HOUSE OF COMMONS

Science and Technology Committee

Oral evidence: Science Communication, HC 162

Wednesday 7 September 2016

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Watch the meeting

Members present: Dr Tania Mathias (Chair); Victoria Borwick; Stella Creasy; Jim Dowd; Chris Green; Carol Monaghan; Graham Stringer; Derek Thomas; Matt Warman.

Questions 129 - 218

Witnesses

I: Dr Seirian Sumner, co-founder, Soapbox Science, Reader in Social Evolution, University of Bristol; Dr Nathalie Pettorelli, Co-founder, Soapbox Science, Research Fellow, Institute of Zoology, Zoological Society of London; Dr Penny Fidler, Chief Executive, UK Association for Science and Discovery Centres; and Tracey Brown, Director, Sense about Science.

II: Paul Manners, Director, National Coordinating Centre for Public Engagement; and Matt Goode, Director of Communications and Public Engagement, Research Councils UK.

Written evidence from witnesses:

- Sense about Science
- UK Association for Science and Discovery Centres
- National Coordinating Centre for Public Engagement
- Research Councils UK

Examination of witnesses

Witnesses: Dr Seirian Sumner, Dr Nathalie Pettorelli, Dr Penny Fidler, and Tracey Brown.

Q129 **Chair:** I welcome our guests for this afternoon's session. I am sorry to have kept you waiting for a few minutes. I will ask you, starting with Dr Pettorelli, to introduce yourself and your background with regard to communication in science. Just to be clear, I declare an interest: when I worked for a charity, I got some good advice from Sense about Science, so I wanted to declare that in case it is reflected in how I question you.

Nathalie Pettorelli: I am Nathalie Pettorelli. I work at the Zoological Society of London. I am a researcher in conservation biology. In 2011, with Dr Seirian Sumner, I co-founded Soapbox Science, which is an initiative that promotes the science of women scientists in the UK and abroad.

Chair: Thank you. Dr Sumner, would you say your name so I know how to pronounce it?

Seirian Sumner: I am Dr Seirian Sumner. I am a university reader at the University of Bristol. I co-founded Soapbox Science with Nathalie.

Dr Fidler: I am Dr Penny Fidler. I am the chief executive of the UK Association for Science and Discovery Centres. We bring together all the science centres and museums around the UK. We engage about 20 million people every year.

Chair: I know a bit about Tracey, but for people who do not know of Sense about Science, could you introduce yourself?

Tracey Brown: I am Tracey Brown. I am the director of Sense about Science, which is a UK-based charity but is also now in the US and Brussels. We equip people to make sense of science and evidence, particularly on difficult, controversial issues or things that people are not very open about in public.

Q130 **Chair:** Our only problem this afternoon is time. My apologies if I move it along a bit so that we get all of your opinions where we want them. I would like to ask the first question of you, Dr Pettorelli, and then I will move across. Beware of the sound system. You might have to speak louder than you naturally would. My apologies again.

For science communication, do you think that the metrics used to measure success in communication are adequate? How do you measure it?

Nathalie Pettorelli: In Soapbox Science we measure different variables. We look at footfall, the number of people attending the event; dwelling time, which is the average number of minutes that people spend at the event; and then we carry out a series of questionnaires as people leave

the event, looking at whether they knew about it, whether they were happy with it, what they learned and whether they enjoyed it and would recommend it. We do the best that is feasible. It certainly could be improved, but there is fatigue from the audience, especially as they want to leave or to move forward with their own life. It has been really difficult to have follow-up once people are leaving.

Q131 **Chair:** That is a very good point. Dr Sumner, would you add anything to that?

Seirian Sumner: Yes. In order to show long-term impact on the public, we, not just at Soapbox Science but generally, need to come up with a better way of following the impact through time, so we want to know whether, for the children or adults who visited an event, it had a tangible impact on them later in life.

Q132 **Chair:** Do you have any evaluation methods in mind?

Seirian Sumner: We have tried follow-up questionnaires, and we have tried survey monkeys, with "Please fill in this questionnaire in a year's time." It is difficult. You get very small sample sizes.

Q133 **Chair:** Right, but you get meaningful responses.

Nathalie Pettorelli: We do for the speakers but not for the audience. It is easier to ask one year after whether the speakers had some tangible benefit from participating in our event. For the audience, it hasn't worked so far.

Dr Fidler: I would agree with what has been said so far. It is the holy grail of science engagement. We would see it as more of an ecosystem. We see that people who take part in lots of different activities generally get more interested in science, particularly those who have family science capital and families who are interested in science.

Q134 **Chair:** Family science capital?

Dr Fidler: Yes. Families who may have somebody working in science or an interest in science. For example, when their daughter comes home and says, "I think I want to be a space scientist," they say, "That's great," rather than saying, "No, no, don't bother. You'll never get there." It is the kind of encouragement that happens at home that we feel is very important.

Q135 **Chair:** Again, is there a way of measuring that?

Dr Fidler: Yes. I am on a board for enterprise and science with Louise Archer, who was on a previous panel. We are looking at how we can measure family science capital. ASDC, our organisation, has one of the largest informal science learning evaluation programmes that has ever been done, for exactly the reasons that everyone points out. Everyone evaluates, but we all do it in different ways. We have evaluated programmes that reached maybe 150,000 people; we have evaluated

4,000 students and then taken the data on that, or 2,000 people and families. We have evaluated on a large scale. We have all the data for that which show the immediate effect afterwards, with between 70% and 80% saying that they were more interested in studying science or a career in science after a one-hour intervention. What we would love to do is a really longitudinal study.

Q136 **Chair:** The holy grail, as you call it. Thank you.

Tracey Brown: We evaluate things that we do in terms of materials and assistance that we give individually. What we are most interested in at Sense about Science is where things don't happen well. I would suggest that, even though the indicators are that people's engagement is becoming deeper, better and more extensive in a whole number of different areas across society, our focus is on the fact that when things get difficult, when there are contentious discussions in society, we still have a major problem. There are areas where the public do not get access to science, so I am more interested in the question of having access to science at a point when there is a controversial debate raging, or at a point when a policy is being put forward by Government and people need to understand the basis of it. There are a whole number of areas where there are blockages in the system, so despite how much better everything else is getting, that is still going on and that is our concern. In that sense, the social impact we are looking at is a negative one in a very specific way rather than that kind of measurement.

Q137 **Chair:** It is slightly different. That is very useful. To follow up, let me ask Tracey Brown first, when science has become political—I use that in the small "p" sense; I am thinking of MMR vaccines, the climate change debate or GM foods—what lessons do you think science communication can learn? Is there an equivalent to the medical "First, do no harm"? Is there an equivalent in communication, do you think?

Tracey Brown: A lot of those lessons have been learned already both by scientific organisations and individual scientists, and by the press. We are now in a position where the issues you mentioned are touchstones for doing it well and doing it badly. Good journalists, for example, mark themselves out as people who seek to have a balanced discussion, a sensible discussion, rather than to sensationalise. Scientists themselves are far, far more available. Most universities now have a press office, for example. That was not the case 10 years ago. Generally, there is a celebratory tone around the idea of public participation and engagement.

On how to do it, I think we are still getting there. We really advocate what we call "Public led, expert fed," which is answering the real questions that people have—things like, "How can you be sure that this won't harm my unborn baby?" What they don't say is, "Run me through the periodic table again." We need to make sure in science communication that we actually answer the real questions that people are confronting in their lives and not the ones that we would like them to ask us. There is work to be done. There is also a problem in the discussions

that we have about the difficult issues. I would say that there is not enough trust within the system. There isn't trust in the public to understand and discuss the fact that you can never have 100% certainty, for example.

Q138 **Chair:** You are saying that in those examples we have learned lessons, but there still isn't trust.

Tracey Brown: We have learned lessons, and one of those lessons is that in order to give people the opportunity to weigh up the science you have to provide it in a form that people can get at, and in response to the kind of questions they really have. I think the scientific community has become much more responsive to the public in general. There is an expectation, when you start a science career now, that it could involve some kind of public engagement. It could involve accounting either for your own research or for people's questions. That is a really big step forward. I can't tell you how difficult it was 10 years ago even to get someone on a TV programme to talk about MMR, for example.

Q139 **Chair:** That is a good perspective. Dr Fidler, what do you think about the lessons from the powerful messages that should have come across about climate change, MMR and GM?

Dr Fidler: I like the idea of "Do no harm," because science communication, if it has the power to do good, also has the power to do harm. We can all get better at it. It is brilliant seeing over the last 10 years the number of organisations that really see this as a focus for their activities. Certainly within the science centre and public engagement sector we would love to do more. There are some science centres, like the National Space Centre, that have a rapid response for any space news that comes out, and they can immediately jump on it. Social media has helped enormously in that.

Q140 **Chair:** Is it the speed of getting good-quality science information?

Dr Fidler: Yes. Most of the people working in science centres have science backgrounds. If they have somebody on the staff—I am a neuroscientist by training—who can jump on a subject and talk about it, that's great. The building of trust and relationships is absolutely vital. It is more about behavioural psychology than it is about factual evidence. People are not always rational—I mean all of us, humans as a species. When we are talking about who is giving that knowledge—the trusted source—if that source is coming from somebody people trust, whoever we are talking about, it has a lot more power. Also, we run a lot of programmes to train scientists and bring them out into science centres and into the public domain. In one of our projects funded by STFC, which was one of the research councils, we reached 300,000 people, and of those about half had met a scientist or an engineer. Actually talking to a scientist or an engineer builds trust, because they realise that they are not "other" but are pretty similar.

