



## Select Committee on Science and Technology

### Corrected oral evidence: Science research funding in universities

Tuesday 21 May 2019

11.25 am

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Members present: Lord Patel (The Chairman); Lord Fox; Lord Griffiths of Fforestfach; Lord Mair; Lord Maxton; Baroness Neville-Jones; Lord Oxburgh; Lord Renfrew of Kaimsthorn; Lord Thomas of Cwmgiedd; Lord Vallance of Tummel.

Evidence Session No. 2

Heard in Public

Questions 9 – 16

### Witnesses

Dr Sarah Main, Executive Director, Campaign for Science and Engineering (CaSE); Dr Andrew Welchman, Head of Neuroscience and Mental Health, Wellcome Trust; Hannah Davies, Head of External and Public Affairs, Northern Health Science Alliance; and Professor Wendy Baird, Faculty of Medicine, Dentistry and Health Director of Research and Innovation, University of Sheffield.

### USE OF THE TRANSCRIPT

This is a corrected transcript of evidence taken in public and webcast on [www.parliamentlive.tv](http://www.parliamentlive.tv).

## Examination of witnesses

Dr Sarah Main, Dr Andrew Welchman, Hannah Davies and Professor Wendy Baird.

Q9 **The Chairman:** Good morning, ladies and gentleman. Thank you all for taking the time and making the effort to come to help us today with this inquiry. Before we start, it would be helpful if, starting from my left, you could say who you are, so we get it on the record. If you represent any institutions, feel free to do so. If you want to make a short introductory comment, feel free to do so. We are now on live-streaming broadcast.

**Dr Sarah Main:** Good morning, thank you for inviting me to give evidence to the Committee. I am executive director of the Campaign for Science and Engineering. It is an independent advocacy group representing the breadth of science and engineering in the public, private and third sectors in the UK. About 120 science- and research-led organisations support us. Among those, 54 are universities of a variety of research intensity across the UK. Our members employ about 330,000 people in the UK and our industry and charity members invest about £32 billion a year globally in R&D.

My opening statement is that our interest is representing the richness and diversity of the science base in the UK, of which universities are a vital part. They need people, funding and support for collaboration to thrive, and each of those face uncertainty at the moment. Therefore, we believe that all policy decisions need to be carefully considered, particularly to assess the differential impact on research and innovation in the UK.

**Dr Andrew Welchman:** Good morning, and thank you for the invitation to be here. I am head of neuroscience and mental health at the Wellcome Trust, where I manage a portfolio of about £500 million of science investment that seeks to understand the brain. I also hold an academic post at the University of Cambridge, where I run a laboratory that uses human brain imaging and machine learning to understand the parallels between biological and artificial computation.

I am attending today on behalf of Wellcome. Just to give you some background on me, I have previously worked at the Universities of Newcastle and Birmingham in the UK and at the Max Planck Institute in Germany. Support for my research laboratory and students has come from UK research councils, charities and the EU, so the experience I bring to the committee is from having run a successful laboratory and from managing strategic science investments for a major international funder.

**Hannah Davies:** Hello, and thank you for having us here. I am head of external and public affairs for the Northern Health Science Alliance. The Northern Health Science Alliance is an alliance of the top research-intensive universities across the north of England, their associated NHS teaching hospital trusts and four northern academic health science networks, so we represent the health research system across the north of England. We were named in the life sciences industrial strategy sector

deal as a delivery partner. We have been awarded a northern powerhouse in health research and science innovation audit and represent that ecosystem across the north of England, which includes more world-class universities than in France, Italy and Spain combined.

**Professor Wendy Baird:** Thank you for inviting me here today. I am the director of research and innovation for the faculty of medicine, dentistry and mental health at the University of Sheffield, which I am representing today. It is a large northern university, with 29,000 students from 149 countries, with 8,000 staff and an annual R&D income of about £200 million across a variety of funding programmes.

I am also director of the NIHR Research Design Service for Yorkshire and the Humber, which has a role in developing and supporting high-quality applications for applied health and translational research throughout Yorkshire and the Humber. I am also here today as a member of the NHS council.

Q10 **The Chairman:** Thank you very much. I will kick off with the first question. What do you think are the current challenges that universities are facing in developing and conducting high-quality research?

**Hannah Davies:** I can start from a northern health research perspective. The north has a great many strengths in health research, particularly in areas such as clinical trials, health economics, med tech, and ageing—which is one of the industrial strategy grand challenges. The north has also been historically underfunded in public health research.

To take some of the facts and figures, in the latest round of NIHR biomedical research centre funding, which was £816 million, the north got £55 million, which was 6.7% of the entire pot; the south-east got 83% of that funding. Of all public funding into health science research, the north gets only 13.5%, whereas the south-east gets about 60%, so we are historically underfunded in that area. It is also important to recognise that there is phenomenal expertise across the north of England, so there is a lot of capability to be funded.

There is also a greater need for research in health across the north of England, where people are likely to die a fifth younger than those in the rest of the country. The health difference between the north and south of England is two years in life expectancy, so there are a number of issues there.

