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DISCUSSION MEETING

Science, Innovation and Brexit

Tuesday 10 October 2017 at 5.30pm
Boothroyd Room, Portcullis House
(Please check the room allocation by telephoning 020 7222 7085 on the day)

ADDRESSES BY:

Stephen Metcalfe MP, Chairman, Parliamentary and Scientific Committee
Sir Venki Ramakrishnan PRS, President, Royal Society
Tom Thackray, Director for Innovation, Confederation of British Industry
Dr Sarah Main, Executive Director, Campaign for Science and Engineering
Professor Julia Buckingham, Universities UK

The meeting will be followed by a drinks and canape reception
in Bellamy’s Restaurant in 1, Parliament Street
Welcome to the first edition of Science in Parliament in the new Parliament. It has certainly been a time of change over the summer for both Parliament and for the Parliamentary and Scientific Committee (P&SC). Professor Alan Malcolm, who has been Executive Secretary to P&SC and Editor of Science in Parliament for five years decided to step down and in June we welcomed Dr Isabel Spence into the role.

Science continues to be a high priority on the political agenda featuring in all party manifestos in the lead up to the election. This commitment was reaffirmed at Parliamentary Links Day on 27 June 2017, the largest science event bringing together parliamentarians and the scientific community, which saw Members from all parties come together to discuss science on the global stage.

As we proceed with Brexit negotiations it is vital that scientific issues are considered alongside economic and social considerations. UK research and innovation allows us to compete on the global stage as an outward-looking nation that works with others around the world to tackle global challenges such as climate change and antimicrobial resistance and develop technologies and products that improve people’s lives around the globe. The strength of UK research and innovation can be maintained and grown with the right mix of skilled people, investment, networks and collaboration, and regulation and trade.

I and the P&SC are striving to ensure parliamentary colleagues understand what needs to be done to maintain and grow UK research and innovation and have published ‘Science Priorities for Brexit’ which was distributed to all parliamentarians. We are also holding an event on 10 October 2017 to highlight these priorities in partnership with other key scientific organisations. I hope to see you there.

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It was standing room only in the Attlee Suite in Portcullis House on 27 June for Parliamentary Links Day 2017 – which is the largest single science event held in both Houses in the annual Parliamentary calendar. The event, organised by the Royal Society of Biology on behalf of the Science Community, brings together hundreds of scientists, policymakers and politicians to discuss issues facing the science sector.

The Speaker of the House of Commons, Rt Hon John Bercow MP, once again opened the event – for a record fourth successive Parliament – and praised the scientific community for its continuing efforts to strengthen links between science and Members of Parliament in both Houses.

The tightly packed audience of Parliamentarians and members of the science community heard keynote speeches from Jo Johnson MP, the Minister for Universities, Science, Research and Innovation and Sir John Kingman, Chair Designate of UKRI. Two panel discussions thereafter focused on european and global opportunities.

Johnson emphasised how important it is that the UK remains world leading, alongside the need to achieve better geographic spread of excellence and investment, and the need to translate more research into commercial success.

“We maintain the enviable record for science and innovation; we are genuinely world class.

“We need to work harder to address economic imbalances and historic under investment in research and development. We want the UK to remain the go to place for scientists, innovators and tech investors from across the world.”

Announcing that the UK Government will continue to underwrite the Joint European Torus (JET) project post Brexit Johnson said: “JET is a prized facility at the centre of the UK’s global leadership in nuclear fusion research, which is why the Government is taking every possible step to secure its future and maintain highly skilled jobs in the UK”
In his speech, Kingman discussed the future development of UKRI, and the opportunities and challenges the organisation will face in the coming months and years. Both Johnson and Kingman also stressed the need for continued achievement to leverage continued Treasury support for public investment.

Two panel sessions followed, with leaders in the science sector, politicians and policymakers taking questions from the floor. Both discussions were chaired by BBC science correspondent Pallab Ghosh.

Present on the first panel to discuss science and Europe were Professor Roberto di Lauro, Science Attaché for the Embassy of Italy, Dr Lorenzo Melchor, Science Attaché for the Embassy of Spain, Dr Sarah Main, Director of the Campaign for Science and Engineering and Chi Onwurah MP, Shadow Minister for Business, Energy and Industrial Strategy.

Chi Onwurah MP discusses concerns from EU scientists about their future in UK science

The discussion quickly focussed on the challenges for the sector in the run up to leaving the EU, with Onwurah acknowledging that some EU scientists are now apprehensive about joining the UK community, as well as the need to reassure those already working here that they will be able to stay.