Seirian Sumner: I can comment from the point of view of the scientist rather than the science communicator, because we are both scientists who happen to run science communication events. From the scientists' perspective, it is a concerning thing to have to communicate and talk about your science if it is contentious or if it elicits an aggressive response from the public. We come across this time and time again with our Soapbox scientists, who work on delicate issues like abortion, GM crops and climate change. What we see in our scientists is that when they first start to talk about what they are going to talk about when they are on their box, they are very, very concerned; they are scared about it and worried about aggressive members of the public. Actually, when they are up there we basically tell them to take it from first principles and build the science up so that they bring the public with them, to get a proper base of fundamental understanding. Nathalie can correct me if I am wrong, but I do not think those speakers ever experience any aggression or anything untoward from the public. The public like the opportunity to have first-hand interaction with the scientists.

Q141 **Chair:** It sounds as though they are building trust.

Seirian Sumner: Absolutely. The public are eager to trust scientists. They want to trust scientists, and by giving them that first-hand interaction with scientists rather than having to go to the media, they are a lot more likely to believe what they hear.

Nathalie Pettorelli: It is important to see the context, not just the crisis, so maybe preparing or creating platforms for scientists and the public to have a dialogue outside the crisis, so that the scientists learn that the science value is only one type of value within the decision-making context and the public recognise the value of science in informing the decision. That is really important. For that to happen—maybe I slightly disagree—we might have learned some lessons but we still have a lot of lessons to learn, because there is no real pathway for scientists to have access to the best way to communicate their science. They have to learn it as they go along, stroll along and participate in other events. They have to find their own voice, their own way, in a culture that promotes a certain type of scientific communication. Communication between scientists is very different from communication between a scientist and the public.

Scientists communicate with each other, trying to find the problems in the arguments, while the public just want to understand the state of where we are at and relate it to a broader context, which scientists can sometimes completely forget. If you are working as a specialist on one specific issue, you might not see the relationship with the societal or economic context, while the public can be much better at that sometimes. Some of the lessons are about how we best communicate with the public so that there is trust but also respect, respect for what you can bring and what you can't bring, for scientists and the public to learn the limit of the contribution.

Q142 **Chair:** It is about managing expectations.

Nathalie Pettorelli: Yes, and the limits to what you bring to the table, how you can inform the decision, when it stops and when it starts. We still have a bit to learn about that.

Tracey Brown: May I add a very brief comment? I think the public are the best guides to telling you how to talk to them, and that is often missed. One of the things that we have just been working on is how to communicate the statistics for surgical outcomes in paediatric heart patients. You are probably aware that hospitals publish that kind of information and people find it very difficult. They start looking at things like, "This hospital has got bad outcomes" and not realising—

Chair: Yes. They trust Dr Foster more.

Tracey Brown: And not realising that the reason why they have worse outcomes than another hospital is that they take harder cases, or they have better surgeons and those kinds of things. It may be because of that. One of the ways we addressed that was that we actually worked with parents of paediatric heart patients and children who had been treated to talk about what they found comprehensible and useful and what they found offensive.

Q143 **Chair:** A two-way dialogue.

Tracey Brown: Yes. You start right at the beginning by asking the public, "How do you want to talk about this?" That is missed sometimes. It is a great opportunity.

Nathalie Pettorelli: It is a dialogue. You should never have one saying to the other how they should do it, but they should learn from each other. Otherwise you never educate your audience, which is an important point.

Chair: Great. We may come back to this, but I want to involve the other members.

Q144 **Matt Warman:** A lot of what you talked about is scientists talking directly to the public, which is obviously a good thing in itself, but ultimately for most cases you are lumbered with going via the media. As a starting point, do you see it as the role of the media to be expert or to be translators? Are there too few expert journalists or is it always going to be their role to try to translate from the scientist to the public?

Dr Fidler: Engagement with journalists has got better over the last 10 to 15 years, for sure. For example, within the BBC there is a difference. BBC Science is brilliant and it is doing an absolutely fantastic job. BBC News could probably do with talking to BBC Science a little bit more. Journalists have an enormous role to play, but they need to get accurate science out there, and it needs to be brilliant. They also have a way of making it very, very lively. There is the journalist, the media and then there are about 5,000 members of staff just within our network who are out there

every day communicating science, many of whom are former scientists. Many are former teachers as well.

There are other players in the sector; it is not just the media. It is very important to get scientists talking, but their time is limited. Just getting hands-on great science out there to families, to children, is really important. Because science is an ever-changing investigative pursuit—it is not a static body of facts—keeping it going, keeping people, particularly children and families, understanding that it is an evidence base that will continue to grow, and as the evidence base grows you may get a different result, is vital to how we communicate.

Nathalie Pettorelli: I think you need both, because your audience is not homogeneous. The public is a collection of individuals with different expectations, different knowledge, different levels of education and different levels of curiosity in topics. A translator is very good at getting someone who is sometimes totally uninterested to notice an issue without going into depth, while the expert is really good at conveying better understanding of an interesting or important issue to the converted, the one who really loves science and wants to know more without completely having to read a peer review paper.

Seirian Sumner: From the scientist's perspective, it is extremely frustrating trying to talk to a journalist about your work when that journalist does not have the appropriate level of understanding of your topic. Generally, if journalists can be experts, or at least have some training, it makes everything better, because the story that is communicated to the public is much more accurate.

Q145 **Matt Warman:** I was a journalist and am married to a scientist, so I have some sympathy with that.

Tracey Brown: I feel that we can go a bit too far down this route in the same way that we can go too far down the route of suggesting that MPs need to be trained in science. A member of one of your predecessor committees once famously said, "You don't have to be a scientist to ask the critical questions. You just need to ask the critical questions." From the perspective of the public interest, what you do in this place and what journalists do is scrutiny, which is part of what the public want them to do; it is asking the intelligent questions, the ones that get you to the bottom of something, not the ones that give you a cheap headline but the ones that penetrate and ask. It is important to remember that journalists are playing that role for us. They are not just giving us science stories, which is nice; they are actually also penetrating those and trying to find stuff out. If they have the skills to do that, it doesn't necessarily mean that they have to have a science training.

Q146 **Matt Warman:** Is there ultimately a disconnect between the hunger for headlines that always want it to be a breakthrough and the nature of science of itself, which is incremental, debating and trying to work out where you get to? What is the role of science communicators in trying to

square that circle, if that is an accurate description?

Tracey Brown: Some of this is not in the gift of the people we are talking about. If you are familiar with journalism, you know very well that you file a story and go to bed, the night editor gets hold of it and there is a different headline altogether from the one that you imagined. That does not come into the relationship that is formed between the journalist and the scientist. It comes into the expectation the newspaper has about the values of its audience. There is a job to be done to persuade. I think it is working. Large parts of newspapers realise that their audience is interested in, for example, debunking stories. When we first did stories debunking common myths, they got on to that and realised that it was actually a really neat way of making news out of the hard science rather than the scandal story. There are ways of showing that and there is expectation in the readership that you are sensible on science.

Q147 **Matt Warman:** Have we got to that point because of the MMR scandals and that sort of stuff, which was in some ways led by irresponsible reporting?

Tracey Brown: Yes. It is definitely the case. There is a cadre of journalists who mark themselves out as being not that. They really do. That is the touchstone. They can point to that with their editors and say, "That's not the route we want to go. We don't want to be in that *Sunday Times* position of misreporting AIDS." They have that to back them up in terms of an identity for their science reporting. That is not to say that it is not going on and that there aren't silly headlines. Of course there are.

Q148 **Matt Warman:** Are there examples of traffic going the other way, of scientists trying to come up with what is ultimately a better headline? There are some scientists who are very keen on publicity, despite the ones you have mentioned, who are very unkeen on publicity. Is there a criticism to be made of the scientific community itself as well as of journalists?

Seirian Sumner: I don't think it is that scientists are unkeen for publicity. We need to show that our science is having impact, and publicity is one way of proving that. The problem is that scientists are trained to be very cautious and non-committal, because we might have one experiment that we publish but the next experiment might find a flaw with our own experiments. Part of being a good scientist is being able to admit, "Oh, this is what we thought, but now we have progressed and we know that that is not quite right." Scientists' fear of the media is that they will latch on to a story and treat it as the black and white answer: "This is the answer." But we are never going to get the full answer in any science field. It is always incremental and progressive.

Q149 **Matt Warman:** Which comes back to trust again, in the sense of talking between journalists and the scientific community.

Seirian Sumner: Absolutely.

Tracey Brown: There is a real problem with the REF, because the REF is pushing for case studies, which is great, but that encourages the idea that you need to present what you did—to be crass about it—as curing cancer rather than as a small incremental step in a question that might lead us to something interesting, because that does not create a great case study. Some serious questions need to be asked about the shift in the REF, which is the evaluation of universities' performance and therefore their funding. Potentially it incentivises over-claiming for research. So often, and I am sure other people have told you this, you chase up something in the press only to find that the press release they were sent was the thing that was responsible for the mis-statement of the research.

Q150 **Matt Warman:** To what extent do the media adequately hold scientists, research councils and all of that to account? Do you feel that the media are asking the right questions about what research we are funding and what scientists are actually doing, or are we largely, as you say, relying on press notices and what scientists want to put out?

Tracey Brown: There is a question of time and money in all our media institutions. That is quite a serious issue now, of course. Then there is the rise of online media, with fast turnaround, less time invested and so on. We have highly competitive media in this country, which means everyone wants to be first with the story. That all militates against measured reporting, but we have some considered journalism. I think the journalists do very well within that constraint. One thing that I am finding rather frustrating, which is not really taken up and Government need to do something about it, is the number of stories that come out that supposedly expose the funding of research. Funding is of course a very important question: "Who funded that study?" It is not necessarily just a question about commercial funding; there could be all sorts of other interests involved. That is important. It is usually declared by the researchers. It is usually declared by institutions that have funding from outside sources. It is not exactly investigative journalism to look at the end of the article.

