THE ROYAL SOCIETY

5 February 2018

Submission to the House of Commons Science and Technology Select Committee Brexit science and innovation summit

Key points

- **UK research is not just made in the UK. The UK government must recognise, support and value the international nature of the workforce and the importance of international collaboration through both its words and actions or it risks eroding the strength of UK research.**
- **Parts of the UK research ecosystem are currently highly dependent on our existing relationship with the EU. These dependencies should inform the UK's priorities domestically and in the negotiations, and the UK government should take steps to mitigate impacts as the UK leaves the EU.**
- **Science is global and if we are to deliver the government's vision for the UK to be a global leader of the industries of the future, the UK must be even more global. There is not a binary choice between collaborating with the EU and the rest of the world. The EU can be a partner in engaging with the rest of the world.**
- **The UK government must seek the best outcome for UK research and innovation and can take steps now to deliver this.**
    - **Proactively engage in shaping Framework Programme 9 and future development of the European Research Area to send a clear message that we intend to be an ongoing partner in the shared European research endeavour.**
    - **Streamline the UK's current immigration system to demonstrate that the UK is open to international research and innovation talent. The forthcoming White Paper on immigration is an opportunity to send a clear statement of intent that the UK will continue to welcome skilled researchers from around the world in future.**
    - **Put in place mechanisms that will ensure that the impact of any Regulations made as the UK departs from the EU are thoroughly scrutinised, supported by a transparent and thorough assessment of the possible effects on research.**

Introduction

1. The Royal Society welcomes the opportunity to submit evidence to the Committee's Brexit science and innovation summit and would be pleased to have the opportunity to take part in the summit on 22 February. The Society is the National Academy of Science for the UK and the Commonwealth. It is a self-governing Fellowship of many of the world's most distinguished scientists working across a broad range of disciplines in academia and industry. The Society draws on the expertise of its Fellows and Foreign Members to provide independent and authoritative scientific advice to UK, European and international decision makers.

2. The Committee highlights in its call for evidence that it will complement and build on a number of initiatives. The Society has submitted evidence to the Committee's previous inquiries into this issue, contributed to the Parliamentary & Scientific Committee's *Science Priorities for Brexit* report and has worked jointly with the Wellcome Trust on a *Future Partnership Project.* This included convening UK and EU science leaders to discuss a shared vision for an

ambitious, close and achievable future agreement on research and innovation. We are publishing two documents produced to inform this discussion alongside this submission: (1) a synthesis of evidence on the UK-EU relationship; and (2) the findings of a wider consultation on the future EU-UK relationship on research and innovation.[1] We would be happy to provide further insights from the *Future Partnership Project* at the summit.

3. **UK research is not just made in the UK**
The UK is a world leader in research and innovation, with a highly diverse, broad and efficient research ecosystem. With less than 1% of the world's population and 2.7% of global R&D expenditure, we produce 15.2% of the world's most highly cited research papers.[2] However, while we should rightfully be very proud of the UK's significant scientific achievements, it is important to recognise that scientific research is an international endeavour.

4. The UK research workforce is truly international, and increasingly so. It is difficult to gather clear and comprehensive data on the mobility of researchers working in industry, whereas data on higher education institutions is readily available. 29% of academic staff in UK universities are non-UK nationals, with 17% coming from other EU countries and 12% from the rest of the world[3]. Trends from 2006/7 to 2015/16 show an increasingly international picture, with the proportion of academic staff from other EU countries and from the rest of the world both increasing. The number of academic staff from other EU countries in UK higher education institutions (HEIs) increased by 94% over this period[4].

5. The international nature of the UK workforce demonstrates that we are able to draw on talent from around the world, which contributes to the strength of the UK's research and innovation base. This strong research base means that we are well-placed to capitalise on this to increase the opportunities for every UK citizen to be part of and benefit from the world-class research base on their doorstep. Many Nobel prize winners and leading entrepreneurs have chosen to come and work in the UK. Five of the fifteen most recent UK Nobel Laureates were born overseas. However it is important to recognise that the UK research workforce includes not just leaders in their fields, but also the specialist technicians that support them and without whom much of this work would not be possible.

