FUTURE PARTNERSHIP PROJECT

# Evidence synthesis on the EU-UK relationship on research and innovation

January 2018

wellcome

THE ROYAL SOCIETY

# 1. Introduction

The Royal Society and the Wellcome Trust have undertaken a rapid evidence synthesis on the EU-UK research and innovation relationship as part of their Future Partnership Project. Organisations and individuals were invited to submit evidence and analyses for inclusion. Evidence was also gathered through internet searches to ensure an inclusive approach. The Annex is a summary of the methods.

Two questions were used in gathering evidence and in determining the material in scope:

1. What incentives, infrastructure and mechanisms can be accessed by research and innovation organisations, funders and individuals in Member States to support collaborations?
2. How do Member States currently use and benefit from these and how might they be affected by Brexit?

This paper is a synthesis of the evidence and covers funding, infrastructures, mobility, collaboration and regulation, with a focus on links between the EU and the UK.

# 2. Overview of the evidence base

A few major reports were of particular relevance; the Royal Society's three reports on the role of the EU in UK research and innovation and two reports commissioned from Technopolis Group by UK organisations, on the role of EU funding in UK research and innovation and the impact of collaboration: the value of UK medical research to EU science and health[1,2]. These documents were often referenced in other submissions. A report from the Lords Science and Technology Committee's inquiry on EU Membership and UK Science also summarises many sources of evidence relevant to this synthesis.

The evidence base included little primary research. The majority of the evidence on potential impacts of EU exit was qualitative and often relied on small-scale surveys. The life and medical sciences were relatively strongly represented in the evidence and the arts and humanities less so. Most submissions took the perspective of the UK research system, but some also considered UK influence on EU research. Others used approaches such as scenarios analysis[3]. A small number of submissions explored issues through the lens of the devolved nations Scotland and Wales; none did so for Northern Ireland.

The content of this paper is drawn from these submissions and does not represent the views of either the Royal Society or the Wellcome Trust.

[1] Commissioned by the British Academy, Royal Academy of Engineering and The Royal Society.
[2] Commissioned by Academy of Medical Sciences (AMS), Arthritis Research UK, Association of Medical Research Charities (AMRC), British Heart Foundation (BHF), Cancer Research UK (CRUK), Medical Research Council (MRC), MQ: Transforming Mental Health and Wellcome.
[3] Fahy et at. (2017) How will Brexit affect health and health services in the UK? Evaluating three possible scenarios. The Lancet.

# 3. Key themes

### 3.1 People

The evidence base covered the international nature of research, researcher mobility and collaboration and the internationalisation of higher education. Researchers, students and other relevant workers travel between the UK, the EU and the rest of the world on a short or long-term basis to work, study and visit. Mobility is often an important part of collaborations. Freedom of movement has made this mobility easy across the European Economic Area, compared with the immigration rules and regulations around the world.

In 2015, there were 1.8 million full-time equivalent researchers in the EU-28, up from one million in 1995, with 48% in business enterprise, 39% in higher education and 12% in government[4]. 6% of EU researchers—70,000 people—are from outside the EU[5].

In 2015/16, 29% of academic staff in UK universities were non-UK nationals, with 17% from other EU countries[6]. Half of PhD students in the UK are from overseas, with 14% from other EU countries and 36% are from outside the EU. In 2015/16, 6% of enrolments in UK higher education were from the EU and 14% were from the rest of the world[7]. Scotland has the highest overall proportion of international students relative to its total student population (22%) and the highest proportion of EU-domiciled students (9%)[8]. The international nature of the research workforce varies in other European countries; at ETH Zürich in Switzerland, only 32% of professors and 36% of scientific staff are Swiss citizens[9].

More than 42,000 UK tertiary-level students are studying abroad, amongst which more than 35% were in an EU country. Through Erasmus+ programmes, the UK receives approximately 30,000 students from other EU countries and sends approximately 15,000 students to other EU countries.

In industry, the UK is often the location of choice for the European headquarters of global pharmaceutical companies, with over a dozen based in the UK including Eli Lilly, Gilead, Astellas, Takeda, Eisai and Otsuka. This is thought to foster a deep talent base across the value chain in areas including research, development, regulatory, manufacturing and commercial skills.[10]

Limited evidence was provided on whether researchers are choosing not to come to, or leaving, the UK in the context of Brexit. Evidence was anecdotal or institution specific and so cannot be considered representative. However, for example, University College London (UCL) provided figures showing that postgraduate research applications from the EU had decreased by 19% from 2016-17 to 2017-18 and the number EU postgraduate researchers enrolled at UCL decreased by 6%. The proportion of EU applications for academic posts decreased from 25% to around 20% since the referendum.