Q151 **Chair:** You have a range, don't you? Some journalists will reference that.

Tracey Brown: Some journalists will reference it, but what happens is that you are also getting exposés, which are presented in the papers as though you have suddenly found out that those nutrition researchers were funded by industry, yet in fact the Medical Research Council-funded institute that they work for actually received the funding. It has been under corporate governance structures, through contract and so on, which is very different from a company flying a doctor on holiday because they are prescribing plenty of their drugs. Yet it is presented in the media in the same kind of way. It is our policy in this country, whether people like it or not, that there is commercial support for the research phase. More people need to take a role in explaining that to the public rather than leaving researchers at the mercy of the media as to whether they

are just going to pick up the story and run a cheap exposé, not really exposing anything because it is usually perfectly okay.

Chair: And losing trust.

Q152 **Stella Creasy:** How do you prevent that, when there are concerns about the involvement of third parties in research?

Tracey Brown: They definitely should not be hidden in any way and they should be looked at. There are two things. One is that we all need to work together towards a conversation that is, first of all, about whether it is good science, before we say whether it is to be thrown in the bin or not, rather than who funded it. That is important. A more intelligent question to ask where there is funding is about the governance of the research. For example, one of the things we have noticed is that different universities have very different contracts governing external research—even within universities. There is no one standard for that. It would be very helpful if there was a standard that the academies and Government Departments signed up to, because then one could say, "Did this abide by those standards or not?" It would give the researchers some sort of measure, not in defence of anything, whereby they could say that they had independence guaranteed within a contractual framework, rather than that it was a casual arrangement or anything like that. That would help enormously.

That conversation should not just be left to people who are on the back foot and defensive because they happen to be someone who has been singled out. It should be a conversation that is led by Government. When we have an announcement that there is a policy of matched funding, for example, with research council funding, we need to have a conversation about the framework within which that corporate funding is going to be managed.

Q153 **Chair:** It is transparency for the public.

Tracey Brown: And good and really clear governance, yes, and explaining to people what the governance structure is—that because a vaccine company is supplying the vaccines on which the research is being done, it does not mean that someone from the vaccine company is coming in every Friday to tell people what to do next. We need to have that explained. We also need to put in place measures, if necessary, to protect researchers from that sort of thing happening, to make sure that that is also true.

Q154 **Chair:** When you say "we", do you mean the scientists and the journalists?

Tracey Brown: We in the sense of those of us who are trying to encourage people to understand research better. Those of us in the communication field have the frustration that this is standing in the way. Where we, at Sense about Science, and others—the Science Media Centre, I know, had the same experience—are trying to work alongside

researchers to help them to communicate, it would be an awful lot better if they were not singled out and hung out to dry without any support.

Q155 **Chair:** You are almost talking about a code of practice.

Tracey Brown: Yes.

Q156 **Chris Green:** Moving from the media, which have a particular way of going about science, with stories which lend themselves to the 30-second soundbite or often a clichéd approach to any given subject, and the scientist who, as you highlighted, takes a very cautious and measured approach where you might need a bit more time to go into a subject, culturally, how does society favour those approaches? Is society closer to the scientist or closer to the media in terms of its interest or approach to consuming articles? Take, for example, the fact that increasingly people look at Twitter. You can flick through and get headlines. It is really fast paced and you are just picking things up rather than reading an in-depth article, which is rather suggestive of where I am on this.

Dr Fidler: It is all and everything, as long as it is brilliant. Social media gets directly into people's inboxes and they read it. That's a great way of doing it. In getting scientists out there, one of the things we find is the confidence of scientists. I am a former scientist. They feel as if they are going out on stage to be eaten when they go out to a science centre. They are a bit nervous about what they are going to be asked. Training scientists and getting them out there in a supported way so that they feel that the public are really thankful that they are there, and are really happy and keen to ask questions, and can ask how they got into those programmes, is a side that is hugely important.

In terms of the media, we talked about the different effects that people have had. The media have a very strong role to play, but it is supplemented by, say, the science centres or Soapbox Science, things that are happening in people's local trusted environments. We run a lot of community programmes, and it is actually the case that bringing people from the community into science centres is really easy.

Q157 **Chris Green:** That is something I was wondering about. In an increasingly diverse society, does communication of science broadly pretty much fit every part of society at the moment, or are there particular parts of society where you have to change the message or the delivery?

Dr Fidler: If you do it well, it is not that difficult. For example, the science centre in Bristol—the one in Dundee and other centres have also done this—has community open days when it invites certain members of certain communities that are very high on the indices of multiple deprivation into the science centre for community weekends. There are ways to do it. I have written a report for BIS, which I have with me, which gives all the techniques and methodologies that are being used around the UK for that. People certainly come in their droves. In Bristol, the first two community weekends attracted 5,500 people, who were all

from the top 10% on the indices of multiple deprivation. There are golden ticket schemes running in Dundee. There are community programmes happening all across. Certainly for the science centres and for the museums, at their heart is social equity. They want to see a fairer, more even society. They are charities. If they were just putting science to those who already were interested in science, they would not achieve their charitable objects. Broadening is part of what they want to do. It is in everybody's mission to reach very wide audiences.

Q158 **Chris Green:** The numbers you have highlighted certainly suggest the appetite in society, or parts of society, to engage, and learn and understand more. Is there an aspect—you may have covered it to some degree—about people coming from a particular background into science, and more dominance in more academic comprehensive schools and perhaps private schools? Many scientists, certainly perhaps at the higher levels, come from those backgrounds and that, therefore, to some extent skews the presentation of science to the general public.

Dr Fidler: Certainly across our sector we try really hard to even the playing field. It is clear that within science itself women are under-represented, as are people from lower socio-economic groups and ethnic backgrounds. Certainly across all of our programmes we make sure that half those presenting are women, that half the scientists we get are women. People come from different ethnic backgrounds and different socio-economic backgrounds in terms of presenting. We know from a study we did recently of 1,400 school students that 23% of those schoolchildren came from the top 20% on the indices of multiple deprivation, so we are getting more children from disadvantaged backgrounds than you would expect by chance. We are kind of achieving that. The family audience for us is different, because families choose what they do and that is where the community weekends and sending home golden tickets through trusted intermediaries are much better.

Q159 **Chris Green:** To the panel as a whole, in terms of other arts, whether high art or pop culture, does science have much of an impact on culture, do you think? Is there any evidence? Is there anything you would like to highlight in that regard?

Dr Fidler: It is a fundamental part of culture. Science is absolutely fundamental.

Q160 **Chris Green:** In terms of music?

Seirian Sumner: Science communication is an art in its own right. You have to be a performer. You have to be an artist to be a good communicator.

Dr Fidler: We work with artists all the time. We are working with an artist who created a great big moon so that people can see a NASA image of a beautiful moon. We work with artists all the time; it is another route in. However, we usually try to attract people with lower science capital, a

lower cultural capital, so we probably put the emphasis on that, but we do a lot of art-science projects.

Q161 **Chris Green:** To some extent, you might suspect that people who are naturally expressive, and able to talk about and deliver a good message have a better understanding of science. On the artistic side, perhaps some of the characteristics are seen in society as being exclusive of one another. Is that the case? Can you have a bit of artistic flair?

Tracey Brown: I do not know about individuals and their particular strengths and weaknesses. It is a peculiarity of our modern times that we see these things as separate. In the enlightenment, it was not seen that we had a trade-off between art, science and literature. They were part of one and the same thing. If you look at the 19th-century discoveries of prehistoric times—for example, the Dorset coast and the understanding in Scotland of time—they were very closely bound up with ideas of who we are and artistic depictions of what that past might have looked like. Without art and imagination, those leaps would not have been made. They formed as much a part of the leaps as the careful, scholarly study of fossils did. There was not a distinction in scholarship between art and science. It is actually a fairly modern phenomenon of specialisation, but I think people are working to get across that. It is not in itself a necessary feature of society that we would look at the world in that way.

Nathalie Pettorelli: For many years, science communication was done by an elite of people seen as experts, who tended to be male and relatively old. One step that we have taken over the years is to increase the number of role models, of all ages and cultural backgrounds, who communicate science. We have changed, or at least we are changing, what we mean by experts. Therefore, a broader range of personalities is starting to emerge, which helps to address the cliché that a scientist is not an arty, outward-looking and outgoing person. The more we showcase different backgrounds, the more we can address that cliché because, truly, there are art students who migrate into science and vice versa. There is an increasing number of platforms for scientists and artists to talk together. As mentioned by other panel members, it is not unusual to see several people having an interest in both and doing very well in both.

Q162 **Chris Green:** Challenging the media stereotype—

Nathalie Pettorelli: And the public stereotype.

Q163 **Chris Green:** The public stereotype is incredibly important because people growing up will think, "I'm not in that category or the other category."

Nathalie Pettorelli: Yes.

Dr Fidler: One of the things we have not mentioned yet is the notion that "It's not for me." All the evidence, particularly the recent evidence, very clearly shows that young people are very excited by science and

interested in it; they think it is great, but it is not for them. Whether we are talking about arts or people from different backgrounds, that seems to be the key factor. We know we make it exciting, interesting and fabulous, but our challenge is how we make people feel that it is for them, and therefore take it. We know that 20% of physics A-Levels are being taken by girls. We know that is because girls feel that it is not for them. We know that when they are thinking about their career choices it is interesting but it is not just for them.