6. RAND Europe conducted a roundtable to gather perspectives of industry on international mobility. They found that the limited data that are available indicate that there is a sizeable minority of research staff in the UK who have overseas nationality, and that those companies and sectors that they consulted see themselves as operating in an international business environment and see themselves as benefitting significantly from the ability to recruit highly skilled staff from other countries. This report also highlights that many companies recruit staff from UK universities, which themselves have a highly international workforce, and access to this talent may influence decisions over where to locate.[5]

7. When we research, we build on the body of knowledge that has been accumulated through the work of people around the world. We often work with others, sharing ideas and collaborating with people both in the UK and further afield. In 2015 over half of the UK's

[1] Available online here: https://royalsociety.org/topics-policy/projects/future-partnership-project/

[2] Elsevier (2017) *International comparative performance of the UK research base - 2016*

[3] Higher Education Statistics Agency (see https://www. hesa.ac.uk/stats-staff, accessed 04 September 2017)

[4] Higher Education Statistics Agency (accessed 26 October 2017 via Heidi Plus: https://heidiplus.hesa.ac.uk) Further details available in the Royal Society submission to the Migration Advisory Committee Call for Evidence on EEA workers in the UK labour market, para 8 https://royalsociety.org/~/media/policy/Publications/2017/10-26-17-submission-MAC-call-for-evidence-EEA-workers-in-UK-labour-market.pdf

[5] RAND Europe (2017) *International mobility of researchers: Supplementary report: Perspectives from industry* https://royalsociety.org/topics-policy/projects/international-researcher-mobility/international-mobility-researchers-industry/

research output was the result of an international collaboration and these collaborations are increasing – both in absolute terms and as a proportion of the UK's research output.[6]

8. Given the international nature of UK researchers themselves, and the people that they work with, it is crucial that researchers are able to move to and from the UK in support of their work. In a survey of national Academy Fellows and grant holders, 91% reported that mobility was very important to their careers.[7]

9. Movement to the UK contributes to the health of UK research and innovation. We benefit from many researchers in receipt of EU funding choosing to come and work in the UK. For example, between 2007 and 2013, the UK hosted 5736 researchers from other EU countries, funded through Marie Skłodowska-Curie Actions. In the UK 65% of recipients of ERC Starter Grants are foreign nationals, compared with 31% in France and 36% in Germany.[8] Many researchers choose to make long-term moves to the UK. A recent survey of the population of over 600 Italian academics in the UK—the second largest national group—found that 56% were senior researchers or lecturers and 29% were Professors and 48% of respondents had been in the UK for over ten years.[9]

10. When UK-based researchers choose to work elsewhere, this also brings benefits for the UK. 72% of active UK-based researchers have trained or worked as researchers abroad.[10] UK-born researchers benefit from being able to work abroad themselves to develop their expertise and networks and often choose to bring these back to the UK. This contributes to the strength of the UK's research base.

11. These data illustrate that the research community can be highly mobile. Choosing where to live and work is a personal decision as well as a professional choice. An OECD study using authors' institutional affiliations to track mobility found that scientists are more likely to move between countries which are geographically closer, socioeconomically similar and have comparable scientific cultures[11]. The study found that scientific collaboration appears to be a major factor associated with the mobility of scientists, but common language and distance between countries have a stronger impact on mobility. Scientists are more likely to move between countries who place similar importance and funding on R&D. This illustrates that perceptions about a country may play an important role in influencing people's choices over where to locate, highlighting the importance of publicly recognising, supporting and valuing the international nature of the UK's research workforce through both words and actions, especially while considerable uncertainty remains.