---

[4] RAND Europe (2017) International mobility of researchers: a review of the literature.
[5] RAND Europe (2017) International mobility of researchers: a review of the literature.
[6] Higher Education Statistics Agency (2017) Staff in Higher Education 2015/16.
[7] Euroscience, The Royal Institution and Academia Europaea (2017) Brexit: The Facts behind Opportunities & Challenges for both the UK & European Science Establishments.
[8] Royal Society of Edinburgh (2017) Brexit Challenge and Opportunities: migration, diversity, rights and social protection.
[9] Euroscience, The Royal Institution and Academia Europaea (2017) Brexit: The Facts behind Opportunities & Challenges for both the UK & European Science Establishments.
[10] UK EU Life Sciences Steering Committee (2016) Maintaining and growing the UK's world-leading life sciences sector in the context of leaving the EU

*Further reading*

- RAND Europe (2017) International mobility of researchers: a review of the literature. An overview of evidence on patterns of, drivers of, and barriers to mobility, as well as the benefits and consequences for research-intensive sectors. Includes a review of data from Eurostat, Organisation for Economic Cooperation and Development, the UK Office for National Statistics, and the UK Higher Education Statistics Authority;
- The Royal Society (2016) UK research and the EU: the role of the EU in international research collaboration and researcher mobility. Outlines the role of international mobility in UK research and the contribution of the EU to this;
- Technopolis (2017) The impact of collaboration: The value of UK medical research to EU science and health. Data showing that global mobility is a key feature of the UK medical research community.

### 3.2 Funding

The EU provides funding for research, development and innovation through several interlinked programmes, including Framework Programmes (FPs) and EU Structural and Investment Funds (ESIF). It is estimated that these will provide €120 billion over the period 2014–2020[11]. Further indirect support comes from other specific programmes, including Competitiveness for Enterprises and Small and Medium Size Enterprises (SMEs), Erasmus+, Health programme, Life programme, Connecting Europe Facility and the European Fund for Strategic Investment, as well as the European Investment Bank (EIB).

FPs are the main EU funding mechanism for research, development and innovation. The current Programme, Horizon 2020, has a budget of €74.8 billion for the period 2014–2020. The UK has a strong track record in successfully attracting FP funding, particularly that allocated for excellence. The UK was the second largest recipient in absolute terms after Germany in Framework Programme 7 (FP7) (2007-2013)[12]. Some evidence looked specifically at health-related projects and found that combined FPs included a total of 2,300 UK participations in over 1,000 projects with a value of €1.2 billion. Between 2007 and March 2017, the UK delivered health-related research worth €4.8 million per 1,000 researchers, a performance ratio higher than Germany or France, but below the Netherlands[13].

Universities secured 71% of the total funds awarded to the UK during FP7 and UK businesses attracted 18%[14]. In UK Higher Education Institutes (HEIs), the top ten UK recipient institutions accounted for 47% of the total funding received from EU government bodies in 2014/15[15]. EU funding was received in every one of 40 disciplinary categories. The top three recipient disciplines in absolute terms were Clinical Medicine (£119 million), Biosciences (£91 million) and Physics (£55 million). In relative terms, compared with research grant income from all sources, they were Archaeology (38%), Classics (33%) and IT systems sciences & computer software engineering (30%)[16].

The UK receives relatively little ESIF funding, which is largely targeted at building capacity in the least economically developed regions of the EU.[17] Some UK HEIs, for example Russell Group universities, use this funding to work with Local Enterprise Partnerships, businesses and other local partners on a range of projects.[18] When FPs and structural funds are taken into account, Poland is the second largest recipient of EU research, development and innovation funds and the UK is fourth.

