



HOUSE OF LORDS

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Questions 1 - 10

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Witnesses: Professor Alex Halliday, Lord Stern of Brentford
and Professor Dame Jocelyn Bell Burnell

USE OF THE TRANSCRIPT

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Members present

Earl of Selborne (Chairman)
 Lord Cameron of Dillington
 Lord Hennessy of Nympsfield
 Lord Hunt of Chesterton
 Lord Mair
 Lord Maxton
 Baroness Morgan of Huyton
 Baroness Neville-Jones
 Viscount Ridley
 Lord Vallance of Tummel
 Baroness Young of Old Scone

Examination of Witnesses

Professor Alex Halliday, Vice President, Physical Sciences Secretary, Royal Society; **Lord Stern of Brentford**, President, British Academy, IG Patel Professor of Economics and Government, London school of Economics; and **Professor Dame Jocelyn Bell Burnell**, President, the Royal Society of Edinburgh (RSE)

Q1 The Chairman: Could I welcome our three very distinguished witnesses to this evidence session? As you know, we thought it might be appropriate to revisit our report on EU membership and UK science in the light of the fast-moving events since the referendum vote. As always, we are being broadcast, and so I am going to ask if for the record you would introduce yourselves. If you would like to make an opening statement, please feel free so do so.

Professor Alex Halliday: I am Alex Halliday. I am the physical sciences secretary at the Royal Society, which means that I am concerned mainly with physical sciences, but I also do quite a lot on science policy, particularly UK science policy. I have just stepped down as head of science and engineering at Oxford University. Before moving to Oxford in 2004, I was in Switzerland for six years as a researcher, and before that I was in America, so I have seen different systems of science funding.

Professor Dame Jocelyn Bell Burnell: I am Jocelyn Bell Burnell. I am president of the Royal Society of Edinburgh. The Royal Society of Edinburgh bridges what the two gentlemen either side of me do. We encompass science, the arts and professions of all sorts. I do not want to say more than that at the moment. I will be making clear later that Scotland is sometimes different, but you probably already knew that.

The Chairman: That will be helpful.

Lord Stern of Brentford: I am Nick Stern. I am president of the British Academy for humanities and social sciences and professor of economics and government at the London School of Economics. I have spent most of my life working on economic development/economic policy around the world. I am a Cross-Bench Member of this House.

Q2 The Chairman: Thank you very much. Before I ask what will be a very general question to start proceedings, I have to remind myself and others that we have to declare interests as we are revisiting a report. I have to declare an interest as a fellow of the Royal Society, chairman of the Foundation for Science and Technology and fellow of the Royal Society of Biology.

In your view, what opportunities, and threats for that matter, does Brexit pose for UK science and research? What do we need to do now?

Professor Alex Halliday: There are both opportunities and threats. The immediate concern is the threats. Last year, the UK Government set out the bold plan of being the best place to do science. When I talk about science, I mean science in the broad sense, meaning all the subjects we are talking about today. Yet, in practice, successive flat-cash settlements have limited the amount that we have been able to grow science and academia in this country. We lag behind in science funding in this country relative to the OECD average. This underfunding has to some extent been made up by the European Union. Ninety-five per cent of the UK's citations come out of the university sector. If you are talking about the impact on science, you are talking mainly about what you do to the universities. In that respect it is important to realise that, despite what has happened in the UK, there has been a growth in research income in many universities, fuelled partly by new opportunities in Europe. For example, while I was head of science and engineering at Oxford we grew our research income every year, and the amount of money we were getting from the European Union ended up being 20% of what we were getting from the UK's research councils. It is massive and has been growing and making up for the flat cash that we have had in the UK. There will be a major problem if we cannot maintain that funding level.

The UK has also had a disproportionate influence on international science policy. That has given us a very competitive edge, particularly in Europe. We have to wonder how that is going to work in future. We have also had disproportionate access to facilities. Some of those are European facilities based in the UK, but there are also others across Europe that we need to worry about. We are also ranked now as one of the most entrepreneurial countries in the world. That was not the case 10 years ago. To some extent that is a result of the many people who have been coming into this country and is reflected in a lot of the entrepreneurial opportunities and spin-outs that have been created in universities over the last few years. We need to worry about that being affected by this too. That includes some funding streams from the European Union.

We have also been the place that seeks to bring the brightest and the best here. Across Europe, 24% of Marie Curie fellows choose to come to the UK. That is a staggering statement about the benefits to academia of the UK as it is perceived by the world. That will potentially no longer happen unless we negotiate very carefully in the future.

We urgently need a very strong, co-ordinated voice for the UK. Ultimately, I could see this as a potential benefit of Brexit. As you know, the UK has been looking at its higher education research landscape, particularly following the publication of Paul Nurse's review of the research councils. There is a need for stronger co-ordination of what we need as a country to deliver for the future. The implementation of UKRI, even though there are details that we need to sort out, is potentially a very important vehicle for delivering a future for UK science

and engineering, medicine, humanities and social sciences. We need to get that going quite urgently to address the Brexit issues.

