Science diplomacy in the UK, Russia and beyond

Summary of a Royal Society-Russian Foundation for Basic Research discussion 18 – 19 May 2017

Background

From 18 – 19 May 2017, the Royal Society – the independent scientific academy of the UK and Commonwealth, the Russian Foundation for Basic Research (RFBR) – the main source of peer-reviewed funding in Russia, and the Moscow State Institute of International Relations (MGIMO) University – an institute for future diplomats run by the Russian foreign ministry, co-organised a discussion on science diplomacy. The meeting was hosted by MGIMO, and took place under the Chatham House rule to encourage free and open discussion[1]. The main points of the meeting are summarised below. This summary does not reflect a consensus of those present or the views of the sponsoring organizations.

The meeting was originally proposed by RFBR Chairman Vladislav Panchenko in a letter to Sir Martyn Poliakoff, then Foreign Secretary of the Royal Society, in 2015, prompted by the latter's article in the journal *Science and Diplomacy* on the role of the Society's Foreign Secretary[2].

The meeting built on a long tradition of good relations between the Royal Society and its Russian counterparts, which date back to the Society's inception in the 1660s, continuing through the time of Peter the Great[3] and throughout the Cold War, during which the Society hosted a high profile visit by Yuri Gagarin and maintained good links with the Soviet Academy of Sciences, with visits in both directions[4].

It was one of the main high profile events taking place during the UK-Russia Year of Science and Education. Led by the British Council, the British Embassy in Russia and the Ministry of Education and Science of the Russian Federation, this initiative was intended to stimulate further scientific collaboration between the two countries[5]. It was the third major activity between the Royal Society and Russian partners in the same year, following scientific meetings on palaeontology (October 2016)[6] and black holes (April 2017) with the Russian Academy of Sciences[7]. It complemented an ongoing bilateral funding scheme between the Royal Society and the Russian Foundation for Basic Research (RFBR) which supports mobility and exchange between scientists seeking to begin collaborations.

1. The Chatham House Rule reads as follows: "When a meeting, or part thereof, is held under the Chatham House Rule, participants are free to use the information received, but neither the identity nor the affiliation of the speaker(s), nor that of any other participant, may be revealed". See https://www.chathamhouse.org/about/chatham-house-rule
2. Poliakoff M (2015). *The Royal Society, the Foreign Secretary, and International Relations*. *Science & Diplomacy*, Vol 4, No 1
3. Appleby J (2001). *Mapping Russia: Farquharson, Delisle and the Royal Society*. Notes and Records – the Royal Society Journal of the History of Science. 55 (2), 191–204 (2001)
4. Royal Society (1961). *Visit of Major Yuri Gagarin*. Notes and Records – the Royal Society Journal of the History of Science. DOI: 10.1098/rsnr.1961.0042
5. See https://www.britishcouncil.ru/en/programmes/uk-russia-science-education
6. See Benton M and Clarke L (2016). *Royal Society – Russian Academy of Sciences roundtable on "The main biotic events in the Phanerozoic history of the earth"*. The Palaeontology Newsletter, October 2016.
7. Clarke L (2017). *Royal Society and Russian Academy of Sciences field stellar team of scientists to discuss black holes*. Royal Society blog In Verba, 13 April 2017.

The event was accompanied by a small exhibition of rare images and documents on the theme of science diplomacy from the archives of the Royal Society and the Russian Academy of Sciences. The exhibition included items from Yuri Gagarin's visit to the UK in 1961, Howard Florey's participation in an Anglo-American medical mission to the Soviet Union in 1944, and the Pugwash conferences (See *The infrastructure of science diplomacy* on page 4).

A list of speakers is provided in Annex 1. Other participants included diplomatic representatives from a number of embassies in Moscow, scientists leading projects supported by the Royal Society-Russian Foundation for Basic Research scheme, and MGIMO students who participated in the second half of the discussion.