12. **Parts of the UK research ecosystem are currently highly dependent on our existing relationship with the EU**
The UK's relationship with the EU is complex and the EU's influence varies across different

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[6] The Royal Society (2016) UK research and the European Union: The role of the EU in international research collaboration and researcher mobility (see: https://royalsociety.org/topics-policy/projects/uk-research-and-european-union/role-of-euresearcher-collaboration-and-mobility/)

[7] Opinion Leader (2017) The role of international collaboration and mobility in research (see: https://royalsociety.org/topicspolicy/projects/international-researcher-mobility/role-of-international-collaboration-mobility-in-research/)

[8] The Royal Society (2016) UK research and the European Union: The role of the EU in international research collaboration and researcher mobility (see: https://royal

[9] Embassy of Italy in the United Kingdom (2017) The Impact of Brexit on the Italian Academic Community in the United Kingdom (accessed 4 September 2017, see: http://www.amblondra.esteri.it/Ambasciata_Londra/resource/doc/2017/06/the_impact_of_brexit_on_the_italian_scientific_community_in_the_united_kingdom_final.pdf

[10] RAND Europe (2017) International mobility of researchers: a review of the literature (see: https://royalsociety.org/topicspolicy/projects/international-researcher-mobility/international-mobility-researchers-review-literature/)

[11] Appelt S et al. (2015). Which factors influence the international mobility of research scientists? OECD Science Technology and Industry Working Papers http://dx.doi.org/10.1787/5js1tmrr2233-en

parts of the UK's research ecosystem. This includes variances in the distribution of EU research and innovation funding regionally and by discipline, and in the proportion of staff within different parts of the UK's research ecosystem who are from outside the UK.

13. Funding from the EU that supports research and innovation is not distributed consistently across the UK. England takes the largest share of funding, receiving 85% of Horizon 2020 (85%) and 55% of the European Structural and Investment Fund (ESIF). Scotland however receives the most per head from Horizon 2020 (€55 vs UK average of €44). For ESIF, which are mostly directed towards SMEs, Wales and Northern Ireland receive the most funding per person – at €125 and €60 respectively. This compares to €23 for the UK as a whole.[12]

14. Academic disciplines also have different dependencies on EU funding. Looking at 2014/15 data, while all academic disciplines received some funding from EU government bodies, archaeology is most dependent on the EU, receiving 38% of its funding from EU government bodies. This was closely followed by Classics (33%) and IT (30%). However if you look at absolute numbers, clinical medicine would see the largest shortfall in funding, receiving £120 million in 2014/15. This is followed by biosciences (£91 million), Physics (£55 million), chemistry (£55 million and IT (£46 million).[13]

15. We have already discussed the international nature of the UK's research workforce, highlighting that 17% of academic staff in UK universities come from other EU countries. UK research also takes place in research infrastructures - facilities, resources and services used by the research community to conduct research and promote innovation. A recent survey of 135 UK research infrastructures found that they may have a greater dependency on non-UK EU nationals, with a total of 32% of staff at UK research infrastructures coming from overseas, 23% of whom are from other EU/EEA countries.[14] This is a snapshot, there are approximately 400 research infrastructures in the UK in total.

16. Any change to the UK's relationship with the EU may have a greater impact on areas with greater dependency. These dependencies should inform the UK's priorities domestically and in the negotiations, and the UK government should take steps to mitigate impacts as the UK leaves the EU.

17. **The EU can be a partner in engaging with the rest of the world.**
The EU has an internationalist vision for research. Commissioner Moedas set this out in 2015, "We need to be Open to the World! Europe is a global leader in science, and this should translate into a leading voice in global debates. To remain relevant and competitive, we need to engage more in science diplomacy and global scientific collaboration. It is not sufficient to only support collaborative projects; we need to enable partnerships between regions and countries."[15] and this continues to be articulated by the recent report by Pascal Lamy[16] which calls for international research and innovation to become a trademark of EU research and innovation by opening up the R&I programme to association by the best and participation by all.

