



Anniversary Address

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THE
**ROYAL
SOCIETY**

Anniversary Day 2018

I want to start by congratulating my former colleague Greg Winter on his Nobel Prize, as well as the winners of this year's Medals and Awards.

It is also with great sadness that I note that Aaron Klug, who was president from 1995–2000, died 10 days ago.

Brexit and international collaboration

I am now three years into my Presidency and it is certainly not what I had expected. Despite the current uncertainties, there has been some good news in the last three years. The Government's commitment to invest 2.4% of GDP in research by 2027 with an ultimate goal of 3%. An investment of £100 million to triple the number of computer science teachers by 2022. The establishment of a Centre for Data Ethics and Innovation. These are all things the Society has worked hard to achieve. I am also pleased that the Society's efforts introduced millions to the history of science via our People of Science series, which brought together David Attenborough and Brian Cox on screen for the first time.

But there has been a cloud hanging over us – Brexit poses a very serious threat to science in the UK and in Europe. It feels as though we are in the eye of the storm at the moment, as we wait to see the outcome of the Parliamentary vote.

In the past two and a half years I have had to become far more of a politician than I ever expected. The Society has striven to do everything it can to try and ensure that a good deal is secured for science. Our refrain has been that we need a deal that:

- Keeps highly skilled scientists working in the UK and ensures that talented people from around the world still choose to come here and contribute to our science;
- Provides access to networks and funds that allow the UK to work with scientists from the EU and globally; and
- Maintains regulatory alignment that allows development and wide adoption of new medicines and technologies.

Julie Maxton spoke earlier about some of the international diplomacy that we have undertaken. We have been in regular contact with the Prime Minister, ministers, parliamentarians and civil servants. We have taken every opportunity to communicate with the media. We launched a no-deal fact sheet that highlighted the potentially catastrophic implications of leaving the EU without a deal. On that occasion, I joined my two predecessors, Martin Rees and Paul Nurse, to field questions from the international press. I also rallied 29 Nobel Laureates and 6 Fields Medalists from across Europe to write to the Prime Minister and President Juncker to make the case for continued close cooperation in science between the EU and the UK.

We have been listened to. The Prime Minister has consistently spoken of the importance of getting a good deal for science including in her speech on science at Jodrell Bank earlier this year. Every indication is that the rest of Europe also wants a good deal for science. The current deal on the table would basically ensure little change during the transition period, which would take us to the end of Horizon 2020.

However, there is no real clarity about what will happen over the longer term beyond expressing aspirations. The future relationships document mentions a commitment to seeking UK participation in EU programmes in science and innovation and the European Research Infrastructures Consortiums. There is also declaration of a wish to pursue a broader scientific relationship to engage in dialogue and exchanges in areas of shared interest, with the view to identifying opportunities to cooperate, share best practice and expertise, and act together.

These are positive indications but they are only that. The EU – including us for now – is engaged in ongoing negotiations on the shape of the next EU funding framework, Horizon Europe. We are hopeful that the framework will continue to focus on supporting excellence, and will become increasingly global in its outlook. We can then seek to ensure that the UK can agree a full association.

A no deal scenario would have serious consequences. It could see us losing access to up to £1 billion a year of funding. A divergence of regulatory and governance arrangements could make it more difficult to obtain access to new medicines and technologies and could limit our ability to tackle global problems.

The implied message in such a scenario could result in an exodus of talent, especially those we have attracted from other parts of Europe. We hope that our elected representatives would not be so irresponsible as to plunge us off such a cliff.

As to what other alternatives we might be faced with after December 11th we will have to wait and see.

Life after Brexit

Whatever the long term impact of Brexit, we must ensure that UK science continues to thrive. The success of the UK as a leading scientific country comes despite the fact that we lag behind our key rivals in terms of investment. We currently invest just under 1.7% of GDP in research and innovation. In the US the number is over 2.7%, in Germany it is over 2.9%, in Japan over 3.1% and in Korea over 4.3%. The Government, recognising that science and innovation are essential for our long term economic health, have now committed to investing 2.4% of GDP by 2027 with a longer term goal of 3%. That is excellent news. The challenge ahead will be to ensure that the additional funding is used well to drive excellence and additional productivity.