Interestingly, public-private sector funding in health science research and development in the north of England is at 20%, so the private sector is leading this, because of the great diversity of experts and the whole ecosystem of health science research across the north of England. One of our main challenges is the lack of funding, and historical underfunding, which does not match what private investment holds. Looking at the biomedical research centre funding, there is a large discrepancy.

**Dr Andrew Welchman:** I think about the sustainability of the financial model. There are significant questions about how universities are going to be funded for all their different activities into the future. We have seen

the change in research funding through UKRI but it is still quite early days to understand what the impact of that would be. There is of course additional uncertainty around Brexit, not just over a loss of access to research money from the EU; there are also significant concerns about access to collaborations and to research data. If we are thinking particularly about the importance of AI and machine-learning approaches in the current era, the UK, with a population of 66 million people, is never going to be competitive by itself in comparison with China with 1.3 billion people. So we have significant questions about access to not only financial but intellectual resources.

**Dr Sarah Main:** The challenge of the decade, and indeed of the generation, for universities is to meet the ambitious goal of the UK Government to substantially drive and increase our research intensity in the UK, where universities are the key driving force of that change, at a time when there is significant uncertainty and there are challenges in the sorts of areas that have been mentioned, including the research landscape for the institutions to which universities can turn for funding, the types of funding that are available and the types of research that are being funded—that is, the nature of what can be funded. There are significant challenges in attracting the quantity and quality of people needed to deliver on those targets, all of which, as the Committee has identified, are impacted in some way by the implications of Brexit for science and engineering, both in the short term during the implementation period and in the longer-term future relationship with Europe.

- Q11 **Lord Fox:** Let us leave aside the regional disparity issue, which clearly is something that will concern you—I come from Herefordshire, where we have no universities, so our situation is rather more serious even than in the north—and look at the general system of finance rather than the specific regional divvying up of that money. This is a big opportunity for you to set out what you think is the current state of public funding for scientific research in universities. How have the levels changed? How is the balance between QR funding and project funding, which we heard about in the previous evidence session, affecting your particular constituencies? How does public funding for research and universities compare with private funding? From a public policy perspective, how should we view the role of charity and private funding versus public funding? How much should we allow that into the formula, how much should we take it for granted and how much should we, in a sense, treat it as icing on the cake for the organisations that you represent, if you follow what I am saying?

**Dr Sarah Main:** May I start with the macro picture? I am sure that more detail will be provided by the other panel members. At the Campaign for Science and Engineering, in response to this sort of question, we have looked at the last 10 years of publicly available data from the Office for National Statistics on gross expenditure on R&D. The lines of data can be a little complex because of what is included under each heading but, in broad terms, funding for research in the universities from public sources over the last 10 years has remained relatively flat, while funding from

private sources has gone up. Those private sources include a range of sources within them from industry based in the UK and overseas, from the EU and from overseas universities.

**Lord Fox:** So you count the EU as private funding in that particular situation?

**Dr Sarah Main:** It is not me who does it, it is the Office for National Statistics.

**Lord Fox:** Sorry, I mean that it is counted as such.

**Dr Sarah Main:** It is indeed. We know from separate analyses that the level of funding from the EU for research in UK universities has been on a steady rise over the last 10 years. A Campaign for Science and Engineering report a few years ago showed that it was the only substantial rising income stream in universities in the period 2010-2015. It is a bit difficult to disentangle but I think that lift in private funding for R&D in universities is related in fairly large terms to the EU.

**Lord Fox:** Do you have a sense of the percentage of the private funding coming from EU sources?

**Dr Sarah Main:** In the ONS data, funding from overseas, funding from different types of EU sources and foreign direct investment of other types are not disentangled, so I am afraid that that is a little difficult to untangle with what I have. On the percentage into universities, I will check with our earlier report but I believe that that income stream rose to be roughly 10% overall of UK university income streams coming from the EU, on average.

**Dr Andrew Welchman:** I would like to add something from the charity perspective about why Wellcome funds UK science. We have an existing mixed economy that covers a range of different ways of doing things. That is very valuable for us because, for us as an organisation that funds successful and competitive projects, working in a system where universities have the freedom to exploit their strengths and develop ideas so that they are then ready to come to Wellcome to be looked at is very valuable. If influencing that ecosystem too much makes it too unstable, that will raise questions for Wellcome as an organisation about where we are going to get the best value for our investment in research.

**Lord Fox:** So your charter is about getting best value ahead of supporting UK research?

**Dr Andrew Welchman:** We are a global funder. We can and do fund across the globe. For the last period the UK has been a very good place to do research. We get very good value for our investment in the UK.

**Lord Fox:** But we should not take that as a given.

**Dr Andrew Welchman:** No, because we have a global remit and are looking for good value.

**Hannah Davies:** SME grants for small innovative businesses make up 45% of UK receipts to date from Horizon 2020. In the north of England,

where the private sector plays an important part in funding research and development, that is very important and will be missed.