18. A number of mechanisms exist to enable scientific institutions and researchers in non-EU countries to participate in, and receive funding from, EU Framework Programmes. These

[12] Technopolis (2017) The role of EU funding in UK research and innovation – an analysis commissioned by the UK's National Academies – The Royal Society, British Academy, Academy of Medical Sciences and Royal Academy of Engineering. https://royalsociety.org/~/media/policy/Publications/2017/2017-05-technopolis-role-of-EU-funding-report.PDF

[13] Technopolis (2017) The role of EU funding in UK research and innovation – an analysis commissioned by the UK's National Academies – The Royal Society, British Academy, Academy of Medical Sciences and Royal Academy of Engineering. https://royalsociety.org/~/media/policy/Publications/2017/2017-05-technopolis-role-of-EU-funding-report.PDF

[14] Royal Society (2018) *A snapshot of UK research infrastructures* https://royalsociety.org/~/media/policy/Publications/2018/snapshot-uk-research-infrastructures.pdf

[15] Commissioner Carlos Moedas (22 June 2015) *A new start for Europe: Opening to an ERA of Innovation*

[16] European Commission (2017) *LAB-FAB-APP Investing in the European future we want*

include association to the framework programmes, but also scientific and technological cooperation. The EU has 20 international agreements on science and technology.[17]

19. While the UK can collaborate with partners around the world independently of the EU – UK-based researchers most frequently partners with scientists from the US[18] – there is also value in joining forces where ambitions align, especially where there are strong foundations to build upon. In over 20 years of participation in EU research programmes, UK researchers have built strong networks of collaborators across the European Research Area. Seven EU countries are among the UK's top ten strongest collaborators and 60% of the UK's internationally co-authored papers are with EU partners.[19]

20. There is some evidence that collaboration with EU partners and with EU funding have a great impact. Analysis suggests that papers resulting from UK-EU collaborations have greater impact than UK-only papers. Looking at funding sources for UK-only and UK-EU collaborative papers showed that those in receipt of funding from the EU have greater impact than the average paper and those with funding from the European Research Council in particular, papers have the highest impact of all. This may reflect the excellence of applications to and research funded by the ERC.[20]

21. This relationship is valuable to both the UK and its EU partners. The Society has recently published a statement together with the Leopoldina and Académie des Sciences reaffirming the importance of the unity of scientific research in Europe, and the shared willingness for scientists in the UK, France and Germany and across Europe to continue to collaborate in future.[21] Pascal Lamy's report also recognises the value of the UK's science base to the shared research endeavour and states that "Whatever Brexit modalities are agreed between the UK and the EU by 2019, full and continued engagement with the UK within the post-2020 EU R&I programme remains an obvious win-win for the UK and the EU." It also highlights the opportunities presented by ongoing UK membership of the European Research Area.[22] Many global challenges that can be informed by science do not conform to national boundaries and there is ongoing value in working together to address these.

22. The UK government must seek the best outcome for UK research and innovation and can take steps now to deliver this.
While much of the UK's future scientific relationship with the EU will be influenced by the broader negotiation settlement, there are actions that the UK can take now to mitigate the impact of ongoing uncertainty and lay the foundations for the future.

23. Agreement reached in December[23] that, in principle, the UK will continue to pay net contributions until the end of the current EU budget plan in 2020 and therefore will continue to participate in Horizon 2020 to its end is extremely helpful. This will ensure that UK researchers can confidently bid for funding, participate in and lead consortia throughout the rest of this programme and that their potential collaborators can be confident working with