The UK-Russia scientific relationship is growing, of high quality, and of vital importance for the global scientific enterprise. UK-Russian joint research collaboration – as measured by co-authored papers – has doubled since 2006. UK-Russia publications are cited more than 3 times the global average – and have more impact than publications co-authored between UK authors and EU or US authors. The UK is Russia's fourth largest collaborator[8].

The science of science diplomacy

A number of examples, historical and recent, of international science cooperation with the USSR/Russia were discussed, from General Charles de Gaulle's 1966 visit to the Baikonur Space Centre, following which an agreement was signed on French-Soviet space cooperation[9], to the establishment of the International Science Foundation (ISF) with a grant of $100 million to support basic science and scientists in the countries that used to constitute the Soviet Union in 1993[10].

Reference was made to the 'three dimensions' of science diplomacy first outlined in a 2010 Royal Society-American Association for the Advancement of Science (AAAS) report: informing foreign policy objectives with scientific advice (science in diplomacy); facilitating international science cooperation (diplomacy for science); and using science cooperation to improve international relations between countries (science for diplomacy)[11].

It was argued that there is a growing need to explore the 'science of science diplomacy' – ie how it is carried out and what works. Creating the right conditions for scientific evidence to inform large multilateral negotiations to best effect is a key challenge for the scientists and diplomats of the 21st century.

Recent advances in some fields – eg neuropsychology – can provide insights into how people process information, make decisions, interpret history, perceive others, and accept or reject advice and/or evidence. People have cognitive biases which can affect their judgement, and these biases differ across cultures. There have been concerns raised that the growth of 'fake news', fueled by social media, has served to reinforce these biases[12].

A number of mechanisms were highlighted which serve to ensure that foreign policy is informed by the latest scientific evidence. One of these is through networks. The UK government has a network of Chief Scientific Advisers across a range of government departments, including the Foreign and Commonwealth Office. A small but growing number of countries (the UK, US, Japan, New Zealand and Senegal) have a scientific adviser attached to their foreign ministries. There are a diverse range of different cultures, systems and traditions among the countries of the world and these are often reflected in different systems of scientific advice[13].

8. *Nature* (2016). *All countries, great and small*. Nature 535, S56–S61 (28 July 2016).
9. US Office of Technology Assessment (1994). US-Russian Cooperation in Space.
10. http://www.the-scientist.com/?articles.view/articleNo/17734/title/George-Soros-Reduces-Scope-Of-His-International-Science-Foundation/
11. Royal Society (2010). *New frontiers in science diplomacy.*
12. Spinney L (2017). *How Facebook, fake news and friends are warping your memory.* Nature 543, 9 March 2017.
13. Jasanoff S (2007). *Designs on Nature: Science and Democracy in Europe and the United States.*

It was suggested that there could be merit in working with foreign affairs think tanks to see them draw more widely on the latest science and research, and to encourage them to cooperate on common research projects. There has been a growth in these organisations around the world[14], from the Royal United Services Institute and Chatham House established in the UK in the early 20th century, to those in the Asia-Pacific region and in Russia, including the Primakov Institute which was represented in the discussion.

One of the strengths of international scientific collaboration is that it brings together scientists from different backgrounds to address shared problems such as climate change, food security, energy security, infectious disease. People from different cultures and traditions can sometimes see the world differently. These diverse perspectives and approaches to research can be very effective when combined. Such diversity is vital to delivering scientific excellence[15].

Language is very important in scientific cooperation. People from different countries and cultures can have very different understandings of similar words or concepts. There have been attempts to bridge this gap, for example efforts in the 1930s to unify science based on the principles of the Vienna Circle, which sought to bring together scientific theories into a single logical framework[16]. There are also differences in language between different scientific disciplines – for example scientists in the physical and biological sciences can have quite different conceptual frameworks or ways of working. On the international space station, where such misunderstandings can be fatal, Russian cosmonauts learn to speak English and US/Canadian/UK astronauts learn to speak Russian[17].

There are different national and regional approaches to GM crops, which have played out in different ways in Europe[18], the UK[19] and Russia[20]. Public dialogue is important in broadening understanding of science and technology issues and in developing policy responses[21].

