THE ROYAL SOCIETY

April 2016

Commons Science and Technology Committee inquiry into Science Communication

Summary

- **Science communication strategies should be underpinned by the evidence –** Large public surveys such as the Public Attitudes to Science (PAS) survey commissioned by BIS are important for tracking trends in attitudes to science and public engagement with science and should continue.
- **With most young people attributing their decision to pursue STEM subjects to an inspirational teacher, working with teachers is an effective way to encourage more young people to choose STEM careers**. These should be long-term partnerships with STEM professionals, through which teachers can give their students the hands-on opportunity to experiment and solve problems for themselves. Schemes such as the Society's Partnership Grants scheme are really effective, but more funding is needed to expand their reach.
- **Science should inspire the nation.** It is important to expand the offering for those that are already interested in science and reach out to new audiences. By working together and partnering with other organisations, such as the BBC, the scientific community can expand and amplify its reach.
- **Researchers should be supported and encouraged to engage with the public.** As outlined in the Society's response to the review of the Research Excellence Framework (REF), a key principle of the UK's research landscape should be openness which engenders public trust, increases transparency and supports the widest possible dissemination and honest discussion of research outputs[1]. The future REF should have consideration for the culture it can create.
- **Where science or scientific evidence are likely to have a significant effect on policy, public engagement, both as public dialogues and as good science communication, are essential.** The UK's National Academies can play a role in supporting government to do this.

Introduction

1. The Royal Society is the UK's national academy of science. It is a self-governing Fellowship of many of the world's most distinguished scientists working in academia, charities, industry and public service. Its fundamental purpose is to recognise, promote, and support excellence in science and to encourage the development and use of science for the benefit of humanity. Within this its strategic priorities include providing scientific advice for policy, and education and public engagement.

2. This submission provides an overview of the Society's own science communication activities and an insight into the rationale underpinning these, providing some comment on the broader science communication landscape.

3. Science is a key element of the cultural and economic life of the nation and an ongoing source of national pride and inspiration. An understanding of science, technology, engineering and maths (STEM) is important for every member of society to make informed choices, empower them to shape scientific and technological development and equip them to work in an advanced economy. Science should be a career choice that is open to all. And all members of the public should feel that they are given the opportunity to contribute their view in the development of policy frameworks to enable the rapid and safe translation of new technologies into commercial and public use.

4. For the purposes of this response we will take 'science communication' to mean informing, listening to and working closely with the public.

[1] Royal Society (March 2016) Submission to the Stern review of the Research Excellence Framework

Trends in attitudes towards science, and public engagement with science

5. Large public surveys such as the Public Attitudes to Science (PAS) survey commissioned by BIS from Ipsos MORI, the Wellcome Trust Monitor and the Culture Tracking Survey conducted by Kings College London[2] are important for tracking trends in attitudes to science and public engagement with science. These show that the number of people that agree it is important to know about science for their daily lives is increasing (72% of respondents to the PAS survey in 2014 up from 57% in 1988). People also show an increasing desire to be involved in decision making (29% of PAS respondents would like to have more of a say in decisions about science issues).

6. The surveys also show us that people are increasingly comfortable with the pace of change – there has been a drop in the number of people that feel that science makes people's lives change too fast (from 49% in 1988 to 34% in 2014). But there is a suggestion that people feel less able to engage with the process – there is an increase in the number of people who feel that they have no option but to trust those governing science (from 60% in 1988 to 67% in 2014).

7. This tracking of attitudes informs the development of science communication strategies and policymaking processes that are responsive to public opinion. More tailored public dialogues, such as those conducted by the Sciencewise Expert Resource Centre, and surveying of attitudes on particular issues can be very helpful alongside these. The Society is currently undertaking public dialogue as part of its project looking at the opportunities and challenges presented by machine learning.

8. Through the National Forum for Public Engagement in STEM established by the Wellcome Trust and the Department for Business, Innovation and Skills, organisations that fund public engagement can share learning, and collaborate, allowing for a more strategic approach to make best use of the resources available with clarity over who is doing what. The forum currently has a strand of work focused on reaching underserved audiences.

'Science inspires the nation'

9. Science is embedded within the UK's cultural framework. The ability of people to understand the world in which they live and work increasingly depends on their understanding of scientific ideas and associated technologies. It is therefore important that everyone has the opportunity to gain an understanding of science, technology, engineering and maths (STEM), whatever career they choose.

