THE ROYAL SOCIETY

Science that works for society – Royal Society manifesto

Science makes our lives better. From antibiotics to understanding DNA, from computing to Artificial Intelligence and from satellites to renewable energy the UK has a proud history. We can also have a bright future.

Science and innovation drive the economy and create jobs. The UK is facing major challenges in the years to come, whether leading a fourth industrial revolution, tackling climate change, or supporting an ageing population. If the UK is to rise to these challenges it is vital that the next government steps up its commitment and equips UK Science with the tools and support it needs to unlock its full potential.

Harnessing the potential of science to power a cutting edge future UK

The foundation: securing a good Brexit outcome for science

EU research funding and collaboration has been central to the growth and global influence of UK science and brought huge benefits to people living in the UK. For science to thrive, we need a Brexit outcome that protects people, funding and collaboration. This outcome should:

- **Keep highly-skilled scientists working in the UK and ensure that talented people still choose to come here and contribute to our globally competitive science.**
- **Keep access to money and networks that support the UK to work with scientists around the world.**
    - The next government must ensure the UK is part of the EU's new funding programme, Horizon Europe, and ensure that there is no funding gap for UK based researchers.
- **Maintain regulation that supports access to new medicines, technologies and constructive collaborations.**

Developing and attracting talent, and securing investment

A migration system that supports the exchange of people and ideas

Science depends on the steady exchange of knowledge and ideas. However the UK's current immigration system is cumbersome, bureaucratic, and expensive compared to other leading science nations. The next government must introduce a system which addresses these issues and signals the UK's openness to scientists and researchers from across the globe.

A new system must:

- **Trust our major research funders:** Any researcher who is given an academic appointment or a position supported by a major public, charity or industry funded research programme; or who is offered a long-term post in a UK university or research institute should be automatically guaranteed entry for themselves and their families.
    - Such posts should also confer guaranteed entry to essential members of a researcher's wider team – including researchers at all career levels, research assistants/associates, technologists and technicians.
- **Be simple and affordable:** The application process must be as simple as possible and visa costs should be commensurate with typical academic salaries and with the length of stay being requested and should not be greater than the average of the UK's major competitors.
- **Meet the needs of researchers**: For those seeking to move to the UK, and UK researchers seeking to relocate, as well as those travelling to and from the UK for both short and long-term visits including short term paid engagements.
- **Support innovators:** A researcher who establishes a company built on research they have carried out in the UK, and which has attracted substantial initial investment, should be given automatic right to residence.

THE ROYAL SOCIETY

Investing in the future of UK research & development for the benefit of UK economy and society

To unlock the full potential of Research and Development in the UK, and to reap the associated benefits for the economy and society, the next government must set out a bold vision which allows UK institutions and businesses to compete with other leading science nations on an even footing.

To achieve this, the Royal Society calls on political parties to:

- **Commit to having the UK invest 3% of GDP in R&D by the end of the next decade**,
- **Commit to reaching 1% public sector R&D investment**, within this 3% target,
- **Publish a 'roadmap' to 3%.** This should set out how public funding will be used to trigger private sector investment and how the positive economic and societal impact of R&D investment will be spread across the UK, so more people and places benefit. A roadmap to 3% should focus on four key principles for effective R&D investment:

    1. Balance: Valuing the importance of both discovery and applied research.
    2. Efficiency: Delivering a funding system that minimises bureaucracy, invests in people and creativity and is long-term.
    3. Talent-led: Improving the pipeline of UK STEM talent through education reform and providing opportunities to train and upskill throughout careers.
    4. UK wide: Delivering the infrastructure needed to deliver on investment potential to spread excellence and impact to all corners of the UK.

Meeting future challenges

Delivering a research and innovation system which harnesses the potential of UK Science, will drastically improve our ability to tackle the major challenges we face.

Climate science and working towards zero carbon emissions

To decarbonise the UK economy, and achieve a transition to net-zero, major emissions reductions will be required from all sectors of the economy. Even if emissions are reduced as far as possible, we will still need to actively remove greenhouse gases from the atmosphere.

The next government must focus on promoting behaviour change in areas such as how we travel, how we heat our homes, what we eat and how we reduce waste with increased reuse and recycling. There must also be a focus on developing new technologies in a range of sectors including:

- **Power:** Further development of renewables, large scale long term energy storage and smart systems, carbon capture and storage (CCS) infrastructure and research into the potential use of the captured carbon.
- **Transport:** Continued improvements in batteries and an early move to alternative fuel sources such as biofuels for sectors such as aviation, HGVs and shipping. Alternative fuels need to be researched further, including hydrogen, ammonia and synthetic fuels.
- **Agriculture, forestry, land use and protecting biodiversity:** Developing solutions for more sustainable livestock farming, increased soil carbon storage, afforestation, restoration of wetlands to store more carbon, and decreased mineral nitrogen fertiliser use.
- **Residential and commercial heat:** improved insulation, use of heat pumps and research to improve their efficiency, and potential use of hydrogen to replace natural gas.
- **Waste:** Work to improve resource productivity; the collection of household food waste, banning wastes containing bio-degradable carbon from landfill and capturing methane emissions.
- **Industry:** shift to low, zero, or negative carbon emissions, for example by using heat more efficiently, developing alternate power and fuel sources, using more efficient processes and building with low or negative emission carbon-negative building materials (wood, carbonated aggregates). Further, capturing CO_2 from industrial processes and storing it underground or in economically viable products will be essential.

- **Adaptation:** Adapt infrastructure in preparation for environmental changes, and increased regularity of extreme weather events to improve safety and minimise economic harm, including through improved return on investments.

Reforming education and skills

The world is changing, so should education. There needs to be long-term reform of education to ensure our young people leave school or college with the broad range of knowledge and skills they will need to flourish in a changing world. To prepare for and take advantage of these changes, the next Government must adapt our education system through:

- **Commissioning a major review of education to ensure every young person has the opportunity to study the widest range of subjects to 18 including science, mathematics and computing**. This will form the foundation for our future economy, alongside developing the skills valued by employers such as communication, problem solving, and team working.

- **Addressing real concerns about the supply of teachers as a matter of urgency, especially in sciences, mathematics and computing**, where a crisis exists in retaining teachers in early career.

Emerging technologies and data

The UK is a world leader in digital and data driven technologies like Machine Learning. These technologies have the potential to transform the way we live our lives and boost our economy if harnessed effectively. In order to reap the maximum benefits from this, the next Government must support:

- **Wider access to data in a well-governed way:** The UK leads the way in allowing access to public sector data, and in conducting debates on data ethics. We need continued efforts to ensure access to data that drives forward AI and Machine Learning, in a way that builds public trust and benefits everyone.
- **Advancing research:** Further funding in key areas can drive progress in Machine Learning (for example areas like health and/or climate change), while helping to address areas of societal concern. Researchers should also have support to engage with the public.
- **Support organisations in the safe and rapid use of AI:** Organisations across sectors need advice and guidance on how to realise the value from data, and support to develop the skills needed at all levels.