We also need to worry about other aspects that involve major restructuring of the universities, in particular the fact the universities will now be split between the Department for Education and BEIS as to where they go to get their advice, support and funding, as part of the White Paper. Having all this happen at the same time as we are trying to deal with Europe is a potential risk that we need to be concerned about.

Lastly, there are issues to do with the universities that particularly reflect their need for stronger infrastructure. Many of their facilities have been going downhill with the cuts in infrastructure spend by government over many years. As a result, universities have been taking out low-interest loans from the European Investment Bank, so a significant amount of money could be at risk. It is European money that has been supporting universities. It is £200 million in the case of Oxford University, which we took out as a loan fairly recently. These strike me as the main worries that we need to think about.

There are potential opportunities as we put together a bold strategy for where we need to go in the future. Hopefully we will talk about some of those opportunities in more detail today, because I think we can rephrase things and look at the UK landscape, as well as the global landscape, in a new way, and we should grab the opportunity to do that.

The Chairman: We will make sure we cover that. Dame Jocelyn.

Professor Dame Jocelyn Bell Burnell: Trying very hard to be positive and starting with the opportunities, I can see relatively few, I must admit, but one obvious thing is that Brexit will lead to a strengthening of collaborations with academics further afield. These perform better will be more expensive because they are further afield and will be more intermittent, so probably will not be as sustaining as the more local European collaborations.

If we wish to trade with Europe we are going to have to largely abide by the European regulatory system, but if some of that proved too onerous—and perhaps the GMO regulation in Europe is a bit ponderous—we could say, “Stuff that”, and trade in GMOs with elsewhere in the world. We might be able to opt out of some of the regulatory stuff if we are more independent.

As has already been articulated, the threats are large. The UK has been successful in science and innovation because it attracts excellent talent from overseas. It is a huge amount of talent. In the leading Scottish universities, about one-fifth of the lecturing staff and one-third of the research staff, other than British passport holders, are EU. They are all very twitchy right now because they do not know what is going to happen. If good opportunities show themselves elsewhere in Europe, they will be off. There is an urgency about reassuring EU passport holders about what the near future holds for them. I will pause there. Perhaps those are things that we can come back to.

Lord Stern of Brentford: Could I highlight the economic/economic growth aspects? I will start with the threats and go on to the opportunities. We have to begin by recognising the importance of productivity and growth and the importance of research and innovation in productivity. I can refer you, for example, to the LSE growth commission, of which I was part, which published at the beginning of 2013. Going up to the financial crisis—everything looks different after that—something like half of UK growth was associated with productivity, and we know that research and innovation is at the heart of that. For example, a couple of years

ago, four UK societies published *Building a Stronger Future*, a document I am sure you will have looked at, outlining the importance of productivity and growth and the importance of research and innovation in productivity. In the UK, we invest in this area as a fraction of GDP about half that of our key competitors. It is about 0.5% of GDP on the public side of research and innovation. Our comparators, such as Scandinavia, Germany, South Korea and the US, are much closer to 1%. There is an interesting leverage. Normally the public side is about half of the private side, so 1% of public GDP in our comparators would go with 2% of private. We are similar, with about 0.5% of our investment as a fraction of GDP in public research and innovation and about 1% in private. We are below our comparators. Key to our strategy in the future, where growth is going to matter more than ever, is that we move that upwards, not downwards, and do so strongly because the gap is big. About 0.5% compares with two-thirds of a per cent for OECD countries—Mexico and many others—let alone our comparators. We have to shift up public research and innovation. That is fundamental to carry through all this discussion.

If you look at what we get from the EU, it is difficult to get the figures on an exactly comparable basis, but we are talking about £800 million or £900 million per annum, with 0.5% of GDP being about £9 billion per annum, so we are losing around 10%—I am deliberately keeping these numbers round—of a number that we should be increasing very rapidly if we are to catch up on our comparators. Our comparators are going up in their share.

That is very important background and there are resources at risk here. These are not marginal resources; £800 million or £900 million in a £9 billion total is a lot. Our research councils get about £3.1 billion per annum. If you compare the £800 million or £900 million with £3.1 billion—that is 800 or 900 compared with 3,100—you can see that we are talking about 25% to 30%. It is a major loss compared to the research council income and a major loss compared even to the overall public expenditure in this area. The resource side of it really matters at a time when we are too low and others are moving up sharply.

I started with resources, but I will say something about people. Around 15% of our university teachers are from non-UK EU countries. For the Russell Group that is about 20%, and for my own—please excuse a rather parochial example—the Department of Economics at the London School of Economics, which is rather important and rather good, in my view, and I am not entirely unbiased, more than half the number of its full professors are from the EU. There is some indication here and we have to investigate it more carefully. Not only is it clear that 15% is a high fraction of our university teachers coming from EU non-UK, but that fraction is higher the higher the quality of universities that you are looking for. If those people are at risk, the quality of our university system would suffer. Of course, we will do our best to make that impact as small as possible and one way to limit it—as my friend and colleague Jocelyn Bell Burnell has already indicated as has the Royal Society in its statements—is to commit to the people who are already here at the moment. That would be extremely valuable. Entrepreneurial vice-chancellors in Europe and entrepreneurial presidents in the United States are already circling. They go after the best. Why would they go after anybody else?