Chair: I am now going to ask another Committee member, Carol Monaghan, to come in.

Q164 **Carol Monaghan:** Thank you, Chair. As a female scientist sitting here, it is wonderful to see an all-female panel. I can't remember the last time we had that. It is a really strong message and people should be taking note. All of you have a role in society as positive role models, as women working in the STEM environment. We need to see more of that. You have talked about science engagement, you have talked about science interest and the outreach work that is done—all of that is brilliant—but it is just a small snapshot in a child's life when they are making decisions. What role do you feel that the media have to play to show women scientists in a positive light—all scientists, but women specifically? I do not mean some scientist who has worked on great research. I mean in "EastEnders", "Coronation Street"—all of those things—where they could see that to be a scientist is a normal thing and an acceptable thing.

Seirian Sumner: There is one really important point to make before we get to the nitty-gritty of that, which is that for a girl to decide on a career in science is not just her decision. She is influenced by her peer group and her family group. Getting the families into science centres is important. In Soapbox Science we catch the passer-by, the families passing by, who did not intend to learn about science. If you can influence that child's immediate environment, their social environment, you have a lot more chance of having that child see that it is for them.

Q165 **Carol Monaghan:** That is a child, though; it is not the whole of society. The big influences are, as you said, the people around them, peer groups and parents, who can be watching telly as well, who can be doing that. At what point do we need to step in and say, "No. We need positive female representation in dramas, soaps and everything that can infiltrate a child's life," not just a snapshot going through a science centre? I am sorry, I am getting on a soapbox, too.

Dr Fidler: I think you are right.

Chair: When you say we, are you talking about politicians, scientists or the communicators?

Carol Monaghan: I am talking about Government. Do Government have to take a role to say, "This is all well and good. It's brilliant work you are doing and it is having an influence"?

Q166 **Chair:** Is there a role for Government?

Seirian Sumner: I guess you are talking about whether we should have quotas of "EastEnders" actors—50/50? Probably not. There are ways of encouraging equal representation. One way of doing it is to educate about unconscious bias, making the people who are casting those roles in whatever TV programme it might be understand that they are already biased towards casting a male in that role rather than a female, just as you are more likely to hear a male scientist on the radio than a female scientist. That is one of the big systemic problems in society, and it is a cultural problem that affects everybody, not just science. It is everything.

Dr Fidler: To pick up on that, 73% of mums and dads who were asked said that they did not feel that science and engineering was an appropriate career for their daughter. That was a study by the Royal Academy of Engineering. Sixty-seven per cent of children get their career advice and guidance from their family, so we have to make sure that we are getting the family learning. If I was devising a national science learning strategy, I would want to see informal and formal learning as two sides of the same coin. They are the same thing. They are all supporting. It is all part of the ecosystem that is supporting, and the media feed into that—the digital media as well, all of them together. Whether or not the Government should then guide, I think it would be nice to be celebrating that.

A study was done in the States that looked at the five interventions that were most likely to make girls go into science, such as teaching them on their own in all-girl groups, but the one that had the most effect was talking to them about unconscious bias and the fact that there was a gender gap. Just letting families know that they have a huge influence, letting families know the role that they can play and letting TV programme makers know the same is really valuable. We do gender-lens training. It is cheap and easy to implement and you could do it through every school in the country.

Q167 **Chair:** Making everybody aware of the bias.

Dr Fidler: Yes, particularly girls.

Chair: I am sure we will cover it again, but I want to move on to Derek Thomas.

Q168 **Derek Thomas:** Can I take you back to the classroom? I am from west Cornwall. Right across the country, we have excellent science teachers who will say exactly the same thing as Professor Brian Cox on the TV screen. I would be interested to know how a celebrity, someone like Professor Brian Cox, can grab attention, but I guess what we are learning today is that that may not have had the impact that we want, because we are only getting 10% of girls taking an interest. What is the difference between a brilliant science teacher and someone on the TV screen, and is it actually working? Is it doing more than raising awareness and actually getting people into science?

Dr Fidler: Brilliant people on telly: fantastic. A teacher who is fantastic can take their children to a university, take them to a research department and take them to a science centre and keep that going for six years. There are brilliant teachers out there. In Finland, which has very good STEM results, they take all the trainee teachers and put them into a science centre for two weeks, so that they learn and become confident about blowing things up, doing chemistry and doing all the very fun end of things. That has a massive impact in Finland. It would be lovely to see a flow-through of great hands-on practical experience happening.

Nathalie Pettorelli: I think I can finally make the point that I have been trying to make for a while. There seems to be the idea that a scientist is good at X, Y, Z and there is a limited portfolio of competencies. If you are only good at that, you can move forward, but if you are not, you do not. What a scientist is, and what he or she needs to be good at, is much more diverse than what we have been thinking of. You can contribute to science in many different ways, from a creative point of view to a very quantitative point of view, or an interdisciplinary point of view, making a connection between the sciences. In school, that is not highlighted enough. It is a very specialised and divided environment, where you do maths in one course and then you move to this and then you move to that, but a lot of science actually comes together. There are very few programmes that bring maths, physics and biology together, yet there is a lot of research that brings those elements together.

We need a bit more integrity and inspiration. When I go to schools to do some science communication stuff, a lot of kids don't see that: "We don't know a lot." They think that science courses are about telling you what we know, so you never show them that they could contribute to something. They have the impression that they are there just to regurgitate, to tell you again what you have just told them. You never show that there is so much to be done. If you were to show them that there is something that they could contribute to by being whatever they want, that would be good, because there is no good recipe to be a good scientist. There are so many different personalities who are successful scientists. Taking that point into account would be more inspirational and maybe it would trigger more interest in science.

Seirian Sumner: Celebrity and the teacher is what you are talking about. They offer two very different things. The celebrity offers the hook and the breadth. You can get a lot of science across in a very narrow and shallow sense. Then you need the teacher to take it to depth. You need the hook to get the child or the family interested, but then you need the depth to consolidate and make it a sticky science love to bring it on to a science career.

Q169 **Derek Thomas:** Following from your point about teachers actually doing the fun stuff in their training, I went to the Science Museum when we launched Tim Peake into space to the space station. After that, I phoned 11 primary schools in my constituency to see if they had watched it and

none of them had. They all had other things to be doing, which really saddened me, because I remember watching launches when I was very young. How are we going to get right into the formative years of children to get them to see what is going on around them? How are we going to break that barrier down so that teachers seize the opportunity of those kinds of events?

Dr Fidler: I worked with the Space Agency on Tim Peake's mission. We engaged 496,000 people—obviously, not the ones in those schools—in the first stage of the launch. I am so sorry, but I have forgotten the question.

Q170 **Derek Thomas:** My point is that, despite all that effort and the thousands of people who visit the Science Museum, there are schools around the country that just did not take any interest whatsoever—11 in my constituency. So how on earth are we going to open up children's minds if we have not got teachers engaged yet?

Dr Fidler: We have to make it easier for the teachers. They have to have places they can go to that are easy, so that if you are doing molecular biology or the latest space science it is easy to go there and easy to take part. It has to be part of teacher training that it is not okay just to stand in a class and do dull science. If you are talking about physics, ask what scientific innovations you need to get a person to Mars, what calculations do you need, and get them thinking through that rather than going through each individual thing. There is a lot in terms of teacher training. They have an enormous amount on.

Q171 **Chair:** I have to say that there are very good teachers.

Derek Thomas: I'm not suggesting that there aren't. I agree.

Chair: Lots of schoolchildren in my area are still buzzing from talking to Tim Peake.

Nathalie Pettorelli: The over-importance of metrics to pass the A-level and the GCSE and the relatively rigid structure that some teachers have to adhere to to pass the Ofsted and have a good report, plus the health and safety aspects have, frankly, made science not that fun. If you want to get the teacher alive and maybe more enthusiastic, you need to give them the opportunity to share with the kids what made them like science from the start. Mostly, it is about manipulating and doing things, observing, going out and meeting. It is a lot of human activity, not just formula.

Seirian Sumner: You need to relax the national curriculum to make space in it. We both go into schools to do stuff with kids, and it is a fight to get teachers to give us an hour of their time with the school kids to teach them something, to take them out in the field collecting bugs. There is just no space in the curriculum for that. There is no time space.

Chair: That is a good point.

Q172 **Victoria Borwick:** What a fascinating discussion we are having. I want to go back to informal science, which we touched on earlier, and research. The Chair asked you what validation there was of research on the success of informal science learning. Perhaps you would talk about how informal science learning has the perceived effect. How do we make the most of it to align it with the national curriculum? You have touched on having events that have the fun, such as explosions. Who wants to lead on bringing the two together?

Dr Fidler: Do you mean how would we make the informal and formal learning strategies assist each other?

Q173 **Victoria Borwick:** Yes. We talked around it before—science events and science festivals as well as learning the curriculum and the fact of getting people engaged. How are you validating that learning? I think the Chair asked you how you are able to assess the results of some of the innovative approaches that you have espoused.

Dr Fidler: From our point of view, we have run a number of national strategic programmes. The first one we did was on molecular biology where we trained and equipped 18 centres to run high-end molecular biology for students. We evaluated that. Because our organisation is running it, we can essentially dictate how the evaluation will be done at multiple centres, in 20 centres.