[17] EU Commission, Countries with EU international agreements on science and technology http://ec.europa.eu/research/iscp/pdf/policy/st_agreement_ec_euratom.pdf#view=fit&pagemode=none
[18] Royal Society (2016) *UK research and the European Union The role of the EU in international research collaboration and researcher mobility*
[19] Royal Society (2016) *UK research and the European Union The role of the EU in international research collaboration and researcher mobility*
[20] Royal Society (2016) *UK research and the European Union The role of the EU in international research collaboration and researcher mobility* page 20/21
[21] Royal Society, Académie des Sciences, Leopoldina (2018) *Consolidation of science and research collaborations between the United Kingdom and the other European countries. See also the Science is Global joint statement which was signed by over twenty national academies across Europe in July 2016."*
https://royalsociety.org/topics-policy/publications/2016/european-academies-statement-science-is-global/
[22] European Commission (2017) *LAB-FAB-APP Investing in the European future we want*
[23] Negotiators of the European Union and the United Kingdom Government (2017) *Joint report from the negotiators of the European Union and the United Kingdom Government on progress during phase 1 of negotiations under Article 50 TEU on the United Kingdom's orderly withdrawal from the European Union.* https://ec.europa.eu/commission/sites/beta-political/files/joint_report.pdf

them. This must be communicated to UK and international researchers effectively and the Society is taking opportunities to support this.

24. Work is already underway to shape the next Framework Programme. This includes plans to establish a new European Innovation Council. The UK government has already indicated its wish to continue to collaborate with European partners on major science, research and technology initiatives and that there may be some specific European programmes in which the UK may want to participate[24]. Proactive engagement by the UK with these developing programmes now will both ensure that they align with our objectives and send a clear message that we intend to be an ongoing partner in the shared European research endeavour.

25. The European Research Area is an EU initiative to create a unified area open to the world, in which scientific knowledge, technology and researchers circulate freely and may provide another avenue by which to build ongoing partnerships.

26. The UK's decision to leave the EU and domestic public debate over the role of immigration within the UK makes it more important than ever that we demonstrate our ongoing commitment to the UK's world-class, international research base. UK Research and Innovation offers one route to address this. It has set out to ensure that the UK maintains its world leading position in research and innovation. Increasing its international visibility can send a clear message that the UK is committed, whatever our future relationship with the EU, to creating the best environment for research and innovation to flourish. The new International Research and Innovation Strategy[25] due to be published early this year in partnership with BEIS offers an opportunity to articulate this global vision, drawing on the strength of the existing global Science and Innovation Network[26] to communicate this.

27. Action to improve the experience of navigating the UK's immigration system for those seeking to work in the UK from outside the EU can also reinforce this message. Recent steps to introduce a 'Research and Innovation Talent Visa' through the Tier 1 (Exceptional Talent) visa route with new accelerated processes and guidance and reduce the time before visa holders are eligible for residency, while also doubling the number of Tier 1 visas available is very welcome. Further reform of the system will continue to send a strong message internationally that the UK is open to research and innovation talent. In the short term, removing international students from the immigration figures would send a strong signal to one important group internationally.

28. Rapidly developing an immigration system that facilitates the movement of EEA researchers when the UK leaves the EU will be a valuable investment into the UK's research base. The early development and communication of a new system would eliminate the uncertainty among EEA researchers over whether they can continue to choose to work and collaborate with the UK. The government's intention to lay out its views in a forthcoming immigration White Paper and its commissioning of the Migration Advisory Committee to gather evidence to inform its views is helpful.[27] The White Paper does present an opportunity to send a clear statement of intent that the UK will continue to welcome skilled researchers from around the

[24] Theresa May (2017) *The government's negotiating objectives for exiting the EU* – relevant excerpts from speech:
"There may be some specific European programmes in which we might want to participate"
"So we will also welcome agreement to continue to collaborate with our European partners on major science, research, and technology initiatives."

[25] Announced in the Industrial Strategy alongside plans for a £110m fund for International Collaborations to enhance the UK's excellence in research and innovation through global engagement

[26] https://www.gov.uk/world/organisations/uk-science-and-innovation-network

[27] The Society has submitted evidence to the Migration Advisory Committee calls for evidence: Submission to the Migration Advisory Committee's Call for Evidence on EEA workers in the UK labour market,
Submission to the Migration Advisory Committee's Call for Evidence on International students: economic and social impacts

world in future. Early clarity over the rights that will apply to EEA nationals during the transition period will also be helpful.