It is early days. We are going to have to look at this very carefully. At the moment the evidence is largely anecdotal. One of the tasks is to look very carefully at that as time goes by. You do not wait until the whole story has played its way through before deciding that the evidence is that this risk is strong. You have to act early on that and guaranteeing the

position of those already here is not only the right thing to do morally, from my point of view, because we have given promises in the past, but economically.

Finally on collaboration, I would give the ball-park figures again. It depends whether you measure collaboration by papers published in collaboration with those overseas or resources or research programmes. There are various different ways of doing these numbers. They come out as 60% to 70% of our international collaborations are with the non-UK EU. Whether you look at the resources, the people or the collaborations, these are serious risks. We will be very active, of course, and do our best to handle them, but government can be really helpful in showing that it understands these risks and making it a real priority in any negotiations. If we are interested in growth—I take it we all are—we are interested in research and innovation as arguably the most important driver of productivity. This is not a minor side thing to be fixed after we have washed out everything else. This is absolutely central to our growth story. That is a key message, which I hope you will take—I assume you are already taking it—to government. Do not put this in the second rank or third rank, put it in the first rank, if you are interested in growth, as I assume you are, but of course it is much wider than growth; it is about what kind of people we are, what kind of society we want, and how we want our students to be educated with others in a very strong way to understand the world much better. I have emphasised growth, but do not get me wrong; it is more than that.

On the opportunities, it is possible that we may be more open to others. I have spent much of my life working and teaching in other countries, particularly India and China. If we open up more to India and China in this context, that is good. I have also watched colleagues and students over the years grappling with embassies and consulates in foreign countries. It is really hard. Will we transform that?

Lord Hunt of Chesterton: No.

Lord Stern of Brentford: Maybe. It would be a triumph of hope over experience, but if we push in that direction—and I hope we do—that could be an opportunity. Whether we take it or not I leave to your judgment.

The reinvigoration of research under UKRI, to which Alex Halliday referred, could be very important. I have discussed that at length with Jo Johnson, who is a fine Minister in this area, and with John Kingman, who is going to chair UKRI and was one of my colleagues in the Treasury when I was there briefly for three years or so. They are very strong on UKRI becoming a clear, analytical, thoughtful, effective, powerful voice for research and innovation in the UK. I believe very strongly that is what they intend. As the academies we will help with that. UKRI is an opportunity to be much more strategic and strong about the role of research and innovation. If we see the threats that we face—and they are real threats, which I have tried to give a quantitative indication of—as making the argument for that strategic approach still stronger, the threats could kick up an opportunity. At the moment, I think it is fairly clear that on balance the threats are rather more specific, large and immediate than the opportunities.

Q3 Lord Mair: I should start by declaring some interests. I am a fellow of the Royal Academy of Engineering and a fellow of the Royal Society. I am a professor of engineering at Cambridge University where I lead a large research team, many of whom are EU nationals.

My question is about UKRI, which you have raised. The Higher Education and Research Bill is getting its Second Reading in the House of Commons today. In the light of Brexit, do you feel that it is on the right course? Do you think it could be amended? Is there anything that should be addressed resulting from Brexit, or should the Bill with its proposals for UKRI continue as if Brexit had not happened?

Professor Alex Halliday: UKRI is an outgrowth of what a number of organisations thought was needed, which was for there to be greater co-ordination of research across the UK, between research councils and with other parts of the UK, such as HEFCE and the way it delivers research funding to the universities. The original Nurse review had already highlighted that it would be good if there was better communication with Innovate UK. There was less emphasis in the Nurse review that Innovate UK had to sit within UKRI. How this will develop depends to some extent on the detail. We need to be careful about that, because the original Nurse review provided a fairly open framework for considering what should happen next. As we are putting UKRI in place, it is important to consult and think hard about what the best way of implementing it might be.

A strategic view and voice of UK science has been needed for a long time. We see this across a range of different sectors. People talk about the need for the research councils to talk to each other more, but it is much bigger than that. It is also the interface with universities and what we learn from the research assessment exercise, which tells us about the health of disciplines in this country. That interface has not been well developed in the past, and it would be of massive benefit to the science community to put this in place. We do not want to hold that back. We want to push it forward, as long as there are safety clauses on the side of the packet that will allow us to flesh out the details more carefully.

The bigger concern is that we are seeing a split between research and teaching, so whereas you had one organisation that covered both research and teaching that looked after all the bits and pieces—the buildings, the people, the museums, the libraries and everything else that happens in universities—that is now being divided into two (research and teaching) organisations. There is not much detail on how that will work. It is fair to say that we are very happy that Greg Clark has taken over at the new department BEIS, because he has some experience of the university sector. We are also very pleased that Jo Johnson has been given this rather unusual broader portfolio to look after across the two departments BEIS and Education (DFE). How that will work will need to be looked at, but we see that as a good thing.