**Professor Wendy Baird:** Some 90% of businesses in the north of England are SMEs, so that is quite a substantial contribution to the economy. In relation to university funding over the last six or seven years, the flat funding from government sources really equates to a 13% decline. Being able to balance those, and having a mixed economy when it comes to the sources of funding that we are applying for, enables us to plan and manage that financial instability. The potential changes to EU funding and so on mean that there is a risk of destabilising the system. As my fellow panel member said, micromanaging some of those changes creates a bit of a threat and further destabilises the universities' ability to manage those risks.

**Lord Fox:** Have you already seen any changes in the past 18 months, or is it still chugging along in the old way?

**Professor Wendy Baird:** We are still managing to work in terms of the crossflow of funding between different parts of the economy. While we are able to do that, it provides flexibility to plan strategically. That is the real advantage of having the stability of QR-type funding: it gives you the long-term flexibility to plan and to think about the sustainability of certain research and priority areas, supporting early-career researchers and retaining them so they can translate to independent researchers and to attract their own funding into the university.

**The Chairman:** Professor Welchman, to be clear about what you said, Wellcome is currently a major funder of research in the United Kingdom. If I understand what you said, it is the quality and strength of research that is publicly funded in universities in the United Kingdom that attracts your funding, but if that were to weaken in any way, your funding to UK universities would be at risk.

**Dr Andrew Welchman:** I think we would ask ourselves hard questions about where we were spending our money. Our mission is to improve human health. We will always ask ourselves whether we are getting a good return on our investment in that system. Within biomedical science, about 25% of the research expenditure is in the UK at the moment, but we already have significant overseas activities. We just look at the case to say, "Are we making the progress that we want to? Are we working in a system where we get good value from the investments that we make?"

**Dr Sarah Main:** I will briefly supplement the answer to Lord Fox. The organisations that are members of CaSE include FTSE 100 companies and companies headquartered overseas. They will make similar decisions in similar ways. We often ask them why they invest in the UK and what influenced those decisions. The strength of the UK's research base is always the primary motivation for locating in the UK. Therefore, the strength of the UK's universities over the next decade will be essential to support wider industry, R&D investment and charity R&D investment, which Lord Fox asked about.

**The Chairman:** Professor Mair. Sorry, Lord Mair.

**Q12 Lord Mair:** I am happy to be either. On the ambitious 2.4% government target, much of it will come from business and industry. Do you think universities are getting more successful at bringing in income from non-public sources, from industry and business? What do universities have to do to improve?

**Dr Sarah Main:** From conversations that I have had with our university members in recent years, I have certainly noticed that many leaders of university strategies will often be mindful of the government's goals with the 2.4% ambition and the industrial strategy challenges articulated as part of it. I notice that universities are responding to the notion of trying to address societal challenges in consortia and collaboratively across disciplines, both within the universities and externally. I have certainly noticed attention being paid to that agenda.

Alongside that, over the past few years, the changes in the REF examination exercise to place importance on impact have demonstrably make changes in how universities express their outcomes. I am afraid that I do not have data on change over time but I have a snapshot of data at least from a report that the Campaign for Science and Engineering commissioned in about 2014, conducted by the economists Jonathan Haskel and Alan Hughes.

One piece of their analysis is pertinent to this point. They looked at the external income generation by all universities and compared that with external income generation by the top 10% of universities, assessed by research funding. The top 10% of universities by research funding win 62.5% of total research income in the year. They attract 45% of total external income—a very large share of total external income. That is different in nature, so it includes income generated by collaborative research, contract research, consultancy and intellectual property, but also things such as continuing professional development.

That demonstrates the strength the strength of those research-intensive universities, but also that of the other 90% of universities, which win only 37.5% of total research income but account for nearly 55% of total external income generated. When you delve into that, as the report did, it shows the great diversity of universities in the UK, which attract external income for different reasons appropriate to their different missions, which perhaps other panel members can expand on.

**Professor Wendy Baird:** Yes, that is certainly our experience. My experience as an academic over the years is that there has been a shift in focus in terms of working with industrial collaborators. At the University of Sheffield, we have significant experience of working with industrial collaborators: large multinational companies such as Boeing, Rolls-Royce, Unilever, GSK, AstraZeneca, et cetera.

That has built on our multidisciplinary work across the five faculties to address significant issues in, say, health. Another aspect is that industry is coming to us because of the world-leading research within the university. Industry does not have the expertise itself: they come to us seeking it so that they do not have to invest in that but we can work together collaboratively to pull it through from discovery through the

basic science route and the translational research into the wider benefits for both patients and wider society.

It is about that culture. The CPD element has already been mentioned. It is also about cultural change in the academic community to understand the working relationships with industrial partners. We have different agendas, different ways of working, and it is about supporting them to understand how to manage those relationships: the pace at which they want to work versus the pace of some of university contracting systems is often a barrier to some of those collaborations. We need to upskill some of the staff to understand those elements of collaboration.

