

15 September 2016

## Royal Society submission to the Commons Science and Technology Committee inquiry into Managing intellectual property and technology transfer

### Summary

1. This submission focuses on the role of Technology Transfer Offices (TTOs) in universities. It reflects the experiences of academics, industry scientists and investors involved in technology transfer and highlights opportunities and challenges to maximising the benefits from this activity.

2. Over the past 10-15 years, the UK technology transfer system has grown and professionalised. The UK is ranked fourth globally for university-industry collaboration (Global Innovation Index), and its universities have seen increases in the incomes generated from patents (£49m to £155m), and from industry collaborations (£698m to £1.257bn) between 2003/04 and 2014/15.

3. The Society has received examples of TTOs improving and strengthening support for technology transfer. This is to be welcomed. There is more to be done, however, as entrepreneurial academics involved in technology transfer, potential investors and industrialists who work with university TTOs continue to raise concerns about how technology transfer is managed in universities. These concerns can be grouped under three interlinked areas:

- Transparency and flexibility around the strategic aims, policies and practice of TTOs, so that they are understood by academics and external partners.
- Governance and resourcing of TTOs so that they are able to prioritise long-term impacts above short-term revenue generation.
- Expertise within the university and institutions' access to the networks needed to effectively support technology transfer.

### Introduction

4. The Royal Society is the National Academy of science in the UK. It is a self-governing Fellowship of many of the world's most distinguished scientists working in academia, charities, industry and public service. 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. The Society supports and rewards excellence in science, including the translation and commercialisation of research (see Annex 1), which we believe is essential for the creation of societal and economic benefits.

5. This response has been informed by the Society's Science, Industry and Translation (SIT) Committee (see Annex 1). This response also draws on the views of over 30 members of the Society's Fellowship, SIT Committee and research fellows, including a mix of academics, industrialists, investors and entrepreneurs and come from a range of universities, research institutes and multinational corporations. We also draw on our responses to previous House of Commons Science and Technology and

Business, Innovation and Skills Committees' inquiries (e.g. access to finance<sup>1</sup> and valley of death<sup>2</sup>), the Dowling review<sup>3</sup>, including our own response<sup>4</sup>, the Wellcome Trust's report *The UK's Innovation Ecosystem*<sup>5</sup>, the Witty review<sup>6</sup> and the recently published Higher Education Funding Council for England McMillan review<sup>7</sup>. We recognise that there are a number of approaches to knowledge exchange, including collaborative R&D and technology transfer, however, our consultation has focused primarily on the latter.

6. Since 2000, technology transfer functions at UK universities have grown in size, responsibility and ambition, becoming a key part of the strategic delivery of knowledge exchange and technology transfer. These developments have coincided with the establishment of organisations responsible for enhancing the professional standing of technology transfer and knowledge exchange professionals, such as PraxisUnico, AURIL and ARMA. These organisations provide continued professional development and training, and build networks to share best practice across the UK and internationally (see Annex 2).

7. Despite the growth and professionalisation of the system, our respondents provided evidence of continuing challenges that inhibit technology transfer and knowledge exchange. These issues, whether real or perceived, include many long-standing concerns, such as limited resources and expertise within TTOs, unrealistic equity demands and intellectual property (IP) valuation by universities, delays in negotiations and administrative processes, and inabilities of TTOs to identify and build appropriate relationships within external networks. These issues are explored below.

### **Transparency and flexibility**

8. There is no one-size-fits-all approach to the process of technology transfer.<sup>8</sup> Universities take different approaches to the governance, structure and resourcing of their technology transfer operations, reflecting differences in the strategic emphases of individual institutions and the investable and commercial activity of its academic population (see Annex 2).