People have worried about Innovate UK in the context of UKRI and it was under quite serious threat from Government regarding its funding. Bringing it under UKRI has partly been about trying to protect it and to make sure that it is stronger in the future, rather than grabbing money from it and using it for something else. That has not been the intent at all.

Professor Dame Jocelyn Bell Burnell: I should have said earlier that I am based at the University of Oxford as well as being president of the Royal Society of Edinburgh, so I have a foot either side of the border, and in this response I am going to use both feet.

There is some anxiety about having research and innovation under the one heading, with perhaps a pooling of resources, because if innovation work moves towards having loans and there is a default on the loans, that money will probably come from the research side. That is

not good. There needs to be some Chinese wall at least between the funding for innovation and that for research.

Turning now to being the stropky Scot, it is different in Scotland. We have a totally different philosophy of higher education. The Bill to which you refer does not really work in Scotland because of the different philosophy. For example, we do not have audits; we have enhancements, which sounds a much better idea. However, it means that we do not have something to measure by in the way the universities in the rest of Britain have. That Bill causes considerable issues in Scotland and gives rise to the question of the extent to which you can regard the devolved Administrations as little perturbations on the Westminster norm that can be sorted out afterwards. We are getting to a stage—and Brexit will make this more acute—where we have to recognise the particular differences of Scotland. When powers are repatriated from Brussels, those that are not reserved will go to Edinburgh. It is different for Wales. Wales has been told, “You can do this, this and this and everything else is Westminster”, but in the Scottish situation it is said, “Westminster does this. You do the rest, Scotland”. That was set up never assuming that we would leave the European Union. Thus Scotland could become more different still, which is going to be a right headache for everybody.

Lord Stern of Brentford: I want to echo what Alex Halliday said about Greg Clark and Jo Johnson being a very strong team. We worked with Greg Clark when he was in the position now held by Jo Johnson and it was a very productive collaboration, and Jo Johnson has been a very strong, thoughtful, listening Minister to work with. I wanted to underline what Alex Halliday had said about that. I would draw your attention to the fact that Greg Clark has a PhD from the London School of Economics. I should have said at the beginning that I am also a fellow of the Royal Society, although, obviously, Alex speaks for the Royal Society, not I. Also I am chairing a review of the research excellence framework. It will report in a couple of weeks and Alex is a very valuable member of that group. I will not anticipate what we are going to say, but obviously we are concerned about relationships between REF and TEF. They should mutually support each other, and it is entirely appropriate to assess both research and teaching, indeed it is necessary, but it is very important to do it in a supportive, complementary way. That is going to be important as we see the division between Education and Business, Energy and Industrial Strategy.

I want to underline the importance of UKRI in the context of uncertainty and therefore the difficulty with growth. Uncertainty is bad for investment and innovation and the extra uncertainty we now have underlines still further the importance of a strategic, strong and well-resourced approach to research and innovation. In that context UKRI is still more important.

I would note one thing. Both Alex and I have emphasised the importance of the strategic approach and how valuable that is in giving a big voice and why that is a good idea. At the same time, of course, academics get nervous about people bossing them around, for good reason. The Haldane principle is of great importance. Governments can and should allocate resources in broad strategic directions, but it is the academics who should look at the detail of assessment. The more you pull things together for good strategic reasons, the more academics get worried about micromanagement. That is a very important issue. We will try to do our bit, but the more you can do to mitigate against any tendency to micromanage would be of real value. That is not an accusation of what is happening; it is an argument for watchfulness.

Q4 Lord Hunt of Chesterton: I am a fellow of the Royal Society and involved in the various other organisations on my list. Do you think that a combination of the research Bill and Brexit will push universities to do new things? Arguably, the American style of university where you have a broad first year is very educational, and it is extraordinary that has not caught on in Europe, except at UCL, in which I declare an interest as an emeritus professor there. One feature of this of course is in the Bill—and perhaps we only began to understand it yesterday after a briefing from the National Union of Students—the Government are encouraging a new type of university. Arguably, we do not have universities providing a significant breadth of operation. The American universities have significant campuses in Europe. Do you think one of the consequences of this Bill and Brexit is that British universities might start having campuses in Europe? That might be very helpful for employment and other things. At the moment we are subject to very considerable change and the universities are saying, “Help, help, help. We want to carry on as we are”, and I am not hearing from the universities that this is an opportunity to do things very differently, perhaps by looking across the Atlantic.

Professor Alex Halliday: I welcome the question. First, when you think about America you have to bear in mind that the financial model for universities is totally different, with much bigger endowments and a longer tradition of significant tuition fees for which people save and get loans for. It means that universities are quite flexible because there is considerable funding coming in that is used to cross-subsidise in a flexible way. To some extent that is an opportunity for the UK with its tuition fees, but, because the UK is in a slightly different place in the development of tuition fees, politically that is quite a difficult thing to do. It is quite difficult to say, “We are going to cross-subsidise something from UK tuition fees”. We have to worry a bit about trying to draw too close an analogy.