The UK venture capital ecosystem, which is critical to commercialising and growing SMEs, provided £630 million in 2015 to SMEs in the life sciences. Investors are heavily reliant on EIB and European Investment Fund (EIF) funding, which often makes up 25-40% of funds and catalyse further private investment[19]. EU

---

[11] The Royal Society (2016) UK research and the EU: the role of the EU in funding UK research.
[12] The Royal Society (2016) UK research and the EU: the role of the EU in funding UK research.
[13] Technopolis Group (2017) The impact of collaboration: the value of UK medical research to EU science and health.
[14] The Royal Society (2016) UK research and the EU: the role of the EU in funding UK research.
[15] Technopolis Group (2017) The role of EU funding in UK research and innovation.
[16] Technopolis Group (2017) The role of EU funding in UK research and innovation.
[17] The Royal Society (2016) UK research and the EU: the role of the EU in funding UK research.
[18] Russell Group (2016) Russell Group response to House of Commons Science and Technology Committee inquiry Leaving the EU: implications and opportunities for science and research.
[19] UK EU Life Sciences Transition Programme Report (2016) Maintaining and growing the UK's world leading Life Sciences sector in the context of leaving the EU.

funding for SMEs can stimulate public-private partnerships. Some evidence suggested detrimental impacts of Brexit on equity investment affecting scale ups and SMEs[20].

A small number of studies looked at potential impacts on individuals. For example, a survey for 255 British Heart Foundation researchers and a set of case studies from Cancer Research UK[21,22]. These demonstrate the benefits to individuals of EU funding, particularly in terms of career development.

Many sources noted that a drop in EU funding for UK research and innovation would have financial impacts, but also affect research infrastructures, mobility and collaboration, as discussed below.

*Further reading*

- The Royal Society (2016) UK research and the European Union: The role of the EU in funding UK research. A breakdown of EU funding received by the UK, including international and regional comparisons. Eurostat and Office for National Statistics data;
- Technopolis Group (2017) The role of EU funding in UK research and innovation. A breakdown of EU funding across academic disciplines, institutions, industrial sectors, company sizes and regions of the UK, as well as of how it interacts with other sources and a set of 11 case studies. Secondary data sources, primary research and interviews;
- Technopolis Group (2017) The impact of collaboration: the value of UK medical research to EU science and health. Focused on the medical sciences, including analyses and case studies on funding mechanisms and showing how EU research funding received by the UK benefits the whole of the EU;
- Universities UK (2017) International Higher Education in facts and figures. A snapshot of UK higher education and the internationalisation of the sector;
- Schuman Associates (2016) The impact of the EU Referendum on the UK's ability to access EU funds. Analysis of funding programmes and existing models of cooperation;
- Comprehensive reports were prepared on particular sectors. For example, Maintaining and growing the UK's world-leading life sciences sector in the context of leaving the EU;
- European Commission (2017) Interim Evaluation of Horizon 2020. Overview of funding awarded through this programme to date, including impacts and comparisons across countries, as well as progress towards Programme objectives.

[20] Royal Academy of Engineering (2017) Engineering a future outside the EU securing the best outcome for the UK.
[21] British Heart Foundation (2017) Submission to the Future Partnership Project.
[22] Cancer Research UK (2017) Submission to the Future Partnership Project.

### 3.3 Infrastructures

Research infrastructures are facilities, resources and services used by the research community to conduct research and promote innovation. They come in an array of forms and sizes, from large facilities and specialist equipment to e-infrastructure networks, libraries and collections. They might be physical or virtual, situated in a single location or distributed across multiple sites at home and abroad[23].

The collaborative benefits from shared research infrastructures were emphasised in submissions. They deliver cost efficiencies, enable collaborative opportunities and provide access to a wider range of facilities than would be possible nationally. The UK gains from being involved in pan-European research infrastructures, both as a host country and as a user of facilities hosted outside of the UK[24]. The UK hosts the headquarters of six pan-European research facilities[25].

Many pan-European research facilities are not EU initiatives, but may receive EU support. Researchers from participating countries can use them and researchers from other countries may do so under certain conditions. These arrangements vary by infrastructure. From 2007 to 2013, the EU supported 3,539 UK-based researchers to access over 1,055 European facilities and assisted international researchers in accessing 107 UK national research facilities.[26] UK participants have been granted €86 million for infrastructure projects in Horizon 2020 in addition to the €272 million granted during FP7.[27]

Research infrastructures that are independent of the EU still operate in a pan-European way. For example, the Diamond Light Source, the UK's national synchrotron science facility is a founding member of the League of European Accelerator-based Photon Sources, a collaboration of European synchrotron and free electron lasers facilities, which coordinates initiatives and bids together for substantial funding.[28]

The EU has established the European Strategic Forum on Research Infrastructures to support coherent and strategic decisions on research infrastructure planning and implementation across Europe. The EU has also established European Research Infrastructure Consortium status to make it easier to establish and operate large research infrastructure across Member States and Associated Countries, removing the need for the repetition of contractual negotiations between countries[29].