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<sup>1</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> (accessed 2 September 2016)

<sup>2</sup> <http://www.parliament.uk/business/committees/committees-a-z/commons-select/science-and-technology-committee/inquiries/parliament-2010/role-of-the-private-sector> (accessed 2 September 2016)

<sup>3</sup> <http://www.raeng.org.uk/policy/dowling-review> (accessed 2 September 2016)

<sup>4</sup> <https://royalsociety.org/~media/policy/Publications/2015/dowling-review-rs-submission-060315.PDF> (accessed 13 September 2016)

<sup>5</sup> [https://wellcome.ac.uk/sites/default/files/wtp057817\\_1.pdf](https://wellcome.ac.uk/sites/default/files/wtp057817_1.pdf) (accessed 2 September 2016)

<sup>6</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/249720/bis-13-1241-encouraging-a-british-invention-revolution-andrew-witty-review-R1.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/249720/bis-13-1241-encouraging-a-british-invention-revolution-andrew-witty-review-R1.pdf) (accessed 2 September 2016)

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[http://www.hefce.ac.uk/media/HEFCE,2014/Content/Pubs/Independentresearch/2016/University,KE,framework,Good,practice,in,technology,transfer/2016\\_ketech.pdf](http://www.hefce.ac.uk/media/HEFCE,2014/Content/Pubs/Independentresearch/2016/University,KE,framework,Good,practice,in,technology,transfer/2016_ketech.pdf) (accessed 2 September 2016)

<sup>8</sup> [http://www.hefce.ac.uk/media/HEFCE,2014/Content/Pubs/Independentresearch/2016/University,KE,framework,Good,practice,in,technology,transfer/2016\\_ketech.pdf](http://www.hefce.ac.uk/media/HEFCE,2014/Content/Pubs/Independentresearch/2016/University,KE,framework,Good,practice,in,technology,transfer/2016_ketech.pdf) (accessed 2 September 2016)

9. This heterogeneity could lead academics to misunderstand the role of the TTOs and their policies and practices, an issue which has been raised by others elsewhere.<sup>9,10</sup> To mitigate this, TTOs need to clearly communicate their governance systems, policies, priorities and capabilities to academics of all career stages. In best case scenarios, TTOs are proactive in developing relationships with academics. This improves the visibility of their services and helps TTOs understand the commercial opportunities within their research community. Our respondents report that knowledge of the role and services offered by their TTO only arises when they start to embark on commercialisation and require a particular service, e.g. patent or contract drafting or business plan development.

10. TTOs should offer flexible support to academic researchers with differing levels of experience in and knowledge of commercialisation. Experienced entrepreneurial academics often have clear expectations about how the TTO should support their work, including a desire to be given greater autonomy from university policies and practice. In contrast, academics less experienced in commercialisation do not always know what their TTO can do for them. The differences in experiences and knowledge of commercialisation among academics may contribute to the variation in perspectives from academics on the quality of TTOs.

11. Previous reviews have found that external partners, including industry and investors, often find the heterogeneity across the university sector challenging to navigate.<sup>11, 12</sup> TTOs should, wherever possible, simplify points of contact and adopt simplified and more efficient administrative practices across the sector. The proposed UK Research and Innovation will bring together the Research Councils, Innovate UK and Research England. This organisation would be well placed to take a strategic overview of technology transfer across the UK.

12. Clear, simple, harmonised and transparent IP policies and practices, which can be adapted on a case-by-case basis, are important, as highlighted by the Wellcome Trust.<sup>13</sup> Government and funders have a role, as suggested in the Dowling Review, to recommend the use of standard agreements and policies, such as the Lambert Toolkit.<sup>14</sup> However, these need to be mutually accepted by and communicated across all parties, including academics.

13. Managing expectations and improving the relationships between academics, industry and TTOs could be achieved by co-creating transparent road maps that set out the journey from idea to commercialisation. These could provide an overview of the decision making processes and criteria, individual responsibilities, timelines, funding sources and involvement of external partners.

14. Universities and TTOs have been previously criticised for valuing their IP too highly and taking too large an equity share in licensing agreements.<sup>15,16</sup> Our respondents repeated these concerns and

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<sup>9</sup> <http://www.raeng.org.uk/policy/dowling-review> (accessed 2 September 2016)

<sup>10</sup> "Keys to the Kingdom", Wong et al, *Nature Biotechnology*, **33** (2015), 232-236

<sup>11</sup> <http://www.raeng.org.uk/policy/dowling-review> (accessed 2 September 2016)

<sup>12</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/249720/bis-13-1241-encouraging-a-british-invention-revolution-andrew-witty-review-R1.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/249720/bis-13-1241-encouraging-a-british-invention-revolution-andrew-witty-review-R1.pdf) (accessed 2 September 2016)

<sup>13</sup> [https://wellcome.ac.uk/sites/default/files/wtp057817\\_1.pdf](https://wellcome.ac.uk/sites/default/files/wtp057817_1.pdf) (accessed 2 September 2016)