However, there are opportunities that we need to think about that Brexit has brought to light. The first thing to say is that Brexit has shown us that there is a fairly deep problem in UK society that we need to be thinking about hard as universities. I am not quite sure how much we have done on this. It has been a bit of a bolt from the blue. It is quite clear that America has problems like this as well. What are we doing about the sectors of society that are becoming severely alienated, and how do we make them part of the solution for their own country? Universities, education and science have lots of opportunities for engagement. Getting the universities to work in that space and come up with new kinds of educational and research opportunities would be a really fantastic thing to do. That should be a top priority for all universities. The need for widening access is very much behind the move of the teaching side of universities into the office of students. UKRI can be part of getting an agenda that links to the needs of the UK regarding its people and social mobility and inequality, and that is an important thing for us to be thinking about. I totally agree with you.

Secondly, we should be thinking much more about the strategic development of our science base. The universities should be considering this in line with the research councils and UKRI more generally. At the moment we are somewhat non-strategic in the way we do things. We grab opportunities to get money to develop science. We hire people with the expectation they will get funding. However, we have been pretty bad at thinking about which areas we really need for the future as a country and which areas we have lost within the UK relative to some other countries.

Thirdly, there is an opportunity from Brexit to think about our international influence and what we can do differently. This brings us back to what you were saying about universities being set up abroad. One of the notes you put down here was about the financial sector and the potential for building links between Singapore, Hong Kong and Switzerland. If you asked me where the most innovative, exciting universities are right now, I would say they are probably in those three countries. In Switzerland, EPFL has been phenomenal. In Hong Kong, HKUST is amazing. In Singapore, there are two universities, NUS and the Nanyang Technology University, as well as the CREATE campus, which are all fantastically innovative. They see the importance of the knowledge-based economy. They realise that to be strong and prosperous as a country in the future they have to invest in education and research, and they are going at it like gangbusters with very exciting, creative new programmes that are somewhat different from the way we have traditionally run our British universities. Thinking outside the box and building links with them is good. They are very open to partnerships, of course. A number of universities in the UK as well as America have built campuses abroad. Since this has started, people on the blogosphere have been talking about building joint networks with France and setting up joint campuses. There are lots of opportunities to think about in this space and how the university sector can be more international, connected and innovative.

Q5 Baroness Morgan of Huyton: You may well have largely covered my question, but I will ask it any way in case you have anything else to add. I should declare an interest as a member of the Council of King's College, where 24% of our academics are from the EU. Certainly there we have already had people turn down opportunities for senior academic appointments. We have all had anecdotes from wherever we are involved. We wanted to nail down whether, beyond the anecdotes, there is any assessment at the moment about the immediate impacts of the Brexit decision. Are there any specific aspects that we should be aware of in relation to Scotland? Are the humanities and social sciences affected in any particular way, or is it the same across the piece?

Professor Dame Jocelyn Bell Burnell: The Institute of Physics is preparing a dossier of examples of EU organisations or individuals refusing to include Brits because we are leaving. That dossier is going to be a confidential submission to your sister Committee, the House of Commons Science and Technology Select Committee. I do not know whether you can share documentation or whether you would like me to see if I can get the Institute of Physics to submit it to you too as a confidential document. Let me know. Universities UK and Scientists for EU are also compiling a dossier of information. I have that information second hand. I have the information from the Institute of Physics first hand.

The Chairman: If you would like to send a copy to our clerk, that would be helpful.

Professor Dame Jocelyn Bell Burnell: I will ask them to send a copy. The issues for Scotland are writ a bit larger because the Scottish universities play a bigger part in Scottish society than British universities do in the UK. The issue is more acute. I do not know that it is particularly different, except to the extent that every so often the Scots get stropky because people do not realise that things are different there, but you will be familiar with that.

Lord Stern of Brentford: Thank you for the question. Yes, in the social sciences and the humanities it is more difficult. There are one or two indicators of that. Of all the European Research Council grants awarded, the UK has won about a fifth of the total. For social sciences and humanities it is more like a third, so it cuts a good deal harder for them. You

can appreciate that we are having to chase down these numbers quickly, but the picture is pretty clear that the loss of grant income for the social sciences and humanities is potentially much worse. According to the Digital Science report, for education 43% of competitive grant research income is from the EU and for law and legal studies it is 39%. I think that is a strong indication, although again you have to back it up, but it is pretty clear already that resources are a good deal more difficult for social sciences and humanities than the average, difficult though it is potentially for the average.

Q6 Viscount Ridley: Can I follow up on Baroness Morgan's question, because I think you have answered the one I was going to ask? Before I do that, I declare my interests as a fellow of the Academy of Medical Sciences, vice-president of the Conservatives for Britain, honorary president of the International Centre for Life in Newcastle and ownership of a farming business in receipt of EU funding.

