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SCIENCE AND POLITICS

A plan for U.K. science after the European Union referendum

Funding, regulation, immigration, and investment should be points of focus

By **Mike Galsworthy¹** and **Martin McKee²**

The 2016 vote to leave the European Union (EU) shocked British scientists. The European Union enjoys strong support from researchers across United Kingdom academia and industry, with 17% of all U.K. university science contracts now funded by the European Union, accounting for 73% of the growth in U.K. university science budgets in recent years (7). These EU funds support high-value multinational collaborations. Free movement of researchers within the European Union ensures flow of talent to where it is most needed and helps early career researchers acquire scarce skills. U.K. scientists have enjoyed access to EU research infrastructure and strong influence on shared regulatory systems. Facing potential exclusion from a global science powerhouse that it has done so much to shape, how should the United Kingdom disentangle itself from this 40-year old collaboration? We propose an eight-point plan to limit the immediate damage and to put U.K. science on the front foot in the wake of the Brexit vote.

Although national research investments have been falling in the United Kingdom, European Union investment has nearly tripled

over the past decade (2–4), accompanied by a strong emphasis on excellence. About 16% of the U.K.'s academic workforce is from elsewhere in the European Union (5). The United Kingdom can attract these researchers more easily by being part of a system that facilitates free movement of people. An international legal framework to harmonize laws and standards on areas dealing with cross-border collaboration avoids the complexity of 28 different sets of laws. In science, this applies to working conditions, chemicals, data protection, clinical trials, animal use, and technical standards. The United Kingdom has often been a leading voice in shaping these regulations. From the European Medicines Agency (EMA) based in London to clinical trials regulation, the United Kingdom has guided the European Union's life sciences framework—and through the European Union has become a global force in medical and life sciences innovation. If the United Kingdom and European Union split, the United Kingdom will find itself without that influence, and the European Union will lose a vital asset.

Although the U.K. science community made its support for the European Union known during the referendum debate (6, 7), the science narrative did not feature strongly in the official Remain campaign. In the aftermath of the vote, the U.K. science minister and the EU Commissioner for science stressed that U.K. partners remained eligible

Collaboration network map: 62% of U.K. papers are in collaboration with other countries, and these have 40% more impact than U.K. domestic-only research.

for Horizon 2020 projects while in the European Union and that there would be no justification for discrimination. In August 2016, the U.K. government announced that it would “underwrite” funding for U.K. participation in EU science grants, including those extending beyond any U.K. departure from the European Union. Yet this simply restated the U.K.'s obligation to honor contracts signed while in the European Union. What was missing was any commitment that, in the long run, any fall in funding due to reduced access to the European Union program would be replaced by money from within the United Kingdom (8).

A PLAN FOR U.K. SCIENCE

Research shows that strong domestic capacity for research and innovation is a major contributor to economic growth (9). Given the threat posed by Brexit to the U.K. economy, revealed by the independent Office for Budget Responsibility (10), coupled with the particular threats that Brexit poses to mobility and collaborative networks, science now requires special attention from the U.K. government. As it develops a new post-Brexit industrial strategy, life sciences must be at the heart of this new vision (11).

1. *Funding.* The U.K. science budget must be put on an upward trajectory, ideally from 1.7% of Gross Domestic Product (GDP) in 2016 toward 3% (12). Failure to commit to this goal risks damaging U.K. science because the attraction and retention of talent is hugely influenced by how a country's future intentions are perceived. Without this commitment, the United Kingdom will be disadvantaged in negotiations with the European Union as it will be seen to lack the safety nets and capacity to compensate for loss of EU grants. The U.K. Chancellor's autumn statement promised an additional £2 billion (U.S. \$2.53 billion) by 2021 (13). If this leverages private investment as expected, that could push the U.K. to spend up to 2% of GDP in 5 years' time. This is helpful but less than competitive. It also must be clarified whether these funds are in addition to (or subsume) any attempt to buy back into the EU science program, which would be of similar cost per annum.

2. *Immigration.* There is a need to shore up the mechanisms to import talent easily and to reinforce the attractiveness of the United Kingdom as a place to pursue a longer-term career in science. The United Kingdom must maintain the benefits of freedom of move-

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ment, along with EU students' rights to live and work in the United Kingdom, with access to schemes such as those provided by the European Research Council, Marie Skłodowska-Curie actions, and Erasmus+.