For our physics and engineering programme, which is funded by STFC, we did the largest academic evaluation of any informal learning programme that has ever been done. The most interesting thing from that, across 4,500 people, was that there was no difference between girls and boys in terms of whether they were more interested in science as a career or more interested in studying science. There was no difference between girls and boys. That was quite ground-breaking. The reason for that, we feel, is that the programme was developed specifically to be gender neutral. Just because of the way it happened, a team of women was developing it. It was very gender neutral. We have done another programme with the Space Agency where we are going to evaluate 10,000 students. There is quantity and quality when you are evaluating. There is the metrics, how many came and what they did, and then there is the deep evaluation where you are asking—

Q174 **Victoria Borwick:** As a result of all that, have you decided that the best way forward for informal learning is science festivals, museums, watching television and bringing people together in the other informal ways that were touched on. What is your recommendation to us?

Dr Fidler: Obviously, I think science centres are great. It is an ecosystem. It all needs to be accurate great science. People need to be taking part in it in multiple ways. It would be great if scientists could come out and engage with the public more, so that you are building trust. A lot of it is around relationship building and trust, and that they trust the

person who is giving the scientific knowledge, the person who is talking to them.

Q175 **Victoria Borwick:** I mentioned engineering because I am always concerned that we seem to have a lot of overseas women engineers and there does not seem to be any ability for children of either sex to start engineering young enough in our schools in order to attain the same level of aptitude that the education system abroad facilitates. In other words, our pupils do not seem to have the opportunity of getting into it at a higher level at a younger age. Therefore, when they are starting employment, our pupils are still going into training, whereas in other parts of the world the field of engineering seems to be greatly recognised. Engineering was touched on earlier, and I know that you wanted to answer on informal learning.

Nathalie Pettorelli: I wanted to make the point, when you were trying to compare science festivals and museums, that those different initiatives have more than one goal. One goal could be learning something, but just by being interested, curious or wanting to learn more, you might be more likely to interact with science, which is also good. Enthusing your audience or creating curiosity makes everyone more likely to understand the more in-depth scientific commentaries or reports in the future. Different goals need to be appreciated and valued differently, because it is not just about what the person will retain from attending one museum exhibition.

Q176 **Victoria Borwick:** Fine. I have a quick question, as my particular interest is starting people in engineering younger. Has anybody got any views as to how that could be improved?

Seirian Sumner: I think children are natural engineers from toddlers.

Q177 **Victoria Borwick:** I agree with you, so how do we make that more integrated in the whole system? I agree with you that they all start by making things with Lego and other things in the garden. How do we carry that through?

Dr Fidler: I would agree. They are all natural engineers and natural scientists. All a child is doing for the first 10 years is testing, checking, looking and observing. That is what they do. That is how the brain develops. We need a lot more science in primary schools. Teachers in primary schools are generally not scientists. We need to give them the confidence or the ability to go somewhere, like a university, science centre or a museum, to be able to do that science. The amount of practical science in schools is getting smaller. We are in a position to offer it for any primary school teacher. We can train teachers, and I know that a lot of universities train teachers. We can bring in scientists and engineers who are great communicators to do it within the school and work with teachers. It is about confidence building.

Victoria Borwick: Thank you. I am conscious of time, Chair.

Chair: I know I always plug my constituency, but we do engineering pre-school.

Victoria Borwick: Very good.

Chair: You are right. They are natural. They are absolutely natural. You just have to see children build Lego to know that.

Q178 **Graham Stringer:** Just over six years ago there was a huge row between the Home Secretary and the scientific adviser about the advice given on drugs to the Home Secretary and his freedom to express himself. That issue was resolved and now scientific advisers to the Government and Government Departments have complete freedom, more or less. I think that was a satisfactory resolution, but scientists working directly for the Government or Government institutions are really restricted. Recently, they were basically told to shut up on xenotransplants. Do you think there should be a code of conduct for scientists working for the Government that allows them to explain the science they are doing, or do you think it is legitimate that the Government stop that communication?

Tracey Brown: In answering that, I should say by way of explanation of my relationship to this issue that I was part of drafting the principles for the treatment of independent scientific advice, which were adopted in the Ministerial Code in 2010, so I have a pre-existing position on this issue of defending scientists in that position.

Largely, there is a big problem. I mentioned that there is a problem of trust, and there is a problem of trust from Government towards not just scientists but to the public's being able to engage in a conversation about stuff. There is too much desire for control. It is not just a desire to control the very specific outcomes of debates. There is also a desire to control the flow of information, making sure that it fits on the No. 10 grid system and so on. We just need to relax about discussions on science.

A good example was in 2012. You may recall that there was a threat to the Rothamsted research centre to trash a GMO trial on aphid-resistant wheat. A public declaration that it was going to be trashed seemed to be attracting public support. We worked there with the researchers and encouraged them. They went out and spoke to the public, they spoke to the press and they made a big public appeal to the protesters not to do it. They explained the reasoning for that. They got so much public support that it was incredible. They got a lot of support from the media. Politicians said nothing and we got the message through.

Q179 **Chair:** It was scientists speaking directly to the public.

Tracey Brown: Then we began to get the message that it really wasn't welcome that there was such discussion going on about potential vandalism to research. The researchers had succeeded in diminishing support for that protest action to the point where it could not succeed. It had actually backfired and led to a lot of public support for the research. On the day, despite the fact that the research council concerned had

brilliant people in communications and the scientists had proven themselves, the message was coming through from central Government that everyone needed to stay behind a barbed-wire fence and not go out and talk to the press and so on.

It is really, really frustrating. People have proved, time and time again, that the public, the scientists and some of the people who are long in the tooth with a bit of communications experience can handle those discussions, thank you. We don't really need everything to be controlled, but there is this brutal fearfulness. I sometimes think that the Government do not even know quite what they are trying to control.

Q180 **Chair:** You are matching what Dr Sumner was saying—that scientists who are new to talking to the public know they are on board once it is explained well. You are saying that we should trust the scientists.

Tracey Brown: There is political insecurity about talking about science. Oddly, despite the fact that on the one hand there is funding now for science communication training and a lot more funding for science communication initiatives, on the other hand around certain kinds of issues which are difficult and people worry about there is still a pulling in and lack of trust in people just getting on and having that conversation when they are employed.

I do not know whether a code of conduct quite covers it. It worries me very much that you have departmental chief scientists writing about the fact that they don't feel it is part of their role to speak publicly. It worries me that you do not have the sense that there needs to be a semi-independent dialogue in that role. This is going to be a problem.

At the end of the day, one of the big reasons why we have support for science communication is the recognition that, when it goes wrong, it can go very badly wrong; it can damage national vaccination programmes and national investment in the environmental sciences and all sort of things. Of course, we need very good communication of risk issues. When we have epidemics and outbreaks, we need reliable communication. I do not understand how Government think we will get that if we pull people back at those moments. That is when we still see it happening.

Q181 **Graham Stringer:** I think we agree on the problem. When this Committee comes to write the recommendation to Government, "We recommend you to relax," it will not have any effect.

Chair: Don't be pessimistic.

Jim Dowd: He has spent too long here.

Graham Stringer: I have been here a long time. You say it would be difficult to write a code of conduct. Can I push you on that a bit more? There must be some way of writing regulations or codes that allow scientists to speak about their work. Obviously, you can exempt Porton Down and research institutes like that, but where national security is not

an issue, can you think of any way of doing that? What would you recommend that the Committee write as a recommendation to Government on this issue?

Tracey Brown: It should certainly be explored. I do not have any problem with extending the principles of independent scientific advice to everybody, with the recognition that, as you say, obviously Government sometimes need to have an internal conversation. That is worth exploring. I suggest it would help. There is a political imperative that needs to be looked at.

I am not being arch when I say that I think you should ask special advisers to go through a two-week induction in what scientific research is and how it is communicated, because there is fear of it, and control of it, that people just do not understand. One of the big issues that happened in the Home Office example that you cited was a category error, which meant that you had a Minister treating the situation as being that a wayward civil servant had behaved in that way, and not understanding that they were actually giving a lecture in a university about a piece of research that had been published three years previously. It is normal behaviour for a scientist. There are a lot of those category errors going on. I would definitely recommend that.

Seirian Sumner: You are talking about Government-funded researchers and research institutes. Most of us in the UK, to do any decent research, need to get research grants from RCUK, and that is Government money, taxpayers' money. If you trust us as scientists to do the work, we follow the scientific method correctly; we get a good set of data, we interpret those data correctly, and we then present the conclusions from the data. As a scientist, we want to be able to say what the data say and not to have to have some other agenda that the Government impose on us about what we can and cannot report.

Q182 **Graham Stringer:** I certainly agree with that. Let me give you another example. All MPs are bombarded by letters drafted by 38 Degrees. I recently got one from a number of constituents who said they were concerned about the latest scientific research paper which showed that the impacts of neonicotinoids on bees and pollinators had been proven without doubt, and that the Government should continue their ban when we leave the European Union. I read the paper, and it did not say anything like that. It was much more cautious in terms of the impact of neonicotinoids. I wrote to the Government Minister responsible and I got the blandest of bland replies, when you would think that the Government Minister should be saying, "Actually, this is our interpretation of that science, and this is how we want to communicate it." That is just another way of approaching the same problem. I don't know if you have any comments on that particular instance or not.

Seirian Sumner: The particular paper that I think you are talking about was presented very cautiously.

Graham Stringer: It was indeed—very.

Seirian Sumner: It was very cautious. I believe it came from a Government research institute.

Graham Stringer: That is correct.

Seirian Sumner: They have to be careful what they say. As scientists, we don't want to come up with "Definitely ban neonicotinoids. This is the proof," because it is only one study. It was a very good study but it is one study. Science is progressive. Who knows what the next study will show? We always have to be cautious. As scientists, we want to be cautious.

Nathalie Pettorelli: In ecology and conservation, you might be aware that there has been a lot of discussion because a lot of those decisions have become very difficult to take. One approach has been not just to make a decision on one study but to do a review of all the evidence available and then to weigh it according to various metrics, and see if it holds up.