10. Currently over half of people in the UK do not feel informed in science[3] yet the jobs of the future will increasingly depend on these skills – 39% of firms have difficulties recruiting staff with skills in science, technology and engineering and mathematics[4]. In 2014 the Society published a *Vision for Science and Mathematics Education.* Central to this is inspiring young people by fostering their curiosity and wonder - giving them the opportunity to take ownership of the scientific process to experiment and investigate - and providing them with role models to help them see where science and maths can take them. I.e. increasing their 'science capital' which is shown to increase aspirations to study STEM subjects.[5]

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[2] http://www.kcl.ac.uk/Cultural/consortium/opinion.aspx [accessed April 2016]

[3] Ipsos MORI (2014) *Public Attitudes to science*

[4] CBI/Pearson (2014) *Gateway to growth:CBI/Pearson education and skills survey 2014*

[5] The concept of science capital encapsulates both cultural capital – having had the opportunity to engage with science – and social capital – knowing and recognising people who in, or are interested in science. A clear relationship has been found between a student's level of science capital and their future aspirations in STEM subjects. Science capital can be quantified to inform new

11. Most young people attribute their decision to pursue STEM subjects to an inspirational teacher[6]. An inspirational teacher has the ability to reach far more young people over time than a one-off interaction so working with teachers is an effective way to encourage more young people to study STEM. Support and professional recognition is needed to attract and retain inspirational teachers. Government actions can help create this environment through the College of Teaching and initiatives to recruit more specialist STEM teachers. A culture of self-improvement and enthusiasm for subject specialism are essential. Leadership from the STEM community that places value on teachers undertaking professional development and building partnerships with other STEM professionals is also crucial. The science community can also play a valuable role by recognising STEM teachers as key members of the community, collaborating with them and providing resources to support them.

12. The Society's Partnership Grants scheme is focused on creating long-term interactions between teachers and STEM professionals. It offers up to £3,000 to UK schools or colleges to buy equipment or run a project in partnership with a STEM professional. It aims to inspire young people by giving them the experience of being a practicing scientist, mathematician, computer scientist or engineer and to give them confidence and a feeling of ownership of the scientific process. The long-term nature of this interaction is likely to have a more significant impact for the pupils involved[7]. A recent evaluation of the scheme found that young people taking part reported pride and satisfaction at being part of the scientific process, a boost in confidence and positive perceptions of scientists and engineers with a feeling of 'it could be me'[8]. However this scheme by its nature has limited reach and, if more funding were available, the Society would like to increase the number of schools that are able to participate.

13. Employers can also play a valuable role in inspiring and encouraging young people to consider STEM subjects. The Society is working with the CBI to develop a practical guide setting out five simple steps for businesses to work with schools and colleges. These partnerships give young people a first-hand opportunity to see how businesses use STEM skills and bring role models into the classroom.

14. Everyone should have the opportunity to choose a STEM career. There is considerable evidence that women are highly underrepresented in the most senior roles in science[9] and persistently low numbers of girls are perusing physics and maths after 16. Evidence also suggests that children from economically disadvantaged backgrounds perform less well in science than other pupils, but to address this a better understanding of the causes of any gaps in participation and attainment is needed. The Society is working with the Education Endowment Foundation to explore these gaps and identify promising approaches (eg pedagogies or interventions) that could boost science attainment and progression among these students. This evidence is important to inform future communication strategies to effectively reach these groups. Other groups are underrepresented in

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approaches to increase engagement in STEM. See Kings College London Enterprising Science Project http://www.kcl.ac.uk/sspp/departments/education/research/cppr/Research/currentpro/Enterprising-Science/index.aspx [accessed 26 April 2016]

[6] Wellcome Trust Monitor (2013) http://www.wellcome.ac.uk/News/Media-office/Press-releases/2013/WTP052643.htm [accessed 18 April 2016]

[7] Wellcome (2014) *Experiments in Engagement: Engaging with young people from disadvantaged backgrounds* http://www.wellcome.ac.uk/stellent/groups/corporatesite/@msh_peda/documents/web_document/wtp056346.pdf [accessed 27 April]

[8] This addesses an issues identified by the ASPIRES report that young people like science and think it is important but perceive it as 'not for me'. Kings College London (2013) ASPIRES: young people's science and career aspirations, age 10-14 http://www.kcl.ac.uk/sspp/departments/education/research/aspires/ASPIRES-final-report-December-2013.pdf

[9] Royal Society (2014) *A picture of the UK scientific workforce*

STEM including Black Caribbean and Black African students and those with disabilities and a similar evidence-based approach is needed to address this.