**Lord Fox:** Coming back at that interesting statistic of the 10% and the 90%, if we are to make the 2.4% increase—this is a tough question to answer—where is the most scope to increase that money? Is it across the board, so we increase the 90% and the 10% equally in proportion, or is there more scope for expansion within the 90% or at the high-level, high-performing 10%? Where is the scope?

**Dr Sarah Main:** If I may answer on the macro level, it is a critical question given that we are already two years into a 10-year strategy. There must be multiple ways to achieve it, and I am sure that UKRI, government and the Treasury are considering them. Numerous Science Ministers have said that a road map will be published to express which strategy they wish to pursue, but one has not yet been published.

**Lord Fox:** I wondered whether we might help them by our discussion.

**Dr Sarah Main:** Conversations that I have had with a number of officials point to the fact that you can achieve different types of things with the ambition to reach 2.4%. The road map is one thing. Another that might be helpful is a clear vision of what the Government wish to achieve for society from this goal. Elements of that have been expressed but we have not been given a lot of detail, and that would have an influence on which strategies one pursued.

From a purely economic point of view, one can see that private investment in R&D at the moment accounts for roughly two-thirds of our total gross expenditure on R&D. Attracting further foreign direct investment, either from companies already based here or by attracting companies that spend a lot of money on R&D to a new location, would be a way to make progress in fairly large steps. However, there may be flight risk associated with that; it is a challenge in itself to attract that investment inwards, and there may be risks of it leaving. A parallel strategy would be a homegrown one, nurturing businesses that are rooted in the UK to develop and grow.

Both a vision and a road map that articulated the public element of that plan would be extremely helpful in sending a signal to the wider world of the UK's intent and perhaps to start to attract that foreign direct investment. In parallel, such a statement should win the support of departments across government, which account for roughly one-third of our public expenditure on R&D and are responsible for stimulating and usefully using a great deal of research from the base.

**Baroness Neville-Jones:** Before I ask my question, I should declare an interest: I am on the council of Lancaster University. I would like to pursue what Professor Baird was saying about collaboration with industry, which seems to be one of the features of the scene in Sheffield. How much would you say that having the advanced manufacturing catalyst there has been instrumental in bringing about that kind of collaboration? Do you think it has the capacity for a greater expansion of those relationships?

**Professor Wendy Baird:** We have a long-standing history of working in collaboration with industry from the health sector through to engineering, so we had a clear vision and existing relationships. Using the model of the University of Sheffield Advanced Manufacturing Research Centre (AMRC) to build future collaborations is something that we are looking at currently. Having that clear vision of the Government's strategy in relation to UKRI would enable us to attract industry into those collaborations. At the minute, it is quite challenging; we spend a lot of time building speculative, prospective, potential relationships with collaborators around broad themes without real clarity about what those collaborations are going to look like. That is a rather time-consuming exercise on both parts, and you end up losing some of those partnerships because of the delay in getting that clarity. Help with getting that clarity would be welcomed by both the academic and the industrial collaborators.

**Lord Fox:** My question goes back to the previous point, so I do not know if Baroness Neville-Jones would like to follow up on hers.

**The Chairman:** We can go back to Baroness Neville-Jones later.

**Lord Fox:** Going back to the idea of attracting foreign direct investment into research, and this goes for SMEs and others as well, am I right in saying that in order to help make the 90% as successful proportionally as the 10% are at getting that money, one of the factors is getting a very clear indication from the Government about what their road map is and the other is the Government's own behaviours? I think that Hannah Davies was going to add some more on that.

**Hannah Davies:** Yes. In a sense, some road maps have been put in place. The science and innovation audits have identified a few of those areas that—

**Lord Fox:** But they have been variable across the regions, have they not? They are done in different ways by different organisations, I think.

**Hannah Davies:** They have, but they have been used as a catalyst. They identify strengths, which can be used as a catalyst for attracting other investment for working with industry. Leeds has a science and innovation audit in medtech, which has been powerful in mapping out the medtech industry there but also in attracting new industry to join that network.

**Lord Fox:** To understand that: they are helping towns, cities or regions understand what they are already good at and then finding better ways of presenting that in terms of bringing money in.

**Hannah Davies:** Yes, that is why you need that place-based approach. It is about identifying what is already there and what opportunities there are. Newcastle has been good with that, with its Institute for Ageing and its support for Science Central, which is an incubator for different health research-based companies. So it is about looking at where the strengths are and helping to support the sector there. Science innovation audits and various other routes mapped out by the Government have identified those areas. If you are going to reach that 2.4%, you need to go outside the south-east: perhaps Hertfordshire has expertise in one area, or perhaps there is something in Durham that can be built upon. You need to take that place-based approach to allocating excellence and looking at how you can work with what is there and grow it to attract industry and investment. It cannot all happen in the south-east, nor in the same areas where it has already happened, because it is too saturated.