3. Regulations. A key area for the life sciences, focus is needed on regulations for the development and use of products for human and animal health. Although some have argued that the United Kingdom could develop lighter, more permissive regulations “unshackled” from the European Union, others have rightly emphasized the dangers of a regulatory rift between the United Kingdom and European Union, a point also recently made by the Japanese government letter to the United Kingdom and European Union. Discussions are under way between the EMA and the U.K.'s Medicines and Healthcare Products Regulatory Agency to preserve their regulatory links, even as the EMA inevitably leaves London, with its 890 staff and with damaging consequences for the pharmaceutical industry in the United Kingdom.

The most efficient path at this stage is to preserve EU regulations for as long as possible, with mechanisms to ensure harmonization as the European Union implements changes. However, there may be opportunities to test alternative regulations. Genetic modification is one target. This should be seen not as the United Kingdom undercutting its European partners, but as providing a testing ground where new regulations could be evaluated. Innovative U.K. regulations would serve as an evidenced-based pilot study to inform EU regulations.

4. Intellectual property (IP). The United Kingdom and European Union should both benefit from completing current IP developments, which should be preserved. The unitary patent (UP) and unified patent court (UPC) are approaching completion. Despite its commitment to leave the European Union, the United Kingdom has ratified the UPC agreement, and it has been agreed that the court section specializing in pharmaceuticals will be in London. It remains to be seen whether this will survive Brexit, especially as it will involve payments by the United Kingdom into the EU budget and acceptance that the UPC will be under the jurisdiction of the European Court of Justice, both things that supporters of a “hard” Brexit reject. There is a danger that the United Kingdom will lose any influence on developments in areas such as the regulation of text and data mining, where it has played a leading role (14).

5. EU collaboration. The U.K. contributes 12% of the EU science budget, but wins 16% of the value of grants. The United Kingdom

also draws a large share of research talent via prestigious EU mechanisms, winning 20 to 25% of placements (15). Like other western European countries, it compensates by being a net contributor to the EU budget—funds that are used, in part, to build research capacity in lower-income EU countries. Science partnership also cannot be divorced from the freedom of movement issue, which could become an impasse. Switzerland was in delicate negotiations with the European Union over access to Horizon 2020, given its own 2014 referendum in which the Swiss voted to restrict immigration from the European Union, a decision that has now been reversed. It is in the interests of the United Kingdom to negotiate for maximum access, but a government placing restrictions on immigration may have to accept only partial access, as in Switzerland. Although it may be possible to create some alternative mechanisms, these will likely fall short of the well-functioning system that currently exists, with potential disruptions for academic networks.

6. Policy. When the United Kingdom leaves the European Union, it will lose its influence on EU science policy—in areas ranging from the direction of the science program to regulations, academic standards, and the technical regulations of the Single Market. The sheer size and prominence of the European Union has enabled it to multiply the impact of U.K. science in the wider world. The United Kingdom must develop a task force to reassess its science policy role in the world. Responsibility in this area would fall to the new national body, U.K. Research and Innovation (UKRI), which will combine the U.K. Research Councils and the government's innovation agency, Innovate UK.

7. Business investments. Many technology start-ups feed off a mix of EU grants, EU and U.K. public funding streams, loans, and venture capital. The last of these is substantially leveraged by public funding. There are myriad European Union-based mechanisms that bring funds into small private companies in the United Kingdom, including Horizon 2020; the Regional Development Fund; European Social Fund; European Fund for Strategic Investment (EFSI, also known as the “Juncker plan”); European Investment Bank; and European Investment Fund, with overlaps between them.

The United Kingdom is the leading beneficiary of the new EFSI, receiving €2.4 billion (U.S. \$2.55 billion) in infrastructure financing and €594 million (U.S. \$631.2 million) for small and medium-sized enterprises (SMEs), which are expected to trigger €14.4 billion (U.S. \$15.3 billion) in private investments and to create >26,700 infrastructure jobs and

benefiting nearly 3000 SMEs (16). If these mechanisms no longer exist, will the United Kingdom have the capacity to fill the gap?

8. Monitoring. Government and organizations in both the public and private sector should monitor and report on key indicators of the health of U.K. science and innovation. These indicators include the application and success rates on EU grants, the flows of students and researchers, SME business registrations, public and private investment into the U.K. innovation landscape, and indicators of U.K. science's ability to attract talent globally.

CONCLUSION

The EU referendum vote has major implications for the future of U.K. science in the world. The United Kingdom should continue to build bilateral partnerships around the globe, as it always has, but focus on healing its relationship with its closest neighbors. The U.K. government must find ways to minimize the damage caused by Brexit and, building on its highly successful relationship with the EU, maximize future benefits for all. ■

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