*Further reading*

- The Royal Society (2016) UK research and the EU: the role of the EU in funding UK research. A short overview of how the EU funds research facilities and major equipment and supports transnational access, networking and joint research activities. Includes examples;
- The Royal Society (2018) A snapshot of UK research infrastructures. Summary of the findings of a survey of 135 UK research infrastructures, including details on their diversity, definition, geographical distribution, type, ownership and usership, funding models, collaboration models, research disciplines and workforce.

[23] The Royal Society (2018) Snapshot of research infrastructures.
[24] House of Lords Science and Technology Committee (2016) EU membership and UK science.
[25] The Royal Society (2016) UK research and the EU: the role of the EU in collaboration and researcher mobility.
[26] The Royal Society (2016) UK research and the EU: the role of the EU in funding UK research.
[27] Technopolis Group (2017) The role of EU funding in UK research and innovation.
[28] House of Lords Science and Technology Committee (2016) EU membership and UK science.
[29] The Royal Society (2016) UK research and the EU: the role of the EU in collaboration and researcher mobility.

### 3.4 Regulation

Policy that influences research can be divided into two types: policy that is intended to govern research and broader policy that has impacts for research practice. A number of areas that are within the EU's competence to make policy can influence research, for example the use of animals in research, the governance of clinical trials, data protection, patents and copyright. A distinction can also be made between policies that influence the practice of research and those that influence the outputs of research and their uses in different sectors. While in some cases shared standards are seen as conducive to more effective and higher-quality science, excessive regulation can be seen as creating obstacles to efficiency and effectiveness[30].

Much of the evidence base related to regulation of the life and medical sciences. Overall, harmonisation or divergence between EU and UK regulatory regimes in future will to some extent determine the impacts of Brexit in this area. Regulatory arrangements and potential impacts also vary by sector. Harmonisation may be fundamental to collaboration and market access in many areas, but for the UK, divergence may present opportunities for innovative approaches. In some areas, other policy approaches could improve practices[31].

As an example of the UK's role in EU policy development, the UK research community has played an active role and contributed considerable resource towards developing the new General Data Protection Regulation, which comes into force in 2018. UK life science organisations identified issues with the proposed legislation that would have imposed disproportionate limits on the use of health data in research. A coordinated campaign secured amendments to the regulation that overturned the requirement for consent in the case of research, allowing life-saving medical research to continue[32].

In the pharmaceutical industry, there are concerns about manufacturing and supply issues, marketing authorisations and moving batch releases affecting access to public health and increasing costs for industry[33]. Clarification of the UK's future relationship with the European Medicines Agency will also be important.

In engineering, regulatory issues include a range of relevant standards and legislation, including regulations, directives, standards, Eurocodes and quality assurance and product safety, as well as other instruments developed on procurement, data and recognition of professional qualifications[34].

---

[30] The Royal Society (2016) UK Research and the EU: the role of the EU regulation and policy in governing UK research.

[31] UK Science Partnership for Animal and Plant Health (2018) Submission to the Future Partnership Project.

[32] Cancer Research UK (2017) Response to the Health Committee (Commons) inquiry: Brexit – medicines, medical devices and substances of human origin.

[33] European Federation of Pharmaceutical Industries and Associations (2017) BREXIT EFPIA survey results

[34] Royal Academy of Engineering (2017) Engineering a future outside the EU: securing the best outcome for the UK.

*Further reading*

- The Royal Society (2016) UK Research and the EU: the role of the EU regulation and policy in governing UK research. Overview of how policy is made in the EU and four case studies: General Data Protection Regulation, Clinical Trials Regulation, Genetically Modified Organisms and EU policy for the use of animals in scientific research;
- Royal Academy of Engineering (2017) Engineering a future outside the EU: securing the best outcome for the UK. Summary of a range of standards and legislation, including regulations, directives, standards, Eurocodes and quality assurance and product safety, as well as other instruments developed on procurement, data and recognition of professional qualifications;
- Bioindustry Association (2017) Maintaining and growing the UK's world-leading life sciences sector in the context of leaving the EU. Evidence on the life sciences, including the regulatory system for medical technologies, pharmacovigilance and future medical device databases, regulation of animals medicines, clinical trials regulation and intellectual property protections.
- Technopolis Group (2017) The impact of collaboration: the value of UK medical research to EU science and health. Report and case studies cover pan-EU clinical trials and the UK's Medicines and Healthcare Products Regulatory Agency, and its collaboration with other organisations, particularly with the European Medicines Agency on matters related to the licensing, monitoring and standards for medical products.
- European Federation of Pharmaceutical Industries and Associations (EFPIA) (2017) BREXIT EFPIA survey results.