Q13 **Baroness Neville-Jones:** I will move on to the next question. UKRI has been mentioned, and I would like to pursue a bit further what your views are on its effect so far and what you think might happen in future. It is worth saying that the creation of the UKRI board has coincided with both the changed status of the research councils themselves and the emergence of the Government's industrial strategy. What experience have you had so far? Dr Welchman, you rightly said that it is early days. Nevertheless, what have you observed about the effect that the new system has had on the kind of research being funded and the ease with which you can get a grant—the application process? Another aspect is: do you think any change is taking place in the balance between translational research and what used to be called "blue-sky", fundamental research? I would be interested in your reflections on what you think is under way and what you think about that. What do you make of it? Who would like to start?

**Dr Sarah Main:** Thank you, Lady Neville-Jones. I do not have insight, though maybe other panel members will, into the experience of applying individually to UKRI for grants. I have noticed, as I think I mentioned in answer to Lord Mair's question, that when I speak to a range of universities across the country, they may well be quite purposeful in trying to respond to the challenges that the Government have established in the industrial strategy challenge fund. So I notice both thematic attention being given to that but also a degree of change in the structure of research bids to become more consortium-based.

**Baroness Neville-Jones:** So it acts as a pull factor regarding what people apply for and what they want to do?

**Dr Sarah Main:** I have noticed, internally within universities, leading figures encouraging their departments to try to create consortia or collaborations internally within universities which might play to their strengths in response to the challenges. Some universities have expressed that formally in external strategies while others have picked it up internally. As you know, the long-standing routes for funding research through the dual funding system of QR and research council funding are

still in place. Substantial additional money is being put in, most of it under the challenge heading.

There is perhaps a little bit to be untangled when it comes to how universities will respond to that over time. Were UKRI to respond to this question, it might be at pains to point out that both blue-sky and applied research may be used to address some of these challenges, so it is conscious that the challenges are not represented as purely applied. My perception, when I am talking to people at different ends of that spectrum, is that what usually happens is that the people who work in more fundamental research think that the applied people are getting everything, and the people who work in applied research think that the people in basic research are getting everything. So there may be a bit of a communications challenge around this. In reality, there is a system of QR and research council funding that has been under pressure for some time.

**Baroness Neville-Jones:** I think QR is under pressure.

**Dr Sarah Main:** It is, and it has been held flat for some time because government department budgets have been under pressure. Now this additional money comes in that has a very specific nature and character, so the proportions are changing and that will probably have some effect on behaviours. QR as a proportion of total research expenditure in universities has dropped from about one-third to about one-quarter over 10 years.

**Professor Wendy Baird:** I would say, from my 10 years of supporting people making applications to NIHR, that it takes the community a bit of time to adjust to changes to funding programmes. I think we can see that the institutions are aligning their strategies and processes to the new structures that are being put in place. For example, in Sheffield we have created four new research institutes: one on healthy ageing, one on neuroscience, one related to plants and food, and one related to energy. That has probably come as a direct consequence of the changes in the wider ecosystem. They are all large multidisciplinary groups of leading experts across the university, and that has been supported to help them to develop those sorts of external collaborations in putting in these types of applications to UKRI. A single researcher on their own cannot put in an application on the scale being asked for.

Another thing that is slightly challenging when it comes to responding to the new changes, and this is apparent with many other funding programmes right across the public and private sectors, is the increasing expectation that the universities will put in match funding. That is a challenge when everyone is expecting significant levels of match funding. With regard to UKRI, when you are looking for match funding from an industrial partner, for the large multinationals there are several layers that they have to go through in order to get that approval, and within the six-week timeframe that is often not possible. The small ones have less complex approval systems to make the decision, but they do not have the money. Matching in kind is easier for both universities and the

industrial partners to do, but actual hard cash is slightly more challenging for people.

**Baroness Neville-Jones:** To pursue that for a moment, I have the impression, and tell me if I am wrong, that there is a danger of some of this REF money coming and being a loss leader for a university; in other words, it is very important for reputation but actually there is no money in it and it has to be cross-subsidised from teaching or other sources of revenue for the university. The question in my mind is whether that is sustainable over the long term when it is deliberate policy not to fund the whole thing.

**Professor Wendy Baird:** Yes. The 30% shortfall in research funding that is evidenced by fEC is a substantial challenge for universities, and there is a system of cross-funding. I think you are absolutely correct: there is an element of prestige from some of the funding that is awarded helping to attract further additional investment and leverage additional income from industrial partners.

**Baroness Neville-Jones:** I think that is what the Government are seeking to achieve.

**Professor Wendy Baird:** But it is about having the space and the flexibility to do that and the pace to keep up with the ability to financially manage.

**Baroness Neville-Jones:** I also suggest that it is bound to affect the kind of work that is done.

**Professor Wendy Baird:** That is right. Universities will follow funding that is linked to their strategic priorities and the priorities of the staff. They are not going to go after funding where they do not have the expertise.

**Baroness Neville-Jones:** No, although there is clearly a spectrum within which expertise can operate.

**Dr Andrew Welchman:** On the point about balance, the balance that I would see is between the challenge-led approach and the much more bottom-up approach. Both of those will be important because the grand challenges of tomorrow are going to come from those seeds, and one of the real values of the QR system is to allow universities to play to their strengths and build up those ideas, and to nurture them to a point at which they can come in for funding from larger schemes.