This was echoed by di Lauro, who told the audience that a survey of Italian academics across UK universities found that 82% of respondents were considering leaving post-Brexit. Melchor noted the findings of a recent SRUK study and explained that his embassy had set up a specific taskforce to help Spanish academics understand their options for remaining in the UK, as people were still uncertain over their rights to remain in the UK.

Dr Main commended the sector on coming together and helping define top priorities for the upcoming Brexit negotiations, but she stressed the importance that those in attendance also continue to engage with policymakers.

The second panel discussing science in a global context featured Professor Dame Jocelyn Bell Burnell, President of the Royal Society of Edinburgh, Malcolm Brinded, Chair of Engineering UK and Professor Sir John Holman, President of the Royal Society of Chemistry.

Discussion across the second panel focused on the need to expand the global science sector. Burnell explained that schools need to offer more comprehensive careers advice for those going into STEM, and ensure not only pupils get excited over becoming
scientists, saying “We need to reiterate the value of being a scientist not just to children but to their parents too.”

Meanwhile Holman explained the need for specialist science teachers to inspire students from a primary school age, to strengthen the “skills pipeline” and ensure there will be enough scientists for the future.

Brinded added that there is a skills shortage faced by global engineering as well as the need to address diversity. He explained that the UK is particularly dependant on overseas students coming to study at the UK, with 68% of current postgraduate engineers from overseas: “We have to factor these issues into any immigration policy, as well as improving the supply of UK nationals.”

A Q&A across both panels covered issues of regulation, funding, political awareness of science issues, leadership against xenophobia, and inspiring the next generation.

The event concluded with closing remarks from Stephen Metcalfe MP, the immediate past Chair of the Science and Technology Select Committee for the House of Commons. “We know the UK is world leading for science.

“We know that we have 1% of the world’s population but contribute to 16% of the world’s research citations.

“We now need to build an optimistic, outward looking, inspirational vision of science in the UK; we need to create a vision that attracts and not repels the best scientists in the UK and globally.”

Professor Alex Halliday FRS delivered a keynote address at the House of Lords Luncheon, which is available to read on the Royal Society website.

EVENT COVERAGE

There was lots of tweeting on the day with #LinksDay17 trending in London and it helped to get the message out that UK Science is still in the business of being open, inclusive and looking forward.

You can read the RSB news story, view the event Storify, listen to it again on SoundCloud and see photos on Facebook and Flickr: www.rsb.org.uk/linksday. Please credit the Royal Society of Biology (RSB) when using these photographs, and contact media@rsb.org.uk for additional images.

QUOTE FROM SPEAKER RT HON JOHN BERCOW MP:

“I believe that Parliamentary Links Day will continue to play a helpful part in providing Members of Parliament with a greater and more rounded understanding of science and engineering and the scientific issues with which we must deal – and that can only be a very good thing in today’s ever more technological and scientifically conscious world.

“I know from my unique vantage point in the House, that Members on all sides continue to raise issues that have a scientific aspect to them and they value the assistance which the scientific community can offer them.

“It is all the more important that every Member of Parliament should be able to benefit from non-partisan assistance of the kind offered by professional scientific bodies.”
SCIENCE PRIORITIES FOR BREXIT

On 21 March 2017, Stephen Metcalfe, Chair of the Parliamentary and Scientific Committee, launched a statement outlining the priorities for the science community to help inform Brexit negotiations.

This statement was informed by advice and evidence from the research and innovation community, representatives of whom joined Stephen on a panel to discuss what action the UK must take now to send a bold, positive message that the UK is one of the best places in the world to research and innovate, and capture the benefits stemming from this to improve the lives of people all over the UK.

The statement outlined four priority areas summarised below:

PEOPLE
It is in the UK’s national interest to attract diverse individuals from around the world with strategically valuable skills as well as give every one of its citizens the opportunity to develop the skills that the UK needs. Individuals with strategically valuable skills to the UK include successful leaders in research fields, early-stage researchers, technologists, technicians and those with entrepreneurial and management skills.

INVESTMENT IN RESEARCH AND INNOVATION
Signal the UK’s intention to compete internationally by investing in scientific research and innovation and creating an attractive environment for other investors.

COLLABORATION AND NETWORKS
To realise the UK’s ambition to remain one of the best places in the world to do research, to innovate and grow business, UK-based researchers must be able to engage with the brightest minds, the best organisations and facilities, wherever they are in the world.

REGULATION AND TRADE
UK regulation should continue to support cutting-edge science and trade, while keeping people and the environment safe and earning public confidence.