I was surprised by how many academics I talked to during and after the campaign who were under the impression that EU funding programmes were available only to members of the EU, even though we made it clear in our report that associate country status was available, et cetera. To what extent have these problems that are emerging and the rumours that we have heard about, and that you have all mentioned, been worsened by the fact that Universities UK, other organisations and leading academics have left an impression with academics that by leaving the EU we will automatically have to leave Horizon 2020, Erasmus and many other projects?

Professor Alex Halliday: The harsh reality is that the Brexit vote was in part connected to the issue of mobility and migration.

Viscount Ridley: That is a slightly different point from the one I am making.

Professor Alex Halliday: It is intertwined regarding these other countries having access to that funding. The alternative models such as the Swiss model, which is hovering there at the moment as to whether they go ahead or not, and the Norwegian model, et cetera, are dependent to some extent on migration.

Viscount Ridley: But that is not true of Israel, Tunisia, Armenia, Georgia, which are all in Horizon 2020.

Professor Alex Halliday: It is true that there are other versions of the model. Getting down to the detail over the next couple of years of a proposal that is going to be acceptable to the UK public as well as what will work for science in delivering that funding is going to be quite a difficult and complicated issue. Most people assume that the UK will not be treated in quite the same way because it is a very, very big fish and that there will be political agendas to try to stop the UK from being seen as though it has benefited from this. There are worries about that. I take your point, Matt, but at the same time there are lots of worries about trying to assume that because it has been done this way in these other countries that will necessarily map on to how it will work out for the UK, particularly when so much concern was being raised about migration in particular.

Viscount Ridley: What I am getting at is that it is not just the Government's responsibility to reassure academics; it is also academics' responsibility to reassure each other on this.

Professor Alex Halliday: Universities have been doing that in spades. Having said that, people are deciding not to come to the UK right now, and they are saying that they are not

going to become a professor at such-and-such university—and we have growing evidence for this—because of what has just happened.

Lord Stern of Brentford: It is an important and fair question. There is a distinction between “not impossible” and “getting more difficult”. There is a clear perception—and it may well be well founded; we will find out—that it is going to be a lot more difficult. There are consortia that were in the process of being put together in which it has been suggested that while the UK group could be associated with it, it could not hold the principal investigator position, which is an attractive one from the point of view of funding.

Viscount Ridley: I pointed out in debates with Dame Jocelyn and others that some countries outside the EU provide more project co-ordinators in Horizon 2020.

Lord Stern of Brentford: There is a difference between things being possible, and examples of where they happen, and life becoming more difficult. I am sure as academics that we will make a big effort to keep associated, but you have to recognise how the behaviour of other people in the EU might be towards us as they think about the probabilities of grants being successful. Putting in research grants is a lot of work. Thinking of the consortium I have put together in France, with others, for an application to the EU, which contains the UK, I think that some of them may be a bit more cautious about who to include. It is that kind of example of it being not impossible but probably more difficult. It is very important to distinguish those two perspectives on this. The examples prove that it is possible, not that it will not become more difficult. That is a real worry.

Secondly, you spoke about rumour, and it is early days for the data, but there are lots of anecdotes that we have to try to build up and understand the collection of better. It is not rumour. These are real stories about real people.

Viscount Ridley: Who said that the plural of “anecdotes” is not “data”?

Lord Stern of Brentford: I understand that, but it is not rumour either. I think you have to be careful with that language.

Q7 Lord Hunt of Chesterton: The other question is whether higher education and research communities and government can take practical steps to address all these issues. All one hears at the moment is slightly tenuous statements by Ministers, particularly Mr Davis, which clearly cause upset. I helped to set up networks in my areas, which continue, and they were from Europe, not just the EU. Surely one of the ways in which the UK scientific community must demonstrate its strength and commitment to collaboration is to push forward and strengthen these networks. Some of the comments are that, even with the existing situation, the research councils do not necessarily regard putting money into these networks as being a particularly good way of spending money. Last night I met scientists who commented there was funding into these networks from the research councils of the EU countries, but it was always very difficult to get it from our research councils. I merely comment. Is there some kind of programme of practical developments that will reassure and keep involving people, because you can do that without waiting for the grants?

Professor Dame Jocelyn Bell Burnell: Can I start a response to that? In Britain over the last five or six years there has been a significant cut in funding from the British Government for science research. Miraculously, British scientists have made that up through gaining prestigious European Research Council grants and the like. We have showed great innovation in that respect and now that source looks as if it is going to be pulled from under

our feet or reduced. Our track record shows that we can be very innovative and have been to a remarkable extent. In my community of astrophysics we were expecting a serious dip in research following the cuts five or six years ago, and it did not happen because we pulled in European Research Council fellowships and professorships right, left and centre.

Lord Hunt of Chesterton: That is money for a few people. In the 1990s the Royal Society had an amazing meeting of European clockmakers, lettuce growers and national physicists to see what these networks were. These networks do not cost a lot of money, but it is those little bits of money that are jolly difficult to get out of the research councils. That is not the money given for superstars; it is money given for a lot of communication. Do you feel that is a practical area?