**Lord Fox:** How much further can QR proportionally fall before the whole system—the balance between QR, match funding and project funding—collapses? The sense that I got from the previous evidence session, and from what you have said, is that at the moment it is stretched but it is getting through. How much more pressure can it take before the whole thing begins to fall off the rails?

**Dr Sarah Main:** To answer that question would take quite a bit of analysis. The answer will vary enormously across the UK science base and its university base. I noticed that even in the previous session, with only two witnesses, there were considerable differences in their

assessments of the role of QR in the universities, and that goes even wider across the whole university space. I notice that even for universities that have much smaller research activity, QR can be enormously valuable and they can achieve a great deal with relatively small sums. Because of the fact that other types of income streams may be more relevant only in certain disciplines or types of research, significant reductions in QR will have a differential impact on certain disciplines, certain areas of research and certain places in the UK.

**Lord Fox:** It is hard to be specific but which areas or regions will be relatively worse off—which types of disciplines, which regions and which types of organisation, do you think, if QR continues to be pushed down?

**Dr Sarah Main:** I will not answer that question directly. Were you to try to analyse that, an important factor to consider would be in what respect you would consider them worse off—in terms of their contribution to civic society around them, such as the local economy, or in their success rate in winning external competitive awards? The Wellcome Trust has done work to illustrate the different types of things that QR can be used to fund. To do a proper analysis of that, one might take each of those different types of things: providing a platform, enabling researchers to compete for more competitive external research income, supporting early-career researchers, innovation and connections with local skills base and so on. There would be different outcomes for the different purposes for which QR was used.

**Dr Andrew Welchman:** On top of that, I would add the physical infrastructure. Providing the pieces of equipment that are essential for scientific development is a key enabling function. My sense from the analysis that Wellcome conducted on QR spend is that an awful lot of that money is used to support physical infrastructure within universities. It is not something that Wellcome as a fund does a lot of, and my understanding is that UKRI has limited sources of money for it too. If we get to the situation where universities cannot make the strategic choices of where they want to invest and the facilities that they want to invest in, we are going to see a decline in the physical infrastructure of those universities.

**Baroness Neville-Jones:** I do not think other funders want to pay for that bit either, so it becomes a real problem. For universities that do not have endowments or some source of their own, it is a deterrent to entering the scene.

**Dr Andrew Welchman:** If you look at the international landscape, you see major infrastructure investment in China, Germany and the US. We need to see the research that is able to be conducted in the UK in the wider context of that landscape.

**Baroness Neville-Jones:** If I may say so, Lord Chairman, it is an important part of what we are looking at—not to ignore the business of how research funding is distributed among the tasks involved.

**Professor Wendy Baird:** I just wanted to add to the conversation about the infrastructure. It is also really important to consider maintaining the

infrastructure that we fund and capital investment. It is one thing getting the money for it but another maintaining it in the long term. For example, the NIHR funded the biomedical research centre in neurology in Sheffield for £4 million, but alongside that, we committed as an institution—between the university and the local trust—to fund a PET MRI scanner at the cost of £11 million as matched funding for that application. That is a significant investment from the trust and the university. Alongside that, a substantial amount of money was raised by the public to support that initiative in neuroscience research in Sheffield. We are about to open that building, but it is now about finding money to sustain it and maintain the equipment, which will be a step change in our ability to conduct neuroscience research.

**Baroness Neville-Jones:** As well as funding for future projects, otherwise it is a very expensive one-off.

**Professor Wendy Baird:** Absolutely: it is not intended to be a one-off; we have a lot of strength in imaging.

**The Chairman:** Professor Lord Mair.

**Lord Mair:** Lord Chairman, my question on the QR funding dual support system has been covered.

**The Chairman:** Professor Renfrew, Doctor Renfrew—Lord Renfrew. I am in academic mode today.

Q14 **Lord Renfrew of Kaimsthorn:** Thank you. The Government are committed to a target of 2.4% of GDP invested in research and development by 2027, but is it clear how much of that work is likely to be undertaken in universities?

**Dr Sarah Main:** Internationally, there is a rule of thumb. Many nations with similar research economies to ours have roughly a one-third to two-thirds ratio where public funding accounts for about a third of research activity and the private sector accounts for about two-thirds. Most of that public funding is executed in universities—some of it is in government institutes. In the UK at the moment, the proportion has been moving slightly closer to a three-quarters to one-quarter model. Business accounts for slightly more than that at the moment.

In terms of delivering the target you mentioned, growing research in universities will be both an essential part of the public element of investment in R&D, on which we would like at least a five-year commitment to be made in the next spending review, and vital for attracting the other types of research and innovation investment that account for the rest of the total. The private and charitable sectors tell us—this is cited in many reports—that the strength of university research is their motivator for locating their research business. They are looking for excellence in whatever is the relevant area to them.