Chair: Consensus on best practice, which has not happened. I am conscious of time.

Graham Stringer: I will not ask the last question.

Chair: Okay. I understand that Matt wants to put a quick point. It is a very important point.

Q183 **Matt Warman:** Have you any sense whether Government scientists are more or less trusted than scientists?

Chair: Yes or no to that one.

Matt Warman: I think it's going to be four nos.

Nathalie Pettorelli: It depends.

Seirian Sumner: I have no comment on that.

Dr Fidler: I would say that they are less trusted. There was a MORI poll about five years ago that looked into elements of that.

Tracey Brown: The caveat is that, whenever the public are asked which kind of scientist they trust, they don't really have a sense of what a Government scientist might be. In the same way, they all say they trust scientists employed by environmental groups when there are about seven scientists in the UK who are directly employed by environmental groups. There is no sense really of who those people might be and what they are doing. I do not think that that is very helpful. I certainly think that such evidence and such experience as we have show that when people are pretty open and level with the public about the situation and why they have come to the conclusion and they show the chain of reasoning, people are much more engaging and trusting. That is trustworthy behaviour. I don't think that trust is a great thing that you go and give someone. It is whether they are trustworthy.

Chair: That is a very good point to wind up on. I think we can all trust what you have said, and you have shown best practice in communication, so thank you very much indeed. As Carol said, you are very welcome. I hope you were not our first all-female panel, but I certainly hope you are not our last. Thank you very much.

Examination of witnesses

Witnesses: Paul Manners and Matt Goode.

Chair: Thank you very much for your patience. I am glad you were in the room so that I do not need to explain why we overran. Thank you for your time. I am going to ask you briefly to introduce yourselves and your backgrounds in communication, starting with Matt Goode, and then we will ask questions of you.

Matt Goode: My name is Matt Goode. I am Research Council UK's director of communications and public engagement, where I am responsible for collective research council strategy to strengthen research-society relationships, covering activities across strategic communication, science communication, public engagement and public dialogue.

Paul Manners: I am Paul Manners. I am director of the National Coordinating Centre for Public Engagement, which is funded by the research councils, the higher education funding councils and the Wellcome Trust, to encourage a culture within universities where public engagement flourishes. In that capacity, we provide the secretariat for the National Forum for Public Engagement in STEM. I am quite involved in national collaborative efforts to improve the quality and impact of our public engagement.

Q184 **Chair:** Brilliant. Thank you very much. I think you heard some of what the first panel said. I would like to ask both of you initially, starting with Matt Goode, whether you think that formal qualifications in science or journalism are necessary for people involved in science communication, bearing in mind the idea "First, do no harm."

Matt Goode: Could I clarify? On that one, are you referring to the role of scientists or researchers doing the communicating, or the journalists, or the enablers and the professionals?

Q185 **Chair:** Yes; all. Bearing in mind what the public receive, how can the public discern who is the good journalist, where the trusted source is?

Matt Goode: Picking up on some of the comments of the Committee and the previous panel, I would argue that more important for the communicator and particularly the media—the intermediary side—is understanding of the research process. It is the importance of how the scientific process works, the point about inquiry and the process of research building towards knowledge and not necessarily being about big breakthroughs, rather than necessarily a pressing need for an individual

journalist to be a scientist themselves. There are some fantastic scientists. Again, I would echo the previous panel. I have worked with some fantastic journalists in the UK science media sector, who are scientifically qualified, say, in physics. On a daily basis, when you chat to them they are working across four or five stories across the whole of the sector, so just the fact that they have a degree in physics is not necessarily going to mean that they automatically know something about molecular biology. What is important is that they know about how the research process works and the impact of their story within that process.

As research councils, we are strong supporters of the role of science communicators within the system as well. Again echoing the previous panel, there has been a lot of progress over the last few years towards seeing that as an important role within the system itself, with a move towards having—I hesitate to use the phrase "professional qualifications" because it can cover quite a broad spectrum—professionals and staff who are properly supported and have a clear role in institutions to support researchers in their public engagement and their communication.

Paul Manners: We heard Penny Fidler's point about the idea of an ecosystem. It is such a complex world in which science circulates, with the role of teachers, the role of science communicators and science centres, journalists, producers, scientists in universities and so on. There are so many different people who have a contribution to make. What we try to emphasise is that there are some core principles about excellent engagement with science, which we try to emphasise when we talk to anybody about it. One of the key things we try to encourage people to think about is their purpose. "Why are you choosing to engage and with whom?" People often just jump to a technique. They think, "Oh, I'm going to do a teachers' pack," or, "I'm going to do this, that or the other," but we really encourage people to step back and think about their purpose for that engagement. They can be so different. For engagement as a journalist, you might want to disseminate news, or you might want as a producer to create a really exciting and inspiring television programme, and that is wonderful.

Equally, as a scientist, you might want to engage in a real dialogue where you are really listening to the public. There is a very different set of techniques that you would need, and perhaps specialist help, to do well, or you may want to develop a really collaborative endeavour, where the public are actually working with you to do science, whether that is citizen science or other kinds of collaboration. They are all different. You have to think about your purpose and about the people you want to engage with and not jump to conclusions that they are just like you. We spend a lot of time helping people to articulate their intention. From that you can start to think, "Ah, those techniques might be the best, the most appropriate," and you might also think, "Who do I need to talk to who knows how to do that really well?" and not assume that you can just knock it up yourself. It is a matter of giving people lots of support and drawing on the expertise of people.

Q186 **Chair:** You think that is more important than a formal qualification, which might not cover all skills?

Paul Manners: I think so. We are working on many levels to think about this. There are people now in universities who act as enablers, who help people to do really excellent engagement, and that is a job, a profession, with real skill. Those people need professional recognition for that; they need promotion and a career path, frankly. That is important. For researchers, public engagement would be one aspect of a much more complex array of skills that they need to develop, so perhaps with that it is not so appropriate to do a formal qualification, but to build it into their research training in such a way that they are repeatedly coming across modules that teach them about public engagement. Fantastic.

Q187 **Carol Monaghan:** I would like to ask a bit more about that public engagement training. Do you think that as part of our science undergraduate or postgraduate courses there should be public engagement modules built in?

Paul Manners: Yes, absolutely. What we are talking about is, over time, developing a community of scientists who are excellent at public engagement. Where do you want to start? Clearly, in schools, you want to get excitement about studying science, but when they are becoming serious scientists at university they should be learning about the importance of taking the ethical-social context for their work really seriously, and being developed with some skills and techniques that they might then deploy when they become scientists.

Q188 **Carol Monaghan:** For some scientists that would be quite a challenge.

Paul Manners: It would. I have tried to do it actually, once or twice.

Carol Monaghan: Some are fabulous.

Paul Manners: You get some very blank looks. "Why on earth are we talking about this?" Again, it goes back to the purpose: why does engaging the public in science matter? You have to step back and you have to talk about the profound reasons why, if we don't, there are issues around trust, around accountability for the work we do, around our social responsibility and around doing science that really matters to the world, not just to other scientists. You have to really take people on that journey. From that, you can, hopefully, begin to get people feeling really receptive to why it matters, and then to think about it in relation to their own science.

Carol Monaghan: Mr Goode, do you have anything to add?

Matt Goode: I would clearly echo what Paul said. Our ambition is to have a UK research community that is open, responsive and engaged and that we have a public who have access to the knowledge that research is generating and the opportunity then to influence the questions that that research is seeking to address. To achieve that ambition, we need to

build in exactly what the Committee and Paul have been talking about throughout the research career pathway.

From a research councils perspective, we are involved in some of that training, some directly from the research councils to the specific research council community, through the National Coordinating Centre, through some of our major public engagement investments, like the Catalyst seed funds, and then, possibly most importantly, from the perspective that you are taking, as a key feature in terms of the doctoral training centres that the research councils support.

I echo the point about purpose: which audiences do we want the researchers to engage with? Which audiences do the researchers themselves or their institutions want to engage with, when actually some of this is beyond the public? There is research council support through some of the doctoral training centres' training programmes or aspects that help our research community to engage more widely, by reaching further out into society.

Q189 **Carol Monaghan:** In terms of research councils, are there examples of research councils that are doing better in this field than others? Are there universities that are doing particularly good work that could be used as an example of how things should be done?

Matt Goode: I am slightly reticent about placing things in a hierarchy. Training is an area where some detailed evaluation around what really works is probably still the step that is required. Certainly the factors from a survey earlier this year—I am sure Paul can talk about this as well—highlighted that access to training was not seen as the biggest obstacle in why researchers are not engaging with the public.

I would highlight some examples. Some are better than others. The Medical Research Council runs some showcase events where they bring in researchers who have done public engagement to talk to a peer group about what worked, what didn't work and how another group could work better at the next project and learn from their peers. I know that the BBSRC doctoral training centres include a three-month professional exchange programme as part of their requirements, in which, although not directly, public engagement training is an opportunity for a lot of their students to get out to places, such as policy environments like the research councils. Students also go to places like the Bank of England or the Parliamentary Office of Science and Technology, which helps those researchers very early in their careers to gain a wider perspective and understanding about what wider society expects from them and their research.

Carol Monaghan: Thank you. I will stop there because I know that we are tight for time.

Q190 **Jim Dowd:** I want to look at the role of research councils in advancing public engagement as such. I was interested in what Mr Manners said

originally about how you engaged the public, but that must have its limitations in so far as science is not a democracy. You do not vote at the end and say, "Is this theory right or is it that one?" You just need to engage with people and give them your best view of what things are and then try to carry them with you. Isn't that what counts?

