was published alongside a series of case studies.<sup>21</sup> This research found that:

- The UK private sector currently receives approximately €190m of funding per year from Horizon 2020 (Framework Programme 8) and is due to receive about €1bn from the European Regional Development Fund (ERDF) over the period 2014-2020 (€860m of which will go to SMEs).

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<sup>20</sup> <https://royalsociety.org/~media/policy/Publications/2016/02-10-16-royal-society-response-to-the-bis-select%20committee-inquiry-on-access-to-finance.pdf>

<sup>21</sup> <https://royalsociety.org/topics-policy/publications/2017/role-of-EU-funding-in-UK-research-and-innovation/> (accessed 5 September 2017)

- EU Framework Programme 7 funding corresponded to 16.9% of total SME spend on research and innovation in the UK over the programming period (2007-2013);
- The European Investment Bank (EIB) provides loans at low rates to support its four priority areas: Innovation and Skills, SMEs, Infrastructure, and Environment and Climate. Between 2007 and 2016, the EIB provided £54.4bn loans to the UK, including £2.8bn to UK universities and £2.5bn for industry R&D. EIB loans have helped UK universities to expand knowledge exchange activities and develop new campuses and research centres.
- European funding is particularly important in supporting research and innovation in the regions and devolved nations, eg ERDF part-funds (60%) of the €200m EU Investment for Growth and Jobs Programme run by Invest Northern Ireland, which assists Northern Irish businesses via R&D support, a design service and access to financial instruments. The programme is scheduled to run until December 2020.

40. In a recent analysis for BEIS, NESTA noted that 41% of business accelerators and incubators in the UK are supported by public funding, including ERDF.<sup>22</sup>

41. A further benefit of European funding is that it facilitates collaborations across Europe, which can help accelerate R&D, and allow UK firms to develop new business models and access new markets. Losing access to these forms of collaboration could prove detrimental to UK firms, in particular SMEs.

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<sup>22</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/608409/business-incubators-accelerators-uk-report.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/608409/business-incubators-accelerators-uk-report.pdf) (accessed 5 September 2017)