In order for science diplomacy to succeed, it was acknowledged that the science underpinning it must be of a high standard. There was some discussion around evaluating and supporting scientific excellence and the different models of funding that can achieve this. The European Research Council, which funds research on the basis of excellence, was cited as a good example[22].

The Global Research Council (GRC) – on whose board the RFBR is represented – was highlighted as an important example of cooperation between research funders. The GRC is a virtual organization, comprised of the heads of science and engineering funding agencies from around the world, dedicated to promoting the sharing of data and best practices for high-quality collaboration among funding agencies worldwide[23].

14. Abelson D, Books S Hua X (Ed, 2017). *Think Tanks, Foreign Policy and Geo-Politics: Pathways to Influence.*
15. See https://royalsociety.org/topics-policy/diversity-in-science/
16. See https://plato.stanford.edu/entries/vienna-circle/
17. See Hadfield C (2015). *An astronaut's guide to life on Earth*.
18. https://ec.europa.eu/food/plant/gmo/legislation_en
19. Royal Society (2016). *GM plants: questions and answers*.
20. Korobko IV, Georgiev PG, Skryabin KG, and Kirpichnikov MP (2016). *GMOs in Russia: Research, Society and Legislation*. Acta Naturae. 2016 Oct-Dec; 8(4): 6–13.
21. Royal Society (2013). *Written evidence submitted to the UK Science and Technology Committee's Inquiry on "Climate: Public understanding and its policy implications"*.
22. See https://erc.europa.eu/
23. See http://www.globalresearchcouncil.org/about-us

There was also some consideration given to broad-based research culture as a whole, and in particular how to assess institutional excellence, using the UK's Research Excellence Framework (REF) as an example. These are areas of interest to the co-organisers of the discussion: the Royal Society is leading a programme of work on research culture[24]; while the Russian Foundation for Basic Research, the Russian Academy of Sciences and the embassies of the UK, US and the Netherlands co-organised an international seminar on scientific publication in May 2017.

The importance of collaboration between early career researchers from both countries was also highlighted. A number of the participants had benefited from such programmes in the past. It is important to build on government-supported programmes such as these, and to explore further how they might contribute to science diplomacy and provide opportunities for early career researchers to engage with policymakers and diplomats. The AAAS Science and Technology Policy Fellowships provides an example of how scientists and engineers can be supported to contribute to public policy[25].

The infrastructure of science diplomacy

The discussion highlighted a number of international fora which have made a major contribution to science diplomacy. These include:

- the Pugwash Conferences which bring together Western and Soviet scientists to address the threat of nuclear weapons[26];
- the Dartmouth Conferences which represent the longest continuous bilateral dialogue between Soviet and now Russian scientists with their US counterparts[27];
- the Organisation for the Prohibition of Chemical Weapons (OPCW), informed by a scientific advisory board made up of 25 independent experts from OPCW Member States[28]; and
- the development of a science advisory process for the Biological and Toxin Weapons Convention (BTWC), which has been led by the Royal Society, the national academies of the US and Poland, and the InterAcademy Partnership, the network of the world's science academies[29].

24. Downey F (2016). *The future of research culture in the UK*. Royal Society In Verba blog, 13 December 2016.
25. See https://www.aaas.org/program/science-technology-policy-fellowships
26. See https://pugwash.org/
27. See https://www.kettering.org/dartmouth-conference
28. See https://www.opcw.org/about-opcw/subsidiary-bodies/scientific-advisory-board/
29. IAP (2015). *The Biological and Toxin Weapons Convention: Implications of advances in science and technology.*

A number of other initiatives were cited as good examples of science diplomacy. Jointly governed by scientists and policymakers from multiple countries, they enable cooperation not just on the scientific research but also on the shared challenges of building, funding, managing and running the infrastructure associated with it. These projects include:

- CREMLIN (Connecting Russian and European Measures for Large Scale Research Infrastructures), which is designed to improve and strengthen the relations and networks between European and Russian research infrastructures[30];
- ITER ('The Way' in Latin), which brings together 35 nations to build the world's largest tokamak fusion reactor[31];
- the 'FAIR-Russia Research Centre', a cooperative venture between the Russian Federal Agency for Atomic Energy ('Rosatom') and the Helmholtz Association in Germany on nuclear science;
- the European x-ray free electron laser (European XFEL), which will generate extremely intense X-ray flashes to be used by researchers from all over the world[32];
- the ESRF (European Synchrotron Radiation Facility), the world's most intense X-ray source, backed by 22 partner countries[33];
- the Human Genome Project, a major international collaborative research programme that successfully sequenced the human genome in 2003; and
- the European Molecular Biology Laboratory (EMBL), an intergovernmental organisation with more than 80 independent research groups covering the spectrum of molecular biology[34].

The changing nature of science diplomacy

Science diplomacy takes place in a changing world, characterised by major political developments (eg Britain's exit from the European Union) and major scientific advances.

A critical component of today's interconnected global science system is the physical infrastructure that underpins it. A network of optical fibres around the world carries 95% of all digital data at a rate of 100 terabits (10^{12} bits) per second, and has underpinned a rapid expansion of global data. IBM estimates that over 90% of all data generated in human history has been generated within the last 5 years[35].

Data has played an important role in international negotiations. The 1987 Montreal Protocol was the culmination of a major international effort to reduce the production and consumption of ozone depleting substances in order to reduce their abundance in the atmosphere, and thereby protect the earth's fragile ozone layer. Without the scientific data clearly demonstrating the damage to the ozone layer, there may not have been a political response.

The 'big data' revolution now affects almost every area of life. Machine learning is automating routine technical tasks in many fields, and the applications of machine learning in these areas are diversifying, which could affect employment and career progression within a wider range of fields[36]. The direct value of public sector data in the UK is estimated at £1.8bn[37]. Public and private datasets are increasingly being acknowledged as assets in international trade, which previously centred around goods and services. This has considerable implications for science and diplomacy.

30. See https://www.cremlin.eu/
31. See http://www.iter.org
32. See http://www.xfel.eu/
33. See http://www.esrf.eu/
34. See https://www.embl.de/
35. Wall M (2014). *Big Data: Are you ready for blast-off?* BBC News, 4 March 2014.
36. Royal Society (2017). *Machine learning: the power and promise of computers that learn by example.*
37. Shakespeare S (2013). *Shakespeare Review: An Independent Review of Public Sector Information.*

Classical statistics, which has characterised much scientific research in the past, is based on making use of limited data and drawing conclusions which are as robust as possible. Large datasets now enable new forms of analysis, from simple correlations to semantic links to hyperdimensionality.

Data standards are crucial – databases need to be able to 'talk to' each other. Ensuring that this happens can be time-consuming but can lead to tools of immense capacity. Data can also be held privately and be inaccessible, a fact which could have diplomatic implications, and raises questions of global public interest in that data[38]. At the same time, research funders are increasingly developing policies to ensure data is accessible and there is a growing private sector whose business model is based on openness.

The growth of data and predominance of information technology also presents risks. The recent cyber attack which caused major disruption to the UK's National Health Service – which also affected the Russian Ministry of the Interior[39] – is a prime example[40]. Digital systems and infrastructure are transforming the world, and robust cybersecurity is essential in order to realise the benefits they promise[41].

Increasing data availability has underpinned rapid advances in machine learning, a branch of artificial intelligence that allows computer systems to learn directly from examples, data, and experience. Machine learning can provide more accurate analysis that spots patterns within the data – for example the quality of weather forecasting has improved greatly in recent years. This goes to the heart of one of the most fundamental aspects of science – namely the ability to detect patterns in nature. The Bank of Russia has used machine learning to identify unlicensed money lenders[42]. A Royal Society study on machine learning found that only 9% of people surveyed had heard of machine learning, but over 70% used it through personal assistants on smartphones or other devices[43].