They are also looking for talented people, who arise from such university research environments, to become part of their workforce, so physical proximity and the creative and cutting-edge excellence are critical factors. To quote one industry member: “We want to see the UK taking a

strategic decision to maintain and build basic research strength. Basic research provides us with the tools for our business to be cutting-edge and competitive internationally. This is only possible if there are people in the UK funded to do cutting-edge basic research". That illustrates the fact that, internationally, our basic research is seen as a distinctive strength.

**Lord Renfrew of Kaimsthorn:** That is very important. Do you think then that the connections between universities and the private sector need to improve radically?

**Dr Sarah Main:** I think they have improved enormously and continue to do so.

**Dr Andrew Welchman:** I think that those lines between pure university research and private sector research will become increasingly blurred. The locations I think about that exemplify that best at the moment from my knowledge are the biomedical research and innovation area around Cambridge and the Knowledge Quarter in London, where we are seeing convergence of a number of key individuals located both in universities and in private sector organisations.

One area where EU programmes have been successful is in bringing SMEs and third sector organisations together with research training, producing a workforce which can switch between private sector, universities and the third sector. I envisage that becoming increasingly important, precisely because those companies see the benefit of having that knowledge base. That locates them, and I think we will increasingly see a cohort of very well-trained, clever people who can go back and forth between sectors.

**Baroness Neville-Jones:** I think fewer and fewer companies engage in basic research. We have a few pharma companies and some defence companies. There is not much else in this country.

**Dr Andrew Welchman:** Again, I would point to the success of working with SMEs that I have seen through European framework programmes, which have explicitly tried to drive that. Companies that do not have the resources to have their own R&D arm then get the exposure to cutting-edge research and allow it to shape their thinking and business models.

**Hannah Davies:** The fact that health innovation has been recognised as a prime capability of the north demonstrates that, out of necessity, we have worked collaboratively with SMEs and continue to do so. That interdependent relationship is really important.

**Baroness Neville-Jones:** Is that growing, do you think?

**Hannah Davies:** Yes, it is growing. There are centres located in the north, such as the Centre for Process Innovation in County Durham. That is helping industry see the value of the expertise available.

**Baroness Neville-Jones:** That should be a comparative advantage for the north, should it not?

**Hannah Davies:** It is. That is why we have more private sector funding in the north than public funding.

**Baroness Neville-Jones:** What are the proportions?

**Hannah Davies:** Some 20% of R&D funding of health research across the UK is in the north, and that is from the private sector; whereas the public sector equivalent is 13.5%, so industry funds more in the north than government does. Industry is leading the way.

**Lord Fox:** One of the past barriers or impediments to those kinds of relationships has been understanding who gets the value from the intellectual property. In your view, is that becoming less of a barrier? Do people on both sides have a more realistic expectation of what they can bring to those relationships, or is it still a problem?

**Baroness Neville-Jones:** The maturity level is often the issue, is it not?

**Professor Wendy Baird:** I would suggest that universities have increasingly become more aware of the need to protect intellectual property.

**Lord Fox:** But sometimes they have been accused of being unrealistic in their expectations.

**Professor Wendy Baird:** Yes, but they need to set up collaboration agreements and have a shared conversation. The SMEs do not necessarily understand IP and the need to protect it. They need a transparent process in place in that regard.

Initiatives such as HEIF (Higher Education Innovation Fund) funding and the MRC's Confidence in Concept funding programme are interesting models creating a little pump-priming funding—perhaps £50,000 or £70,000—to develop a relationship with an SME. That in turn builds that working relationship and leverages further investment from the company.

But yes, there is a shared journey on IP. There are some very good examples and some that may be not so good.

**Dr Andrew Welchman:** I would point to the changing models for innovation; I am thinking particularly about some of the pre-competitive space, both between companies and between companies and academics. That is something that we explored with the pharmaceutical industry.

**Lord Fox:** Sorry, I do not think I understand that answer.

**Dr Andrew Welchman:** If you are thinking about trying to develop a new drug target, that is a very costly endeavour. You do not know how successful a potential target is likely to be so companies come together to co-invest—

**Lord Fox:** So a sort of consortium will do a scientific risk look at it. Got it.

**The Chairman:** Do you have another question, Lord Fox?

Q15 **Lord Fox:** Yes. This is a free question, really. This is about your wishes. We have already talked about UKRI and government policy. What is the one change, the golden ticket, that you would like from either government policy or UKRI policy that would help strengthen the UK science research base? This is an easy one.

**Hannah Davies:** I think I have made my point clear.

**Lord Fox:** More in the north!

**Hannah Davies:** It would be to increase public spending in health research to match that in the private sector. That would make a big difference to health research in the north of England.