Professor Alex Halliday: The first thing to say is that science is absolutely international and global. It is no longer so much the lone scientist and, even when it is, the lone scientist needs to talk to people around the world. Europe has achieved so much relative to America over the last 20 years as a result of working together and establishing some major research initiatives that have put it on the map. Of course we all think of CERN but there is also the European Centre for Medium-Range Weather Forecasts, which is based here in the UK and is the best weather forecasting system in the world. It predicted the right egress of the storm that hit New York a couple of years ago and the American forecasting did not. We have this phenomenal capability that has been developed through very clever people working together, networking, and putting together facilities, where necessary, that are world leading. As a country we have done exceptionally well from having our foot in the door and providing leadership for Europe. For example, our leadership of fusion through JET and ITER and UK leadership of the Square Kilometre Array project for studying the universe with radio waves—these and others are spectacular projects. We must make sure that we do not lose access to these and also not lose leadership and influence. I do not know how one does that, because they are only partly related to the European Union, and the question of exit and the degree to which you can use money to solve the problem is not necessarily clear. However, where people had been talking about forming networks in Europe and engaging with or sometimes under the leadership of Britain, they are now thinking about using other partners. We have anecdotal evidence of that. When they are putting forward a proposal for a new network, they are wondering if it will receive more harsh criticism in review from people across the European Union who, frankly, do not see the UK as such a wise partner to involve at this particular stage or perhaps just feel somewhat fed up with the way things are going in the UK.

Q8 Baroness Young of Old Scone: I declare my interest as chancellor of Cranfield University and an honorary fellow at Sidney Sussex College, Cambridge, and in various capacities with conservation bodies that commission research. Can I ask about a parallel funding process that may have the same issues? Lord Stern told us about the split between publically-funded research and business-funded research. There are a number of collaborations across Europe and beyond that are funded by industry equally with the public purse or even funded totally by industry with universities. What effect will Brexit have on those collaborations, some of which can be very major and very long-term?

Lord Stern of Brentford: I am sure that Alex and Jocelyn will come in. There is a perception that the UK economy in relation to Europe has become a secondary market for investors rather than a gateway. If that is what investors are thinking, there is a danger that that

would also apply in some part to research and innovation. It is another example of things becoming potentially more difficult; not disappearing, not going away, just being less of something that really matters. If you think of research to innovation to investment as being an important pathway in a healthy, strong economy, if you make the investment end of the pathway more difficult—and, as I say, it becomes a secondary market rather than a gateway as far as Europe is concerned—it could well have kick-in effects on the earlier stages of research and innovation as well. We do not know. They will not disappear, but there is a risk they will be damaged.

Q9 Lord Cameron of Dillington: I have to declare interests. I am a farmer. I am a trustee of Rothamsted, chair of the Advisory Committee at CEH, and chairman of the Strategy Advisory Board of the Government's Global Food Security programme.

I am interested in what positive steps you thought the UK Government could take over the next four years to sustain the health of UK science. In talking about the ensuring of continued access to EU funding that Lord Ridley was talking about, the hosting of EU institutions and research facilities and driving opportunities, perhaps Lord Stern could put some flesh on the bones of his problems with China and India, and say what the Government could do to drive an agenda with other countries, not only BRIC countries but the developing world, the opportunities in Africa and so on.

Lord Stern of Brentford: Relations with China and India, being the two most populous countries in the world and the two fastest growing among the major economies, are extremely important. We should be investing in those relationships anyway. I do not see the relationship with Europe being a conspiracy against relationships with India and China and that a reduced relationship with Europe would mean an increased relationship with India and China. That is not a logic that I would follow. All three are very big potential sources of markets and ideas. China is moving very rapidly as part of its 13th five-year plan to increase its investment in research and innovation. It is very important that we invest in those relationships. As an academy we do exactly that. We have close relationships with the Chinese Academy of Social Sciences. Those inter-academy relationships are going to be very important around some of the difficulties created by Brexit, inter-academy relationships both in Europe and outside. It seems to me that China, India, Africa, Latin America and Asia more generally are of enormous importance to our student body and our academic researchers. That has been clear for a very long time. Many of us have been working very strongly in those parts of the world. It continues to be true. I am not sure how far Brexit makes that any truer. It should have been obvious to us all anyway. We work very carefully and closely on that. Personally, I spend a lot of time particularly in India and China and will continue to do so. Let us not see those things as being alternatives where the relationship with Europe going down automatically means we go up in the others. We should be going up strongly in those relationships anyway.

Professor Dame Jocelyn Bell Burnell: One of the things I have done in the last week or so is to write to 25 or 30¹ academies around the world as president of Scotland's national academy, stressing that we want to continue to work with them and that, as far as we are concerned, it is business as usual. I am happy to say that I have had a lot of positive responses. Academies can do things like that. There is a soft power network around the

¹ A subsequent count showed the number to be almost 90.

world of academics and academic institutions, regardless of the political ones, and it is surprisingly strong. At one level I am optimistic. I am a bit concerned about the funding, however.