Any growth in the scientific enterprise depends not just on new buildings, equipment, and infrastructure, but crucially on new people. The increase from 1.7% to 2.4% of GDP represents a nearly 50% increase in the size of the enterprise and will depend on a large expansion of the scientific workforce.

Such growth will need to come from a combination of home-grown talent as well as highly skilled people from the rest of the world.

Attracting international talent has already been made more difficult because of how we are perceived internationally as a result of the Brexit-related debate about immigration. We will soon have an idea of how serious a problem this will be for the future when we see the details of the promised white paper on immigration. Some of the murmurings coming from Government do not bode well.

Clearly any restrictions on the flow of people and ideas from Europe will be a setback for British science, but if we just apply the current system for non EU nationals to everyone, it could be chaotic. The current system is expensive and overly bureaucratic. It needs streamlining regardless of who it might apply to in the future. The salary threshold could see people that we need, such as technicians, barred from coming here. And what about young rising stars who might not yet command the required salary. For those who make it over the barriers, will their families be allowed to come with them? We have written to the Government raising these concerns ahead of the upcoming white paper on immigration.

We are competing in a global market for the people the UK needs to thrive, immigration processes should not create unnecessary barriers that dissuade people from coming here. We will always need such global talent – to be the best in the world, we need to recruit from the best in the world.

At the same time, we must also ensure that we are training new generations to take on the challenges ahead. For that we have to start at the beginning – in our schools.

Those schools have produced many generations of fine scientists but our educational system, just like our workplaces will need to embrace change to remain competitive. A-levels have been around since 1951 and other than the occasional brief flirtation with broadening their scope they have maintained a focus on a small number of subjects. The A-level model in England is one of the narrowest upper secondary systems in the world, and it is becoming even narrower. The average number of A-levels per student is now just 2.7.

In their current form A-levels are too focussed on producing narrow specialists. It cannot make sense to focus on equipping students only for specialised careers, including becoming academics, when we live in a world of rapidly changing technologies. Many of today's biggest companies, or even their industries, didn't exist 20 or 30 years ago. Moreover, some of the most exciting areas of science and technology involve various disciplines coming together, not only from different areas of natural science and mathematics, but also from the social sciences and humanities. A broad training at an early stage will best prepare us to develop and use skills to tackle entirely new fields.

Science is a means of both understanding the world and changing it, and a broad and balanced education can also help scientists not only to understand the broader context of their work but also to communicate it, a skill that is essential if we are to carry the public in some of the difficult decisions we have ahead. The debate around AI is a good example of how the Society has facilitated discussion in everyday language. Our You and AI series has connected experts with the public and I hope that it is just the start of the informed debate we need around the application of these technologies.

Another area of debate is the use of increasingly powerful genetic technologies. Do we want to make genetic changes that can be passed down through generations to eliminate disease, despite potential risks? Where is the balance between privacy and the beneficial use of data in organizations like the NHS?

When we are facing big global challenges, we need to make informed decisions based on open debate. To achieve that, the teaching of science, from early childhood onwards, needs to combine creativity, curiosity, imagination, observation and rigour. And science, alongside the arts and humanities, should be taught to everyone through to age 18, so that we have a population with the scientific understanding needed to play a full part in public debate and prepared for an ever changing workplace.

Career paths are becoming more flexible and we need to change expectations of what a person's 'career' – or perhaps 'careers' is more accurate – will look like. Of course we need specialists and academics, but businesses need employees with a broad range of skills and experience that can help them to creatively adapt to technology-rich environments. And young people need a broader range of skills so that they can move between careers.

Changing the curriculum to better suit the future is a difficult journey, which requires careful coordination. This cannot be a political football, kicked around by competing ideologies or by deeply vested interests. So we need to proceed gradually, building wide consensus over the role of education both now and in the future. We need to consider the views of students and their parents and teachers as well as their future employers. And of course we need to persuade politicians to put both the time and resources into investing in changes in education when there are competing priorities. But the reason to do it is because we owe it to future generations of both scientists and non-scientists so that they can compete and prosper in an increasingly technological and changing world.