### 3.5 Collaboration

Several sources highlighted current trends in science: convergence, the blurring of scientific boundaries, internationalisation, interdisciplinarity and the rise of 'big science'. Some of the evidence may have conflated the role of the EU with that of other pan-European or international collaborations. Collaboration, particularly the role that EU membership plays, is hard to quantify. A survey of UK National Academy Fellows and grant holders found that international collaboration is integral to life as an active researcher across all disciplines and career stages[35]. As well as collaborating on scientific programmes, researchers are often part of advisory boards and networks[36].

The EU supports collaboration through the aspiration of a European Research Area, supporting joint projects, access to national research facilities, engagement with intergovernmental research efforts and collaboration with countries outside the EU[37]. Co-publication rates show a marked increase in cross-border collaboration within Europe when countries join the EU, which starts even before nations are full members, perhaps spurred by access to EU research funds as Associate Countries[38].

Almost 50% of UK academic papers are written with an international partner, with 13 of the top 20 'most collaborated with' countries being EU Member States[39]. In 1981 less than 5% of UK publications had an overseas co-order, whereas in 2016 half the output was internationally co-authored. The proportion of the top 10% highly-cited publications increases from 15% to 23% for other EU countries when collaborating with the UK[40].

Of all the successful Irish projects in Horizon 2020, 11.5% of them involve the UK as a collaborator. This is similar to the percentage of Irish collaborations with other major European countries, e.g. Germany at 11.3%. In all cases these collaborations occur in multi partner projects, i.e. they are not exclusive UK-Ireland relationships. Analysis of the larger successful EU Horizon 2020 projects involving the UK and Ireland as collaborators shows that the UK leads less than 10% of these projects and that the distribution is evenly spread across scientific disciplines[41].

*Further reading*

- The Royal Society (2016) UK research and the European Union: the role of the EU in international research collaboration and researcher mobility.

[35] Opinion Leader (2017) The role of international collaboration and mobility in research: Findings from a qualitative and quantitative study with Fellows and grant recipients of the Royal Society, British Academy, Royal Academy of Engineering and the Academy of Medical Sciences.
[36] Technopolis Group (2017) The impact of collaboration: the value of UK medical research to EU science and health.
[37] The Royal Society (2016) UK research and the European Union: the role of the EU in international research collaboration and researcher mobility.
[38] The Royal Society (2016) UK research and the European Union: the role of the EU in international research collaboration and researcher mobility.
[39] Universities UK (2016) Parliamentary briefing: the effect of exiting the EU on higher education.
[40] Technopolis Group (2017) The impact of collaboration: the value of UK medical research to EU science and health.
[41] Science Foundation Ireland (2017) Submission to the Future Partnership Project.

**Annex: Methods for evidence synthesis**

*Research questions*

The evidence synthesis aimed to provide a snapshot of existing arrangements for collaboration between the UK and the EU and their value, as well as the implications of Brexit. Research questions:

1. What incentives, infrastructure and mechanisms can be accessed by research and innovation organisations, funders and individuals in Member States to support collaborations?
2. How do Member States currently use and benefit from these and how might they be affected by Brexit?

*Evidence gathering*

Evidence considered in scope included:

- Publicly available, original research, analysis and reviews from authors in academia, industry, think tanks, learned societies in the UK and the rest of the world;
- Personal communications from thought leaders;
- UK and EU databases and records on the nature of, and participation rates in, programmes that support collaboration between UK and EU researchers.

Evidence was gathered through:

1. **Open consultation**, which invited individuals and organisations to submit evidence that they had commissioned or produced on:
    a. The partnership between the UK and EU on science;
    b. The potential impacts of Brexit in both the UK and EU.

2. **Independent web searches**, to gather any additional relevant evidence that may not have been submitted to the consultation, to ensure that the synthesis was inclusive.
    - **Databases:** Google, Google Scholar.
    - **Combinations of keywords:** Brexit, EU exit, UK, EU, negotiations, science, research, innovation, academia, Research and Development, Horizon 2020, Framework Programme 9, Framework Programmes, European Structural and Investment Funds, European Strategic Forum on Research Infrastructures, European Research Council, European Investment Bank, structural funds, funding, research infrastructures, mobility, collaboration, regulation, association, third country, European Research Area.

*Processing*

All evidence was logged and sifted for relevance. All relevant evidence was taken account of in producing the final evidence synthesis.

The approach to this evidence synthesis was informed by the Society's broader project on evidence synthesis.