15. As well as encouraging people into STEM careers it is also important to keep people in those careers. Projects such as the Royal Society's *Parent Carer Scientist*[10] campaign can help with this

16. Science should be a source of pride and inspiration for the whole nation. Many people will engage with science issues or apply STEM skills in their daily life without categorising them as 'science'. Other groups have a specific interest in 'science', many of whom form the core audience of the Society. The Society's current science communication activities aim to both broaden the offering for existing 'science' audiences and reach new audiences to ensure that science inspires the nation.

17. To inspire the nation, science needs to feed people's curiosity and wonder at the world. Museums and science centres around the country are excellent at giving people a hands-on experience of science and the media can bring science stories into people's sitting rooms. The Society has increased its science communication activity. Last year it appointed Professor Brian Cox as Professor of Public Engagement to provide high-profile leadership and the Society is increasing the number of events it holds around the UK. At the forefront of this is the Society's flagship event, the Summer Science Exhibition, which gives members of the public the chance to engage with cutting-edge science and technology from across the UK and talk to the scientists who are doing the research. Held in the Society's building in central London, in 2015 there were more than 13,000 visitors, including 2538 students aged 14-18 years old and their teachers. There were 22 exhibits from industry, universities and research institutes across the UK, which brought together more than 700 scientists to interact with the public. 80% of visitors told us that they now had an increased understanding of how science affects our daily lives and 98% of students said that they enjoyed it.

18. Increasingly the Society is seeking to reach the 'culturally active' who may not think that they are interested in science per se but will be excited by the issues it raises – for example attending literature festivals as well as science festivals. Science is an integral part of our culture that is as relevant to literary festivals as it is to science. Social media and digital content play an increasingly bigger role in how people access information – recognising this the Society is developing 'bite-size' and virtual content tailored to this audience, whilst retaining the high standards and quality that define Royal Society content. For example in 2014 the Society published a Q&A on climate science jointly with the US National Academy of Sciences. Online, people are able to drill down to the level of detail that they want, meaning that this content is accessible to a diverse range of audiences – it has been used by schoolchildren, politicians and Catholic bishops. This is accompanied by a short film, *An introduction to climate change in 60 seconds*, and a set of Q&A postcards that are taken to events to encourage people to find out more. This successful format will be used with the Society's forthcoming Q&A on GM crops. The Society has also partnered on a series of *Objectivity* films showcasing its historical archives that have had over a million views.[11]

19. Not everyone has the ability to attend events. Working with partners is a key way for the Society, and others like it, to reach its audiences. This is why the Society is working with the BBC and the wider scientific community on A New Age of Wonder. The combination of the knowledge and expertise of science organisations such as the Society with the story telling, innovation in communications technology and reach of the BBC can make a winning combination and the Royal Society looks forward to making that a reality. Similar partnerships, including with museums and science centres around the country, will be vital to expand the reach of the amazing science stories that are out there. Science should be embedded throughout our media and culture rather than being seen as something separate.

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[10] Royal Society (2016) *Parent Carer Scientist* https://royalsociety.org/topics-policy/diversity-in-science/parent-carer-scientist/

[11] The Royal Society's Objectivity videos are produced in partnership with Brady Haran. 55 Objectivity channel videos were released in 2015/16: these attain audiences of 20,000-22,000 viewers within the first week; 18 videos have gone on to achieve 40,000-130,000 views.