<sup>14</sup> <http://www.raeng.org.uk/policy/dowling-review> (accessed 2 September 2016)

<sup>15</sup> <http://www.raeng.org.uk/policy/dowling-review> (accessed 2 September 2016);

<sup>16</sup> [https://wellcome.ac.uk/sites/default/files/wtp057817\\_1.pdf](https://wellcome.ac.uk/sites/default/files/wtp057817_1.pdf) (accessed 2 September 2016)

expressed the view that TTOs can be slow and inflexible when it comes to negotiation. Examples were given to us of where this had caused academic entrepreneurs to become demotivated or potential deals with collaborators and investors lost. There remains disagreement between universities and their TTOs on one hand, and many academics, investors and industry on the other, about what are reasonable levels for IP valuation and equity stakes. At the very least, TTOs should be transparent about their decision making processes and flexible and prompt when negotiating with academics and external parties.

### **Governance and resourcing**

15. The importance of the support given to technology transfer by senior university leadership is critical, as highlighted in the recent McMillan review.<sup>17</sup> We recognise that universities prioritise research and teaching, and technology transfer is usually a small income generator. Consequently, many TTOs have only limited resources and staff have briefs stretched across many roles and departments. Limited resources also constrain TTOs' ability to communicate widely across their academic communities and can create inefficiencies in the system.

16. Some academics reported a sense that universities have strategic interest in pursuing one avenue for commercialisation over another, in particular to prioritise short-term revenue generation to make the TTO financially sustainable. This may make TTOs risk averse and is perceived to be a cause of the high equity shares and IP valuations that they expect.

17. However, the focus of technology transfer should be on the long-term benefits the commercialisation of research can bring to society and the economy. TTOs might be better judged through metrics that focus on longer-term benefits, such as turnover of products brought to market or gross value added, rather than those that focus on volume outcomes such as spin-outs formed or licence agreements signed. Some of our respondents suggest that TTOs could also consider adopting a portfolio approach, taking smaller equity stakes in more technologies to increase the likelihood of a spinout succeeding and therefore contribute longer term gains for the TTO, in terms of revenue generation.

18. For TTOs to take longer-term approaches to technology transfer, they need supportive funding and senior management should recognise that they may operate as cost centres as well as income generators to the university. External sources of funding, such as Higher Education Innovation Funding (HEIF) and Research Council Impact Accelerator Awards,<sup>18,19</sup> play an important role in supporting knowledge exchange, of which technology transfer is only one activity. There is a need, through appropriate evaluation, to identify good practice approaches to technology transfer and knowledge exchange and ensure they are supported through stable funding mechanisms.

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<sup>17</sup> [http://www.hefce.ac.uk/media/HEFCE,2014/Content/Pubs/Independentresearch/2016/University,KE,framework,Good,practice,in,technology,transfer/2016\\_ketech.pdf](http://www.hefce.ac.uk/media/HEFCE,2014/Content/Pubs/Independentresearch/2016/University,KE,framework,Good,practice,in,technology,transfer/2016_ketech.pdf) (accessed 2 September 2016)

<sup>18</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> (accessed 2 September 2016)

<sup>19</sup> <http://www.raeng.org.uk/policy/dowling-review> (accessed 2 September 2016)

19. Leadership is also important in demonstrating the value of technology transfer to academics and to foster an entrepreneurial culture within universities. The Wellcome Trust<sup>20</sup> and Dowling<sup>21</sup> review have both stated that translation and commercialisation should be recognised and rewarded in terms of academic recruitment and promotion. Success in these activities should be held in the same esteem as traditional academic outputs, and opportunities for researcher mobility between academia and industry supported. The impact element of the Research Excellence Framework<sup>22</sup> has allowed universities and academics to articulate the social and economic benefits of their research and is changing the way in which commercial activity is viewed and valued.<sup>23</sup>

## **Expertise**

20. Having commercial expertise, both within the TTO and accessible through its networks, is important in ensuring TTOs have a clear understanding of what is and isn't suitable for commercialisation. Creating strong external partnerships can also help facilitate longer term pathways to commercialisation and knowledge exchange that contribute towards long term benefits to the university, e.g. through collaborative research, as well as the society and economy.<sup>24</sup>

21. Academics at all career stages are likely to need support to develop business awareness before they can effectively engage with commercialisation activities. Training, network building and mentoring are all important aspects of developing an entrepreneur and the TTO has a responsibility to help academics find these opportunities. However, resource constraints can mean TTOs struggle to develop the sector-specific expertise in-house needed to build wider industry networks.