Paul Manners: It depends greatly on the area of science and the phase of the science as to how you might answer that question. In some cases, that is absolutely true. In all areas of science, the public have a stake in the science. Some cases might be deeply sensitive, and those are the places where we need to put our particular effort and investment. There are some wonderful examples of how that has been done. Recently, the mitochondrial DNA story, which was breakthrough science 10 years ago in the lab, through a series of really well-orchestrated public consultations, debate and dialogue that developed over time led to legislation being passed to allow for people whose children suffered from that mitochondrial condition to be given a therapy that was absolutely life-changing. That is an extreme example where the need for public engagement is absolutely paramount, and of a very deep, sustained dialogic kind.

In other areas of science, perhaps our responsibility is to stimulate curiosity, excitement and interest in science. It is about making appropriate judgments. I do not think that one can characterise all science as the same. You are absolutely right that it is very different. What we try to encourage is awareness that people are always sensitive, that your science is public science and that the public have a stake in it. They may just be funding it; it may profoundly affect their quality of life and their wellbeing; it may have dramatic consequences for the environment, for the world that we live in. We want all scientists to feel very sensitive to that possibility.

Q191 **Jim Dowd:** You mentioned the mitochondrial issue. That was overlaid with religion. People were going back to the stem cell arguments, almost back to the genome as well. I won't say it was irrational argument, but you were up against religious beliefs which were irreconcilable with what, fortunately, Parliament decided to go ahead with.

Is the level of public engagement mostly dependent on public funding, as most things are? Is the level of public engagement, or your ability or willingness to engage the public, limited by financial considerations, in so far as everything is?

Paul Manners: That is an interesting question. We are very privileged to be public servants. Most of us who are involved in science all work in universities, and that carries a profound professional responsibility to think about what it might mean. What is happening in the world of science is obviously mirrored in the world of Westminster. The public are much more critical, much more engaged and much more prepared to challenge us. They have much higher expectations of us as public servants. We have to profoundly change how we do our science, how we

work as politicians, how we run a business and how we run a charity, because the public want a different kind of relationship with us.

Frankly, the world of science has probably woken up to that slightly later than other areas of public life. When we look into other sectors, we see a kind of model of where we are heading, where there is much more investment in really profound professional skills in audience understanding and in research into our customers, our audiences and our publics. There is more leadership in organisations where people have a strategic responsibility for engagement. It is not just a nice thing that we do because it is a good thing. It is a business priority. If we do not get it right, we do not run a successful organisation. Our customers, our supporters or our members will drift. That is the world we are all living in. I think the world of science is moving in that direction, too. There has been tremendous progress over the last 20 years, but there is still a long journey to travel.

Q192 **Jim Dowd:** Mr Goode, is it a key role of research councils to encourage that degree of public understanding, or is your job just to dole out the money and let all the scientists get on with it?

Matt Goode: No, no. The reason why I hesitated was that I wanted to come back initially on the use of "public understanding." We would very much echo the terminology around public engagement and the importance of having a spectrum, from inspiring science communication through to public dialogue, and again echoing the point about the purpose of why you are engaging. It is the role of the research councils and potentially what you might call the wider public science leadership community not only to dole out money but to provide some championing and to provide leadership and a degree of expertise and input where necessary. The research councils and some of our other partner organisations also have a key role in helping to set the culture that we would like to see among the research community in general, but specifically in institutions in the higher education sector. That is a key reason why we work with the National Coordinating Centre, but we are involved in a number of projects and initiatives that are driving towards that. Again, I echo the point that relevance, trust, accountability and transparency as a community, as organisations, but also as individual scientists and individual institutions, really are the centrepiece of the relationship between research and society.

Q193 **Jim Dowd:** How much of it is enlightened self-interest, in so far as the more the public comprehend about what you are doing, and more particularly why, the more kindly disposed they will be to allocating you the dosh in the first place?

Matt Goode: There is probably space within the spectrum of purposes for that enlightened self-interest. We would hope, both strategically as organisations and in terms of the culture change within institutions, that it is not the only driving force, but clearly, to steal some of the words of previous colleagues, this is all an ecosystem. That is one aspect of the

whole debate. The fact that it is public money is an opportunity to exercise that self-enlightenment but also an obligation to be open and communicative about the work that our researchers are doing.

Paul Manners: There is a strong conviction among many people that working in this way leads to better science, and a lot of the scientists who have started to work in a more engaged way find their science transformed by it. There is more input, more curiosity and more opportunity to pursue new avenues that they had not thought about before. There is enormous pleasure in seeing the work that you are doing actually touch people's lives and make a difference. Yes, that is self-interest, too, but it leads to better science, which we should all be proud of.

Q194 **Jim Dowd:** Sure. Do you think that Lord Stern's recent report on the research excellence framework will have a positive, negative or nil effect on the ability to communicate science?

Paul Manners: Very positive. He reviewed the research excellence framework and the extent to which it had delivered on its promises and what, if anything, should change about it. Probably the most controversial thing about the REF was the fact that it invited researchers to talk about the impact that their work created, and that was part of the assessment. It was not just the peer judgment of the quality of the research but the quality of the difference that a proportion of the work had within each submitting unit. That was an invitation to the sector to celebrate the excellent engagement work that they have done. Whether they were economic, social, cultural or policy impacts, when you read 6,640 published case studies you get a fabulous picture of science in public making a difference.

The issue is the extent to which researchers felt encouraged and skilled enough to account for the impacts in, I guess, more complex ways than simply economic return. It is quite easy to talk about an innovation that leads to a specific commercialised application and the funding that might flow back, but when you are talking about the kinds of impacts that perhaps are to do with children being inspired by science, how on earth do you put some kind of precision into the descriptors of that difference? He was saying, I think, "Don't lose your nerve. Hold firm," and that a very broad spectrum of impacts is really important. He specifically said that public engagement and cultural engagement should be there. The thing I would push back on is to say that as a sector we need to rise to that challenge. Public engagement should not be there just because it is a good thing. We should be able to make the case for the difference that it actually makes. We take a lot of encouragement from the work that the Economic and Social Research Council has done about measuring impact. They have come up with a very useful framework, which we use a lot. Forgive me for boring you with this for a couple of minutes, but it is really important that we can explain the impact of public engagement in very tangible ways.

Q195 **Chair:** That is consistent with one of Lord Stern's recommendations.

Paul Manners: Yes.

Chair: That is really what we are looking into.

Paul Manners: Yes.

Q196 **Jim Dowd:** My final point is: how do you temper the inclination, if indeed it exists, to overstate or exaggerate the benefits of what you are doing in your efforts to engage public enthusiasm?

Paul Manners: Somebody made the point earlier that some case studies attempted to do that and made exaggerated claims. The point is that the REF is a peer-reviewed process. The panels who read those case studies were shrewd enough to recognise when that was happening. Those panels were not just academics or fellow researchers; they also involved what were called users of research—community representatives. We had a very broad group of people looking at, interrogating and testing the validity of the claims that were being made. Maybe people were a little more generous this time than they certainly will be next time. I think we can expect that next time it will be a lot tougher, but we were blessed to be able to peer review that work. We can trust that those panels were really professional in their approach.

Chair: Thank you.

Q197 **Matt Warman:** We have talked a lot about public engagement. We have not really talked about public participation, if you see what I mean. There is obviously a lot going on with citizen science and a whole host of different measures. Could you talk a little about how you see the two fitting together and whether they are on the same spectrum or whether they are fundamentally two different things?

Matt Goode: Citizen science is a fantastic opportunity. I refer back to the point about purpose and the reason you are seeking public participation. You can have citizen science that is genuinely collaborative, involving a group of citizens in the co-creation of a research project, through to co-delivery, where you have citizens as scientists, effectively, and something that some people have disparagingly called citizens as the drones.

Q198 **Matt Warman:** To what extent is it real?

Matt Goode: There is a spectrum, and I think what is important is—

Q199 **Chair:** It is not as if they were analysing what they are measuring. Are they?

Matt Goode: It is that sort of thing. As long as you and we, as the research community, are clear as to why we are engaging with the public, and as long as we are not dressing something up as genuine participation and co-creation if it is actually an opportunity, for example, to inspire and enthuse, all are perfectly valid along that spectrum. It is just really

important that we are clear why we want to do it and which category along the spectrum it falls into. It is a fantastic opportunity.

Paul Manners: There are really excellent examples—for instance, in health, where public participation involvement has had a much longer tradition in both clinical practice and research, and has been very, very strongly pushed by funders as a requirement of funding. When you look at some of the benefits that that is now delivering in terms of the direction that research has taken, it is very different from what the researchers would have thought if they were just conceiving of that research on their own; with genuine engagement and involvement of patients, research agendas are being set that are transformative. There are fantastic examples when it can work really well.

Q200 **Matt Warman:** Is there a meaningfully understood definition of what public engagement is or what public dialogue is? The research councils have their view. There is not necessarily consensus over whether it has helped, is there?

Paul Manners: It is a very good question. We spent about a year, not full time but a lot of time, talking to a lot of people about whether we could come up with a definition of public engagement, and we ended up with something that was very loose. We understood that what is going on is that lots of people are building a commitment to involving the public in their work but they are doing it for different purposes; they are working with different publics and the kind of outcomes that they are looking to achieve are different. We set quite a loose framework around it. We focus on one or two critical things. For us, what public engagement is about is a two-way relationship. This is not about public relations. This is not about telling people. This is about genuine engagement.

Q201 **Chair:** That is how you define it.

Paul Manners: Yes, absolutely. It is that simple in a way, but it then allows for a real diversity of techniques and approaches.