**Professor Wendy Baird:** One thing that would be helpful and welcome would be earlier sight of some of the collaborations that are coming out. Having a six-week turnaround will constantly be a barrier to being able to facilitate high-quality—

**Lord Fox:** Presumably it is a barrier but it also costs you money. It is suboptimal.

**Professor Wendy Baird:** You are building speculative relationships in the hope that they might just match what comes out. When the NIHR was first set up, it also had six-week deadlines for its bids but it now gives us up to a year's notice of what the content of the commissioning brief will be. That allows you to build a much more competitive—

**Lord Fox:** Of course it needs to know that before it can tell you what it is.

**Professor Wendy Baird:** Well, yes.

**Baroness Neville-Jones:** You in turn can build a much more substantial project on that basis.

**Professor Wendy Baird:** It also means that you as institutions are not all chasing the same industrial partners.

**Lord Fox:** It gives you more time.

**Professor Wendy Baird:** And the chance to build consortia between the different universities, which bring different strengths and different partnerships. It would mean that you got a much stronger consortium collaboration that has been well thought through.

**Lord Fox:** For example, how long does the Horizon 2020 project give you, in comparison?

**Professor Wendy Baird:** I am not entirely sure.

**Dr Andrew Welchman:** Typically, 36 to 48 months would be the duration.

**Lord Fox:** We probably do not want anything as long as that, but somewhere in between.

**Professor Wendy Baird:** Even six months would be good.

**Dr Andrew Welchman:** I would point to the value of having some stability and the ability of universities to plan forward. There is real value in having a mixed economy of different methods of funding and different ways of innovating and allowing universities to innovate and individual academics to innovate, but we should also think about how the sector as a whole might think about working with industry and learning from it about some of the ways and practices of working within that sector. That room for innovation is something that the UK has been very good at, and

it would be great to see it continue to help UK research and science flourish.

**Lord Fox:** Coming back to the first answer, is that stability driven primarily through safety around the QR funding, or are there other things that should be going on to deliver that stability?

**Dr Andrew Welchman:** Teaching income, QR funding and uncertainty in the international landscape are the issues that are weighing heavily on people's minds. Those are all big sources of uncertainty that affect the UK's ability to attract and keep the best people and compete on the international stage.

**Baroness Neville-Jones:** You said you would like to see more business/academic collaboration. Do you think there are actual barriers that need to be removed, or is it much more a question of habit and getting to know each other? Is it more a process of a lack of familiarity rather than actual impediments?

**Dr Andrew Welchman:** My sense is that actually they are growing much more closely together. That has an awful lot to do with the career choices of young people who are coming into this area. People are pursuing PhDs and because that gives them a range of options they see that in the UK you have the potential to use that knowledge in a range of different ways. If we can promote further that ability to hop back and forth, I think we will see a natural convergence of those things.

**Baroness Neville-Jones:** That is very interesting. Are there any statistics on what people are choosing to do at the PhD and subsequent phases?

**Dr Andrew Welchman:** Yes, lots, but I do not have them in my head. We can certainly send them to you; we have done quite a bit of analysis.

**Baroness Neville-Jones:** I think that is an interesting prospect.

**The Chairman:** We will take that as evidence.

**Dr Sarah Main:** The Campaign for Science and Engineering is publishing a report, maybe in the next week or so, that will give a nice list of golden ticket requests. It focuses on how we can increase research intensity. The message is to reflect on what the Government can do and what is in their own gift in terms of public investment in R&D, how to incentivise private investment and, importantly, how to support the people and skills required to conduct that activity. My one request would be to see set out in the spending review a clear long-term budget for the public investment element of the 2.4% goal because that is what would send a logical, clear and purposeful signal to begin to attract the new private investment that we are seeking. Additionally, it really must attract not only global R&D attention but cross-government support.

Q16 **The Chairman:** My final, simple question is about EU funding. Lots of universities get research funding from the EU, but the question is: if we were to lose that funding, which areas of research would be most affected?

**Dr Sarah Main:** I may have some statistics on this that I could offer you from different parts of our membership. Members of the Campaign for Science and Engineering in space science have said that the Science and Technology Facilities Council reports that between 30% and 40% of all funding for UK space and astronomy science comes from European Research Council funding. That is approximately one-third of its funding so there is a considerable risk exposure there. The UK has the highest amount of participation funding received from both the European Research Council grants and the Marie Skłodowska-Curie actions in Horizon 2020—around £1.5 billion and £830 million respectively.

In terms of regional impact, we have data that shows the regions of the UK that are most reliant on EU funding for research as a percentage of the total. They are the south-west of England, outer London, the north of England, and Scotland. That data can be analysed in different ways; what I have told you here is the percentage of the total but one can also just look at the flat cash sums. Certain disciplines are particularly exposed as they are very reliant on EU funding. These include archaeology, chemistry and IT. That work was conducted for the National Academies by Technopolis.

**Hannah Davies:** The EU 28 produce one-third of the world's scientific publications with only 7% of the global population, so not being a part of that will have a phenomenal impact. Britain is an important location for EU scientists, with more than one in five European Research Council grant-holders choosing to work in the UK. So it will have a massive impact.

**The Chairman:** Thank you all for coming to help us today. Your comments have been most helpful. If on reflection you feel that there are some issues that you did not get an opportunity to discuss, please feel free to write in and we will take that as evidence. If you have any written material that you want to send, please do so as well.