22. Some academics felt that the lack of expertise meant that they were not given the right advice or options by their TTO. In some instances, academics believed they were being pushed into a potentially unsuitable model of commercialisation by the TTO. Instead, they felt they were often better placed to find appropriate industry contacts but reported occasions where the advice of these experts was ignored by the TTO.

23. Where TTOs do not have the resources, and there is not the business case for a TTO to have expertise in-house, they should be able to signpost academics to other sources or consider pooling resources with TTOs that might, e.g. in regional consortia.

24. During our consultation a number of approaches that help academics and TTOs access greater expertise were described:

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<sup>20</sup> [https://wellcome.ac.uk/sites/default/files/wtp057817\\_1.pdf](https://wellcome.ac.uk/sites/default/files/wtp057817_1.pdf) (accessed 2 September 2016)

<sup>21</sup> <http://www.raeng.org.uk/policy/dowling-review> (accessed 2 September 2016)

<sup>22</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/541338/ind-16-9-ref-stern-review.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/541338/ind-16-9-ref-stern-review.pdf) (accessed 5 September 2016)

<sup>23</sup> <https://royalsociety.org/~media/policy/Publications/2016/24-03-16-royal-society-response-to-stern-review.pdf> (accessed 5 September 2016)

<sup>24</sup> <http://www.raeng.org.uk/policy/dowling-review> (accessed 2 September 2016)

- Distributed networks of knowledge exchange units attached to specific departments or research institutes at a university. We were given examples of how these can improve knowledge exchange as the units possess staff with a more intimate understanding of both the academic research and its commercial potential than is possible in a centralised TTO.
- National and regional organisations, such as the KTN, LEPs, National Academies, trade bodies or learned societies, creating expert networks that academics and TTOs can tap into.
- Seconding industry professionals into TTOs to work on specific technology transfer projects.
- Encouraging researchers to build industry networks themselves, e.g. as achieved through the iCURE programme.<sup>25</sup>
- Joined-up working within universities between departments with strong industry connections, including the business school, industry advisory boards and career, enterprise and alumni services.
- Hiring industry experts as consultants.

25. Finally, there would be value in raising awareness of the organisations involved in training and sharing of good practice amongst technology transfer and knowledge exchange professionals. We did not investigate how recognised such organisations were among our respondents but the responses we have received suggest a greater dialogue initiated between these groups would help overcome the real and perceived problems we report in this response.

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<sup>25</sup> <http://www.setsquared.co.uk/research-commercialisation/applications-cohort-7-are-open> (accessed 2 September 2016)

## Annex 1: Royal Society activities and initiatives to support translation and technology transfer

The Royal Society runs activities and initiatives to support translation and technology transfer, which aim to address some of the issues highlighted in this response.

For instance, over the past 2 years we have published a series of case studies<sup>26</sup> showcasing the how this translation of research into industry has been achieved in the UK. Each collection of stories highlights a particular perspective on translation, helping to illustrate different approaches and bring out the experiences of the scientists and businesses involved. Together, these case studies demonstrate one of the key ways in which science and research contribute to and enrich UK society.

As part of the Society's Science and Industry programme, we run a conference series entitled *Breakthrough science and technologies: Transforming our future*<sup>27</sup>. These events aim to bring industrial and academic communities together around a new or emerging technology. This forum is designed to stimulate discussion and therefore increase the possibility of collaborative activity between university and industrial partners. Past conference topics have included Machine learning<sup>28</sup>, Robotics and autonomous systems<sup>29</sup> and earth observation in agri-tech<sup>30</sup>.

The Society provides funding for early stage proof-of-concept research under the auspices of our Innovation<sup>31</sup> (for the development of a proven novel concept through to a near-market product ready for commercial exploitation) and Translation<sup>32</sup> awards (for scientists who wish to investigate the potential to commercialise an aspect of their research).