Q202 **Graham Stringer:** How do we evaluate it? We are talking about science communication. How do we evaluate it and what are the right metrics for the impact of it?

Matt Goode: I would pick up some of the points from the previous panel. Being a good communicator is about understanding your purpose, your audience, your methodology and what you are trying to achieve. Are you setting out to inform, to consult or to collaborate? If you are being a good communicator, whether that be in an engagement sense or in an informing and inspiring sense, if you know what you are trying to achieve in those objectives, you can evaluate against it. Therefore, you are able to do things. If you are setting up to run a particular public event and you set your objective on footfall, it gives you something to measure against whether that particular event was a good investment or not. What is important is being clear what your purposes are and recognising that you can be multi-purposed.

For example, BBSRC ran a fantastic public festival of bioscience in Bethnal Green almost two years ago as part of its 20th anniversary. It went there with a very clear set of science communication objectives in terms of taking inspirational UK bioscience to a specific community in east London, while at the same time having a series of public engagement objectives for the research community it was bringing. How far did that research community feel that the scientists who had been involved in the festival got something out of it, and did they feel that the interactions they had with the public led to them thinking about their research projects in a different way? That festival used an external evaluator to make sure it was independently assessed. It looked at it against both those objectives before declaring whether it was successful or not. It is important to cross that.

In the area we work in, things like the public attitudes to science survey are very important. When we are looking at really long-term public trust in the research system, it is important that we have very long-term quantitative and qualitative approaches to evaluating public attitudes.

Q203 **Graham Stringer:** But it would be difficult, with those long-term assessments of public opinion, to relate them to particular communication episodes at the time.

Matt Goode: Yes.

Graham Stringer: I am really looking to see how you would measure the impact of one project of communicating. Can you give me a good example both of a communication and of the measurement of the impact?

Matt Goode: If you look, for example, at the work that NERC did around the Name Our Ship campaign earlier this year, they now have a series of very detailed quantitative impacts where they can see both the reach and the quality of message delivery, effectively. We are talking in quite traditional communication terms on those sorts of projects. In an ideal world, you could then look at some sort of longitudinal tracking of something like a schools project where you worked with some particular individuals who had been through that particular initiative. I would pick on something like the Nuffield bursaries that the research councils support. You could look at how the participants through that had progressed, and the impact of that on their career choices. That would be something I would point to.

Q204 **Graham Stringer:** In answering the question about science communication, you went into engagement as well. Can you talk a bit more and give more examples of engagement and the metrics used for measuring the impact of an engagement?

Paul Manners: Could I pick up on that? I mentioned the ESRC framework for thinking about impact, which is quite helpful. One of their categories is conceptual impact, which is really around meaning,

inspiration, knowledge and how ideas travel. There are ways that you can capture that.

Q205 **Chair:** You can measure it.

Paul Manners: Exactly. Through questionnaires and focus groups you can get a sense of how people's understanding has been shifted.

The second category is around instrumental impacts, which are much more practical things that have changed in the world as a result of the engagement. There are many examples of engagement where the objective is not simply to inspire or to get people to learn something, but to make something happen. Maybe in health it would be to do some work together to develop a new service or improve an existing service where the service users were involved. You can see some very practical and instrumental changes as a result of that, which can be articulated.

The third category they use is what they call capacity building, which is about skills and networks of people being brought together, so that it increases our capability. Again, you can find measures of outcomes that allow you to talk about that. What we would love to see is that people have a more explicit language to talk about the difference that their work makes and some appropriate tools to catch some sense of whether they have succeeded or not, and for everybody who is doing this kind of work to do some kind of excellent but relatively basic evaluation.

What we also need to invest in are the bigger, long-term research projects, looking at challenges such as: does an intervention, when a child is seven, really change things by the time they are 17?

Q206 **Chair:** That is what the previous panel called the holy grail.

Paul Manners: Yes. Things like the ASPIRES project, which Louise Archer talked to you about. It is a 10-year tracking study, which gives us confidence, from a very robust sample and a very robust methodology, about what happens. We don't all need to do that. If we have investment in some really significant and intelligent long-term research, it will feed the rest of us with the intelligence we need to do good work.

Q207 **Graham Stringer:** Earlier, you gave a really good example of communication on mitochondrial replacement therapy in answer to Jim's question. Are there any other examples you can give, so that we can put them into the report?

Paul Manners: I could send you lots of examples from the REF impact case study.

Chair: That would be fine.

Paul Manners: Let me give you one brief example. I read with interest the Boaty McBoatface session. You pushed hard for NERC to talk about a strategic approach to build on public interest in that particular wonderful episode. The University of Southampton's oceanography department's

REF case study talks about how, over the last eight years, they have done exactly what you were asking of NERC, which is to build a really strategic long-term plan around their media, schools and community engagement with oceanography. It is a brilliant example of how you can do that kind of work in a strategic and sustained way and account for the difference you have made by working in that way. That is a good place to start.

Q208 **Chair:** It would be great if you could send us more. As you heard, we asked the previous panel about what more the Government could be doing. We got advice about relaxing the curriculum to help teachers. We had advice about special advisers perhaps being given some specialist training, even just a short burst. If you have any thoughts, they would be very welcome.

Matt Goode: I would particularly point to the policy, engagement and dialogue end of the spectrum. There is a very important role for Government to champion the use of dialogue, to champion the importance of openness and transparency across the research sector.

Q209 **Chair:** When you say dialogue, is that between Government and their scientists or the scientists and the public?

Matt Goode: In an ideal world, all, of course. I would particularly point to the use of dialogue between the public and science policy. The research councils have quite a strong track record—something like 12 initiatives over the last five or six years—of engaging in strategic dialogue activities. Using a variety of different techniques, they ensured that a representative section of the public was engaged in different forms of dialogue activities on their attitudes, hopes, fears or aspirations around a particular area of research before that strategy was developed in the research councils. We would like to see that approach championed more across Government. I would also use this opportunity to voice our support for the work that Sciencewise has done over the last few years, which has been particularly valuable to the research councils and our communities in terms of both their expertise and their funding. Seeing something like that continue into the future is an area we would be supportive of.

Q210 **Chair:** Would you say that there is best practice with another Government in another country at all, or are we the leader?

Matt Goode: Not off the top of my head. Nothing springs to mind. I think we can be confident in saying that the UK, particularly parts of the UK system, is really world leading in the public dialogue, public engagement and science communication field.

Q211 **Chair:** If we are leaders, we will be like the scientists, making mistakes and learning for others.

Matt Goode: Absolutely. We are not perfect by any means.

Paul Manners: I would say beware tinkering, because it is very easy to focus on some of the aspects of how all this works—doing something to the school curriculum or this or that. Frankly, that is tinkering. What the Committee has the opportunity to do is to put a high-level call to Government to recognise why engaging the public with science is absolutely fundamentally important. It is important across all areas of Government.

Q212 **Chair:** That is the commitment. There is that commitment, but we are looking for policy ideas or specifics from you.

Paul Manners: I think Sir Mark Walport is coming to talk to you. It would be really interesting to explore with him how leadership of this agenda could be effectively orchestrated across Government. Who is holding this, who is taking a lead in different Departments, and how is that work aligning in some intelligent way?

Chair: That is good, showing leadership. Okay.

Paul Manners: And a really clear sense of what the outcomes of that leadership should be delivering, being able to be explicit about the difference that working in this way should be making. Given that it is cross-governmental, the other thing is recognising what sort of strategic cross-cutting intelligence should be being invested in by Government to test whether it is working, to feed those areas of our knowledge.

Chair: A scientific approach.

Paul Manners: Yes.

Chair: Matt, you wanted to ask something.

Q213 **Matt Warman:** Very quickly, how will the new Higher Education and Research Bill affect this stuff in the future? We are asking what the Government do, and the Government are already proposing to do some stuff that obviously affects the research councils pretty profoundly. Is that all going in the right direction from your perspective as well?

Matt Goode: As far as it is sensible to comment, we would highlight communication, public engagement and the importance of trust between the public, society and the research sector. That is important. The Higher Education and Research Bill and the creation of UKRI would, I hope, be an opportunity to reinforce that.

Q214 **Chris Green:** I think that science, to some extent, has a similar problem to politicians and people's engagement with politics and what is going on in the country and more widely. You can spend any amount of money on encouraging people to vote and to engage with the political process, but at some point you are going to stop making any gains in that. We could hear arguments for pretty much all kinds of projects, all types of different engagement, in terms of spending on engaging people with science. How much would you emphasise that it is a personal responsibility—that you are personally responsible for engaging in politics and what is going on in

the country, and personally responsible for engaging in science?

Chair: Are you asking for a percentage?

Q215 **Chris Green:** How far off are we from achieving the optimum position where the cost benefit falls off?

Paul Manners: That is a difficult question.

Q216 **Chair:** If you cannot answer it now, you are welcome to write to us.

Paul Manners: Chris's question is really helpful, because in the way we work we are meant to encourage change and encourage people to do more public engagement. You don't do that by telling people that they have to do it. You don't do it by creating regulations. You engage them in why it makes their work better.

Chair: So you are on the same wavelength.

Paul Manners: Yes.

Q217 **Chris Green:** The Government need to make the information available.

Paul Manners: Yes.

Q218 **Chris Green:** Accuracy is also very important, and accessibility is really important, but at some point people themselves have to make their decision.

Paul Manners: Yes.

Chair: I think we are back to holy grails. Thank you very much for coming. I notice that some members of the first panel are still here. If we have follow-up questions, I hope you will be generous and help us with our further investigation. It has been very exciting to have you here communicating so well. Thank you.