Improvements in the curriculum will only work if we also build on the strengths of our education system including our remarkably talented and hard-working teaching workforce. Just as with other professions such as doctors or dentists, teachers need to develop their expertise and keep up with the latest developments and breakthroughs so that they can impart up-to-date knowledge to their students, and the system must help both recruit first-rate well-qualified teachers, as well as retain them and nurture their development throughout their careers.

Turning now to those who choose a career in science: we must ensure a culture where people and their ideas are valued. The majority of research spending occurs in industry and the lines between academia and industry are becoming more blurred with people and ideas moving between the sectors far more freely. Nevertheless, today my remarks mainly concern those who have a career in academia.

A healthy science culture must above all value the people who carry out science. Thirty-five years ago, the Royal Society introduced our University Research Fellowships to support early-career researchers, and twenty-three years ago we introduced our Dorothy Hodgkin Fellowships for early postdoctoral researchers who need to work flexibly. Our goal with both schemes has been to identify the most promising young scientists and give them the freedom to pursue new and more innovative lines of research as they build their careers.

To mark the 35th anniversary of the URF scheme, we decided to find out what difference the recipients felt our funding made to them. The feedback was enlightening. Among those we have supported, just under 70% of University Research Fellows and over 40% of Dorothy Hodgkin Fellows in academia have become Professors. Our alumni also include 58 Fellows of the Royal Society, several best-selling scientist-turned science-writers, a winner of the US\$1 million Eternity mathematics puzzle, a scientist whose disease programme contributed to the eradication of malaria from Sri Lanka, a TV presenter whose shows are watched by millions and the founder of a spin-out company that was sold for US\$600 million. Among them are a Nobel laureate and a Fields medallist. These are great achievements but what is it about the schemes that works? According to the alumni themselves, the freedom they had to pursue the research they wanted to do was most important. The stability and flexibility of the funding were also highly valued. As we expand our science base to meet the 2.4% target, the URF and Dorothy Hodgkin schemes offer a lesson in what works particularly well.

Future science funding in the UK

The 2.4% target is a combination of private and public investment. The government can certainly try to encourage private investment by providing appropriate incentives, but one of the best ways to catalyse private investment is for the government to commit to increasing its share proportionately – the OECD average is 0.63% and we are currently at 0.44%.

How we put that money to the best use is now a big question for the science community. With the establishment of UKRI and the current uncertainty around Brexit, there is a great deal of change and some uncertainty in the air. That can cause anxiety but we cannot lose sight of the opportunities. As we increase our investment in science, we must ensure that it is based on excellence and balanced priorities. Public investment involves a social compact – that scientists help solve pressing problems that face the country. However, it would be a mistake to short change our future by focussing too much on immediate applications at the expense of longer-term fundamental science that has the potential to create the basis of entirely new technologies, transform current ones or even find new unexpected solutions to current problems. So we must invest in excellence wherever we find it, whether that is in pure discovery science or in finding solutions

to well-defined pressing problems. We must trust scientists who are experts in their fields to know where best to invest.

I have listed a number of challenges that lie before us from training new generations, making the UK an attractive destination for international talent, ensuring continued cooperation with the EU, and spending money wisely. If we rise to these challenges, science in the UK will continue to thrive and benefit the entire country.

I want to conclude by thanking those who have made my job not only possible but a pleasure. I thank my fellow officers not only for making my own load light by taking most of it on themselves, but also for their collegiality and frank but friendly feedback; and members of the council and the fellowship for all of the extensive work they do for the Society. Finally, all of us owe thanks to Julie Maxton and her dedicated staff, who have had to be exceptionally proactive during these difficult and uncertain times.

I have now served three years and have matched Lord Rayleigh's term and exceeded that of William Crookes by a year. Barring death, incapacity, or impeachment, I hope to do my best as your president over the next two years to ensure that science flourishes in these turbulent times.

The Royal Society

The Royal Society is a self-governing Fellowship of many of the world's most distinguished scientists drawn from all areas of science, engineering, and medicine. The Society's fundamental purpose, reflected in its founding Charters of the 1660s, is to recognise, promote, and support excellence in science and to encourage the development and use of science for the benefit of humanity.

The Society's strategic priorities are:

- Promoting excellence in science
- Supporting international collaboration
- Demonstrating the importance of science to everyone

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Founded in 1660, the Royal Society is the independent scientific academy of the UK, dedicated to promoting excellence in science

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