Professor Alex Halliday: Briefly, we need stability in what the UK—both the Government and universities—does, and right now everything is shifting. Stability is needed, because when you hire an academic you are doing it for 20 or 30 years, maybe longer, and you are planning research around a particular individual. We are doing this with multiple individuals across multiple universities. If the framework for doing all this stuff suddenly changes, or we do not know what it is going to look like, people will have second thoughts about whether to come to the UK, and universities will have second thoughts about whether they can afford to develop this exciting new programme that would have been world leading because there will not be the funding for it. Things are finely balanced. There is a myth that universities are awash with cash. Some may be making some money at the moment, but many universities, in particular the major research-intensive universities, are borrowing money because they are so short of it. There is a lot of money coming in, but it is money in/money out and the bottom line is barely sustainable. When you are faced with uncertainty like this, it sends a shock wave through the system, which I think we need to deal with as quickly as possible and produce some stability, both from what the Government says to the world and what we as universities do to try to influence that effectively.

Viscount Ridley: Dame Jocelyn mentioned GMOs as an example of where we could escape restrictive regulation. Are the academies drawing up lists of other examples like that? The General Data Protection Regulation, which comes in in 2018, is scaring a lot of the digital industries in Europe. Is it worth putting together a list of regulations and directives coming out of Europe so that, once we are not in, we can be more nimble and innovative as a result of not applying those.

Professor Dame Jocelyn Bell Burnell: As far as I am aware, GMO is the only one with a question mark against it. Speaking with a Scottish hat on, even that is slightly ambivalent, because the Scottish Government does not want GMOs but the UK as a whole is now turning towards them.

Professor Alex Halliday: Data regulation is clearly an issue that Europe has been looking at. In some areas, such as a data-mining, the UK has been much more like America. There are aspects of Brexit that will allow us potentially to look at this differently. Having said that, we still have to work within Europe. We are not suddenly going to become a separate island. We are going to have to work with these other countries and would like to try to influence how regulation is done in those countries. To some extent it makes it harder for us rather than easier.

Lord Stern of Brentford: We have to recognise that the UK on the whole, by most measures, is a rather less regulated place than elsewhere. It may be doing well, to the extent that it does, in part because of that. I do not think that regulation is a great problem overall in the UK, but it is important to be watchful and careful.

Let us not lose sight of the very big issue. We are badly underinvesting as a country compared to our competitors in research and innovation. I gave the numbers at the beginning. The Brexit story makes that still more pressing and important. We work very hard to keep the quality up. For example, Alex and I are working on the review of the research excellence framework. Our quality is very high. You do not have to be a professor of

economics at the LSE to work out that if you have a sector that is very productive in its use of resources and is very important to future growth—now even more so—that is where we should be investing more. That is the biggest message that I hope this Committee can give to the Government in this context.

Q10 Baroness Young of Old Scone: Measuring all this and monitoring the impact is going to be really important. I know that the Royal Society did some analysis of some of the key parameters pre-Brexit. Are there some very important lead indicators that we should be monitoring? Is the Royal Society planning to do that on an ongoing basis?

Professor Alex Halliday: A team at the Royal Society under Dr Julie Maxton the Executive Director has been meeting every day to talk about what we do next and how we deal with the situation. We produced three reports prior to the vote: one on the impact on funding, one on the impact on mobility and a third on regulation. That database is still there. Monitoring what is happening now, apart from some anecdotal work, as the data and information build up, will be quite important for an organisation such as the Royal Society—but it could also be BEIS, and BEIS has offered to engage with us—to monitor quite closely and systematically across the UK what is happening with the success of research funding and people turning down contracts and thinking about leaving, et cetera. However, we should not wait to see the data unfold. We should plan the “what if” scenarios quite aggressively now. I am particularly worried about facilities and making sure that we have a clear understanding of our position on some of the world-leading facilities that are based here, or we have access to, or are connected to in Europe, so that we do not lose our competitive advantage in those areas.

Lord Stern of Brentford: We must act on the risks as we see them now before all the data comes in, as well as doing our best to collect that data. Perhaps the most important of those risks that we can act on is to give clear reassurance now to those people who are already here that their position is secure.

Professor Dame Jocelyn Bell Burnell: A number of the indicators will have a lag on them, such as publications, patents and spin-outs. The more immediate indicators will be to do with research income and the number of overseas academics and researchers in Britain. That will give us a more immediate signal.

The Chairman: You have given us some very helpful and clear advice. We take away some very clear messages. This country has a history of underinvestment in science but nevertheless has maintained high quality by our innovation and the quality of our science. Brexit clearly puts a lot of the sources of funding at risk. You have also given us a very clear message that UKRI could be an important source of clear, analytic, strategic advice in the approach to co-ordinate our science. I am certain that this Committee will wish to talk to Jo Johnson and John Kingman in the future, and we will certainly return to that as we look at the longer-term approach to the strategic issues that you have set out so clearly. I am sorry that we ran out of time. We could have extended this much longer to our great advantage. Very many thanks to the three of you for helping us this morning.