20. None of this engagement is possible without a research community that is willing and able to talk about their science, answering questions and engaging in discussion about their findings. A key principle of the UK's research landscape should be openness to earn public trust, increase transparency and support the widest possible dissemination and honest discussion of research outputs[12].It is important that researchers are both supported and encouraged to undertake these outreach activities. The Society's public engagement programme focuses on giving people the chance to talk to the researchers who actually do the work. The Society provides courses for its research fellows to gain writing and media skills to support them to take part in public engagement activities[13]. The Society is a signatory to the Concordat for Engaging the Public with Research[14] and the researchers it funds are asked to adhere to these principles as a part of the terms and conditions of their award. It has also joined global academies to highlight the importance of nurturing future scientists including through education, and science communication and support ahead of the G7 Heads of State summit in Japan.[15]

Developing and using science for the benefit of humanity

21. The UK's experience with emerging stem cell science and technology shows that the right arrangements can enable a robust public consensus on the safe and valuable use of even the most potentially contentious technologies. In the case of stem cell technologies, high profile public debate began with the Warnock Commission, and continued through the establishment of the Human Fertilisation and Embyrology Authority (HFEA). The recent parliamentary decision to allow the HFEA to regulate the clinical use of mitochondrial donation to prevent inheritance of mitochondrial DNA disease was informed by both public dialogue undertaken by Sciencewise and ethical review by the Nuffield Council on Bioethics.

22. GM technologies have advanced at very different rates in different countries, and were held back in the UK and Europe by a series of, probably, avoidable events at critical moments. In the UK the debate has continued over the last decade with the public still feeling that they are not informed[16].

23. Success is likely to depend on the existence of an established, trustworthy and trusted place for the negotiation of conflicting views about the uses of technology. For major new areas of science such as stem cell technologies, or climate modelling, it has not been sufficient to have a one-off vehicle for debate as and when major decisions arise.

24. Organisations external to government can play a valuable role in mediating this conversation. For example, the National Academies can provide independent, expert advice to answer specific questions that help move policy forward – the Royal Society and Royal Academy of Engineering report *Shale gas extraction in the UK: a review of hydraulic fracturing* answered a specific question over whether 'fracking' could be conducted safely in the UK, allowing the public debate to focus on the question of whether this technology was publicly acceptable.

25. Organisations external to government can play a valuable role in mediating this conversation. For example, the benefits and risks of the rapid development in how data can be used will likely play out in a variety of ways for different applications. In its project on machine learning the Society started a programme of public engagement with a survey and four public dialogue sessions to assess the public's awareness of, and attitudes towards, applications of machine learning. It will build on this work with further activities through 2016 and beyond.

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[12] Royal Society (March 2016) Submission to the Stern review of the Research Excellence Framework

[13] https://royalsociety.org/grants-schemes-awards/meet-the-scientists/ [accessed 14 April 2016]

[14] http://www.rcuk.ac.uk/pe/Concordat/ [accessed 14 April 2016]

[15] Royal Society (2016) *Science Academies call for G7 action on brain science, disaster resilience and future scientists* https://royalsociety.org/news/2016/04/Science-academies-G7-statements-launch/

[16] Ipsos MORI (2014) *Public Attitudes to science*

26. Any widespread public engagement with science and policy will be mediated through the media – print, broadcast or online. The media will often be the first place that the public will hear about scientific advances, or new findings that could inform policy. This can shape the ensuing discussion. Much work has been done to ensure journalists can question experts[17], and that the balance of scientific opinion is reflected in coverage[18]. However the proliferation of 'new' stories can be challenging for the public to process if not provided within the body of scientific evidence. Science organisations can play a valuable role in providing this background and analysis. Initiatives such as the NHS Choices 'Behind the Headlines' are also effective but more could be done to support the public in accessing this 'bigger picture'.

27. The methods by which the government gets and weighs up expert advice and public views are sometimes opaque to the public. But there is a clear public wish to be involved in policy decisions - 88% of the public think that regulators need to communicate with them and over seven in ten people say that they would like to know the public are involved in the decisions made about science issues or wish to be involved themselves[19]. Openness and transparency throughout the process increase the opportunities for people to engage, question and scrutinise policymaking and feel confidence in the final decision.

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[17] The Science Media Centre effectively links the media with scientific evidence and expertise in the timeframes that they need when science hits the headlines. http://www.sciencemediacentre.org/ [accessed 15 April 2016]

[18] BBC *Review of impartiality and accuracy of the BBC's coverage of science* (2011) http://www.bbc.co.uk/bbctrust/our_work/editorial_standards/impartiality/science_impartiality.html [accessed 15 April 2016]

[19] Ipsos MORI (2014) *Public Attitudes to science*