The Society's Industry Fellowships<sup>33</sup> support academic scientists who want to work on a collaborative project with industry and for scientists in industry who want to work on a collaborative project with an academic organisation. It aims to enhance knowledge transfer in science and technology between the academic and private sectors. The Society typically awards 8 Industry Fellowships each year, with a success rate for applicants of approximately 15%. As a consequence of the nature of the scheme, Industry Fellows typically use it to support and grow industrial collaborations, but some do undertake spin-out formation and leverage further investment for their research. For example, Professor Mark

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<sup>26</sup> <https://royalsociety.org/topics-policy/industry-innovation/case-studies/> (accessed 2 September 2016)

<sup>27</sup> <https://royalsociety.org/topics-policy/industry-innovation/transforming-our-future/> (accessed 5 September 2016)

<sup>28</sup> <https://royalsociety.org/science-events-and-lectures/2015/05/breakthrough-science-technologies-machine-learning/> (accessed 5 September 2016)

<sup>29</sup> <https://royalsociety.org/science-events-and-lectures/2015/11/robotics-and-autonomous-systems/> (accessed 5 September 2016)

<sup>30</sup> <https://royalsociety.org/science-events-and-lectures/2016/06/observation-and-agritech/> (accessed 5 September 2016)

<sup>31</sup> <https://royalsociety.org/grants-schemes-awards/grants/royal-society-innovation-award/> (accessed 2 September 2016)

<sup>32</sup> <https://royalsociety.org/grants-schemes-awards/grants/royal-society-translation-award/> (accessed 2 September 2016)

<sup>33</sup> <https://royalsociety.org/grants-schemes-awards/grants/industry-fellowship/> (accessed 12 September 2016)

Maslin (University College London) has used his Industry Fellowship to focus on the development of his spin-out company, Rezatec Ltd.<sup>34</sup>

As part of our course on the Innovation and Business of Science which is offered free-of-charge to all holders of a Royal Society grant or research fellowship<sup>35</sup>, we provide researchers with a solid grounding in the commercial aspects of research, including understanding IP, technology transfer, working with industry and the wider innovation policy landscape. Since its inception in 2006, nearly 400 individual researchers have taken one or more of the modules (N.B. the Society gives out 200 grants or research fellowships each year), and feedback suggests that it has a profound effect on how those taking the course think about the commercial aspects of their research.

## **Annex 2: Developments in Technology Transfer**

In the past decade there have been moves to increase the professional standing of technology transfer through the establishment of a number of organisations and professional standing of technology transfer and knowledge exchange professionals.

- PraxisUnico<sup>36</sup> which was formed in 2009 from the merger of Praxis, a training company for technology transfer professionals, and Unico, representing the interests of university companies, promotes best practice and development of knowledge exchange and technology transfer professionals. PraxisUnico has 173 member institutions and communicated with over 5000 individuals through their monthly news updates.
- AURIL is a professional association of practitioners involved in knowledge creation, development and exchange in the UK and Ireland.
- The Association of Research Managers and Administrators (ARMA)<sup>37</sup>, the UK's professional association facilitating excellence in research by identifying and establishing best practice in research management and administration.
- Globally, the Alliance of Technology Transfer Professionals (ATTP)<sup>38</sup>, was established to provide a global standard of professional achievement in technology transfer, the Registered Technology Transfer Professional (RTTP) status, and of which PraxisUnico was a founding member.

Technology transfer activities have also become more of a strategic priority to Universities. The term TTO is rarely seen in the organisational structure of universities, with this function commonly sitting in a 'Research and Enterprise' office, responsible for functions that include knowledge exchange, technology transfer and processing research grants. Although some Universities have "spun-out" their TTO, e.g. Imperial Innovations or Oxford University Innovations, others incorporate it into teams with student, as well as academic-facing operations, such as student enterprise or career offices. It should be noted, however, that through our consultation, the term "technology transfer" and abbreviation 'TTO' were understood by all respondents and we use these terms throughout our response.

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<sup>34</sup> <https://royalsociety.org/people/mark-maslin-7610/> (accessed 12 September 2016)

<sup>35</sup> <https://royalsociety.org/grants-schemes-awards/innovation-course/> (accessed 2 September 2016)

<sup>36</sup> <https://www.praxisunico.org.uk/> (accessed 2 September 2016)

<sup>37</sup> <https://www.arma.ac.uk/> (accessed 2 September 2016)

<sup>38</sup> <http://attp.info/> (accessed 2 September 2016)