Machine learning has helped to inform complex multilateral negotiations. For example, the Mekong River flows through six countries and is a highly complex and interlinked system, with significant variations in hydrology, rainfall, topography and climate. The multi-nation Mekong River Commission is using machine learning to gradually build up a more precise model of the flow of the river, which is superseding the previous arrangement by which individual countries relied on their own models[44].

Other emerging technologies in the life sciences were discussed, such as the gene editing technique CRISPR/Cas9, and the rapidly advancing field of synthetic biology, which is enabling "the design and engineering of biologically based parts, novel devices and systems[45].

38. British Academy/Royal Society (2017). *Data management and use: Governance in the 21st century.*
39. Fisher M, Therrien A, Hand J and McCague B (2017). *How cyber-attack is disrupting NHS*. BBC News online, 12 May 2017.
40. BBC (2017). *NHS cyber-attack: GPs and hospitals hit by ransomware*. BBC News online, 13 May 2017.
41. Royal Society (2016). *Progress and research in cybersecurity: Supporting a resilient and trustworthy system for the UK*.
42. Allison I (2016). *Bank of Russia uses machine learning to identify unlicensed money lenders. International Business Times, March 30 2016*.
43. Royal Society (2017). *Machine learning: the power and promise of computers that learn by example*.
44. Nguyen T, Huu Q, Li M (2015). *Forecasting Time Series Water Levels on Mekong River Using Machine Learning Models*. 2015 Seventh International Conference on Knowledge and Systems Engineering (KSE).
45. Ramakrishnan V (2017). *Potential and risks of recent developments in biotechnology.* Speech at the AAAS annual meeting, 18 February 2017.

Annex 1
List of participants

Academician Anatoly Torkunov
Rector, MGIMO (co-chair)

Academician Vladislav Panchenko
Chairman, RFBR (co-chair)

Professor Sir Martyn Poliakoff FRS
former Foreign Secretary of the Royal Society (co-chair)

Academician Yury Balega
Science Director, Russian Academy of Sciences (RAS) Special Astrophysical Observatory

Professor Polina Bayvel FRS
Professor of Optical Communications and Networks, University College London

Jonathan Brenton
Minister Counsellor (Prosperity), British Embassy Moscow

Professor Geoffrey Boulton FRS
President of CODATA and Regius Professor of Geology and Mineralogy Emeritus, University of Edinburgh

Academician Alexander Choubariyan
Science Director, RAS Institute of General History

Luke Clarke
Senior Policy Adviser, Royal Society

Dr Jo Dally
Head of Policy (Research), Royal Society

Andrei Fursenko
Aide to the President of the Russian Federation

Academician Alexander Gabibov
Acting Director, RAS M M Shemyakin and Yu A Ovchinnikov Institute of Bioorganic Chemistry

Professor Robin Grimes
Chief Scientific Adviser to the Foreign and Commonwealth Office

Professor Evgeny Kozhokin
Vice-Rector, MGIMO

Professor Andrey Krutskih
Special Representative of the President of the Russian Federation on International Cooperation in information security

Professor Sergey Louzyanin
Director, Far Eastern Institute, RAS

Igor Neverov
Director, Second European Department, Ministry of Foreign Affairs, Russian Federation

Alexander Nikitin
Professor, Deputy Chairman, Russian Pugwash Committee under the Presidium of the Russian Academy of Sciences, Member of the Pugwash Council

Professor Helga Nowotny
former President of the European Research Council

Mikhail Popov
Deputy Director, National Research Center Kurchatov Institute

Mikhail Rychev
Special representative of National Research Center Kurchatov Institute for international scientific organizations

Konstantin Skryabin
Academician, President, RAS Center for Bio-Engineering

Ivan Timofeev
Programme Director, Russian Council for International Affairs

Grigory Trubnikov
Deputy Minister of Education and Science, Russian Federation

Fedor Voitolovsky
Professor, RFBR Board Member, Deputy Director, Primakov National Research Institute of World Economy and International Relations

Academician Lev Zelenyi
Vice-president, Russian Academy of Sciences (RAS)