THE ROYAL SOCIETY

Reimagining science

Changing the way we think about science

This programme is ambitious. The goal is to change people's narrative of and engagement with science. This applies to everyone, everywhere; from the people embedded at the heart of the scientific community to those who feel completely alienated by it.

If *Reimagining science* is successful, it will change how 'science' is written about, talked about and thought about. The hope is for people to enjoy and engage with science as they do the arts or sport (and within sport more like football than polo).

Science changes our world and how we live in it, both through the knowledge it creates and the ways it is understood and practiced. This is true for everyone, from small children to Nobel laureates. However, science is often partitioned off as something to be done by the super-humanly clever or sub-humanly robotic; a discrete, solitary and sterile activity hidden away in laboratories and universities. This conception is extremely misleading as well as damaging.

It is easy to forget that the intention of both artists and scientists is for audiences to experience their work, contemplate it and be moved by it. Scientists have long discussed the value of concepts such as aesthetics or beauty in their theories and the juxtaposition of art and science show the two to be much more closely related in their outputs than expected. Creativity, excitement, frustration, doubt, hope and despair are all part of the process, and the separation of science from the humanity that makes it has resulted in a multitude of problems across society.

Education

'Draw a scientist' studies show that children start to form misleading preconceptions about scientists as soon as they start school and these only narrow as they get older[1]. Science in schools focuses heavily on the memorisation of facts, rather than sending children on an exciting journey of discovery and providing them with the skills to navigate their way through the world. Simultaneously, the perceived difficulty of STEM subjects and the idea that STEM is for nerds has a major influence on pupils' career and study aspirations, regardless of their ability[2]. This has knock-on effects for the scientific research base, limiting the pool of talent choosing to study science in higher education and beyond. The lack of diversity in the scientific workforce represents a significant loss of talent to the UK and to science[3].

Academic science

In academic science, narrow conceptions of what good or successful science is affects how scientists are measured and judged on their work. Too much focus is placed on where researchers publish, rather than what they publish or how their work and activities contribute to science, society, and the advancement of knowledge more generally[4]. 'Null' research findings, failed experiments, interdisciplinary work and the synthesis of existing evidence are (to name but a few) crucially important aspects of the scientific endeavour that go largely unrewarded in the current system[5,6].

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1 Miller D, Nolla K, Eagly A, Uttal D 2018 *The Development of Children's Gender-Science Stereotypes: A Meta-analysisof 5 Decades of U.S. Draw-A-Scientist Studies*. Child Dev. 89, 1943–1955. (doi: 10.1111/cdev.13039).

2 The Institution of Engineering and Technology. 2008. *Studying STEM: what are the barriers?* See https://mei.org.uk/files/pdf/Studying_Stem.pdf (accessed 24 March 2021).

3 The Royal Society. 2014. *A picture of the UK scientific workforce*. See https://royalsociety.org/topics-policy/diversity-in-science/uk-scientific-workforce-report/ (accessed 24 March 2021).

4 The Royal Society. 2019. *Research culture: changing expectations*. See https:// https://royalsociety.org/-/media/policy/projects/changing-expectations/changing-expectations-conference-report.pdf (accessed 24 March 2021)f

5 The Royal Society. 2012. *Science as an open enterprise*. See https://royalsociety.org/topics-policy/projects/science-public-enterprise/report/ (accessed 24 March 2021).

6 The Royal Society. 2018. Evidence synthesis. See https://royalsociety.org/topics-policy/projects/evidence-synthesis/ (accessed 24 March 2021).

Competition for public funds pitches disciplines against each other and can encourage scientists to frame their work as separate from, and perhaps superior to, other areas of study.

Policy

In policy, there is a deeply embedded notion that there are unitary scientific solutions to the world's problems. While a comforting thought, this ignores the pluralism and complexity of the world we live in and neglects the importance of uncertainty and doubt in science. The challenges facing governments tend to be multifaceted, complex and chronic; their causes and potential solutions are generally not obvious. It is right to take an evidence-based approach whenever possible and to use science to address complex policy issues. However, science is one of many lenses that a policymaker must look through and science advice is not a straightforward thing that can be simply 'followed'[7].

The economy

STEM skills are crucial for the UK's productivity and a shortage of these skills in the workforce is a key economic problem[8]. During an era of rapid technological change, STEM businesses are struggling to recruit enough qualified workers[9,10]. Not only does this hold back industry, but deficiencies in these skills at a more basic level can restrict people in their everyday lives, for example causing difficulties around understanding risk, helping children with maths schoolwork, and scrutinizing statistics in the media[11].

The media

In the media, science is still presented as a niche interest or is framed within a knowledge deficit model, whereby public scepticism can be resolved simply by experts providing people with more information. Although the COVID-19 pandemic has exposed many more people to science and scientists via the media, the exposure has not always been helpful. The mantra of 'following the science' unhelpfully obscures both scientific uncertainties and the limits of science advice in determining public policy. And the portrayal of scientists as either heroes or villains continues to subject them to the 'othering' that the *Reimagining science* programme aims to reverse.

This programme is not arguing that the knowledge, skills and perspectives science has to offer are superior to other branches of learning or culture. Science does not have a monopoly when it comes to matters of knowledge and an interdisciplinary, inclusive approach needs to be taken. Nor is it saying that there is no need for highly-experienced and gifted scientific expertise for the national and international development of a country like the UK. It is suggesting that this expertise needs to be thought of and operationalised differently, with a continuous 'ladder' of engagement and development that smoothly connects to the confident and critical amateur.

The tools of science can improve our quality life in all sorts of ways – from the routine workings of everyday scenarios to understanding and solving local and global issues. Just as songs are not the reserve of the musical, nor sports exclusively for the athletic, science is not only for scientists. By taking science off its pedestal, and out of its box, it can be seen as something to be shared, used and enjoyed by everyone, everywhere.

> "If science is considered a closed priesthood, too difficult and arcane for the average person to understand, the dangers of abuse are greater. But if science is a topic of general interest and concern—if both its delights and its social consequences are discussed regularly and competently in the schools, the press, and at the dinner table—we have greatly improved our prospects for learning how the world really is and for improving both it and us."
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> Carl Sagan. *Broca's Brain: Reflections on the Romance of Science*[12].

7 Ramakrishnan, V. 2020. Following the science. The Royal Society blog. 18 May 2020. See https://royalsociety.org/blog/2020/05/following-the-science/ (accessed 24 March 2021).

8 House of Commons Committee of Public Accounts. 2018. *Delivering STEM skills for the economy*. See: https://publications.parliament.uk/pa/cm201719/cmselect/cmpubacc/691/691.pdf (accessed 24 March 2021).

9 House of Commons Science and Technology Committee. 2016. *Digital skills crisis*. See: https://publications.parliament.uk/pa/cm201617/cmselect/cmsctech/270/270.pdf (accessed 24 March 2021).

10 STEM Learning. 2018. Skills shortage costing STEM sector £1.5bn. See: https://www.stem.org.uk/news-and-views/news/skills-shortage-costing-stem-sector-15bn (accessed 24 March 2021).

11 National Numeracy. 2014. Poor adult numeracy could cost the UK economy £20 billion a year. See: https://www.nationalnumeracy.org.uk/news/poor-adult-numeracy-could-cost-uk-economy-ps20-billion-year (accessed 24 March 2021).

12 Sagan C. 1979 *Broca's Brain: Reflections on the Romance of Science*. New York, United States: Random House.