29. Departure from the EU raises the possibility of divergence from EU regulation. In the long-term, it is critical that we identify areas of regulation where continued alignment with EU rules is most important for the UK to collaborate and trade, while also recognising the opportunities to develop new regulatory approaches. In the short term, mechanisms should be put in place to ensure that the impact of any Regulations made as the UK departs from the EU are thoroughly scrutinised, supported by a transparent and thorough assessment of the possible effects on research.

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Annex: Summary of announcements to date

Research funding

In August 2016, the **UK government committed to underwrite funding for approved Horizon 2020 projects** applied for before the UK leaves the European Union, even when specific projects continue beyond the UK's departure from the EU

The government's **future partnership paper on Collaboration on science and innovation** outlines the UK's ambition to:

> "agree a far-reaching science and innovation agreement with the EU that establishes a framework for future collaboration. There are a range of existing precedents for collaboration that the UK and the EU can build on, but our uniquely close relationship means there may be merit in designing a more ambitious agreement.
>
> The UK hopes to have a full and open discussion with the EU about all of these options as part of the negotiations on our future partnership. The UK would welcome dialogue with the EU on the shape of a future science and innovation agreement, reflecting our joint interest in promoting continued close cooperation, for the benefit of UK and European prosperity."

The Prime Minister's speech in Florence in September 2017 referenced research funding:

> "And as we move forwards, we will also want to continue working together in ways that promote the long-term economic development of our continent.
>
> This includes continuing to take part in those specific policies and programmes which are greatly to the UK and the EU's joint advantage, such as those that promote science, education and culture – and those that promote our mutual security."

On 15 December 2017, the European Council approved the Joint Report between EU and UK negotiations. The report includes a commitment that UK entities will be eligible to bid, participate and lead consortia in all aspects of the Horizon 2020 programme in exactly the same way that they do now.

Mobility and collaboration

The government has outlined a three phase process. The first phase was the setting out of an offer to EU residents currently in the UK in June. The second phase will be an implementation period with a third phase confirming the long-term arrangements covering the migration of EU citizens.

The government has commissioned the Migration Advisory Committee to undertake two pieces of work, both reporting in September 2018:

- Examine the role EU nationals play in the UK economy and society
- Examine the impact of international students in the UK

The government's **future partnership paper on Collaboration on science and innovation** provides a number of references to the value of mobility of bilateral and multilateral collaborations and states that:

> "the UK will discuss with the EU future arrangements to facilitate the mobility of researchers engaged in cross-border collaborations."

It goes on to highlight the role of the European Research Area:

> "The EU has introduced measures designed to facilitate the movement of researchers - including those from third countries - across the EU. In addition to funding exchanges, the EU facilitates mobility for researchers in the UK and across Europe through the European

> Research Area (ERA) which aims to address barriers to mobility and make Europe a more attractive research destination, acting as an open labour market for researchers. The UK would welcome discussion as to how this might apply in future."

A White Paper on immigration is expected later this year, as is an Immigration Bill.

Regulation

The government's **future partnership paper on Collaboration on science and innovation states:**

> "The UK and the EU start from a position of close regulatory alignment, trust in one another's institutions, and a spirit of cooperation stretching back decades. The agreement on science and innovation should provide a framework for future cooperation, with channels for regular dialogue between leading researchers and innovators in the UK and the EU."

The European Union (withdrawal) Bill includes provisions to move EU law into domestic UK law upon Brexit and enable changes to these by Regulation for the next two years. The provisions in this Bill are currently the subject of scrutiny by both Houses.

Future association with the Framework Programmes may require some regulatory alignment. For example EU policy governing animal research is a condition of all countries that wish to access Horizon 2020 funding, whether or not they are EU Member States.