Further details can be found in the statement and evidence report summarising the evidence and advice received on the Parliamentary and Scientific Committee website www.scienceinparliament.org.uk

The Parliamentary and Scientific Committee will be hosting an event on Science and Brexit with the Royal Society, Universities UK and the Confederation of British Industry on Tuesday 10 October 2017. Please contact office@scienceinparliament.org.uk for further information.
THIRTY YEARS OF DAPHNE JACKSON FELLOWSHIPS

By Dr Katie Perry, Chief Executive

Providing support and flexible retraining opportunities to men and women
Science is at the heart of the world in which we live. Progress and diversity in STEM research affects everyone and is essential as society tackles the big challenges of the 21st century in areas such as climate change, medicine, artificial intelligence, big data and agricultural technologies, to name but a few. We are the only charity in the UK dedicated to realising the potential of STEM researchers to retrain and return to research careers following a prolonged career break. Our unique Fellowships provide an individually tailored retraining programme alongside a challenging research project, with additional mentoring guidance and advice. The fellowships enable recipients to re-establish scientific credentials, update skills and boost confidence.

Many people still struggle needlessly to return to STEM research after a career break
For many researchers, life happens: they have a family, relocate, need to care for a loved one or are ill. This should not mean that they find themselves disadvantaged and unable to re-enter their careers at a level commensurate with their skills and experience. Many are forced to quit the research and scientific work environments until they find the Trust and realise that there is a way to return to their career.

Women are also still massively underrepresented in STEM roles - maintaining an equal, diverse and talented workforce matters now and for the future. We believe more needs to be done to improve working practices and support mechanisms - too many talented women and men face unnecessary barriers in their efforts to return to their STEM career.

Our future plans
As the Daphne Jackson Trust enters its third decade, the importance of our Fellowship programmes is becoming ever more evident and it is essential that the number of fellowships offered increases. This will only be possible with increasing levels of support from our sponsors and host organisations - drawn from universities, the research councils, learned societies, charities and industry.

Raising awareness of the Trust and the fellowships is key and we are keen to work in partnership with our fellow members of the P&SC as much as possible.

Celebrating with our Fellows and Supporters
To celebrate our 30th year, we held a special celebration event at the Royal Society of Chemistry in London on 9th November 2016.

Professor Teresa Anderson, our Chair of Trustees, introduced the event and Dr Katie Perry, the Trust’s Chief Executive, shared her personal memories of Daphne.

The celebration was held at the Royal Society of Chemistry in London

2016 was an important year for The Daphne Jackson Trust
In 2016 we celebrated the 30th anniversary of the first Fellowship being awarded in 1986 by Daphne Jackson, the UK’s first female Professor of physics and a lifelong campaigner for encouraging women in science, technology, engineering and mathematics (STEM) to return to their careers after a break.

Following Daphne’s sad death in 1991 at the age of 54, the Trust was established in her memory and continues her inspired work to this day. To date, we have helped 329 STEM researchers retrain and return to their careers.
Former Daphne Jackson Fellows Dr Sianne Schwikkard and Vijayalakshmi Ramdas provided an insight into their Fellowships and resulting successes.

Vijayalakshmi, one of the first Fellows mentored by Daphne personally in 1989, is now Head of Rail in the Infrastructure Division at the Transport Research Laboratory.

Remembering Daphne, Vijayalakshmi said: "I will always be grateful for the fellowship and the personal encouragement from professor Daphne Jackson. I was one of the first four people awarded a fellowship in chemistry under the scheme."

Dr Sianne Schwikkard, Lecturer in Organic and Natural Products Chemistry at Kingston University, highlighted how her Daphne Jackson Trust Fellowship was instrumental in her successful return to her chemistry career after a break for children. "None of it would have been possible without the Daphne Jackson Trust, and the charity’s life-changing work."

The event was attended by over 100 supporters of the Trust, including current and former Fellows, representatives from host and sponsor institutions, and some very special guests from Daphne Jackson’s family, her brother Ronald Jackson and her niece Susan Balgamie.

'A people person' A personal reflection from Daphne's family

Reflecting about Daphne and the Trust, Ronald says: "My sister, amongst her many attributes, was very much a people person. She was always ready to offer a friendly ear to help and advise her colleagues whilst at school, studying at Imperial and later in her various roles at Surrey. She was a particularly caring aunt to my children and always concerned about their future. Also, in spite of heavy responsibilities as Professor, Head of Department, Dean and serving on many national committees, she personally carried the burden of caring for our mother in her declining years.

"Not surprisingly, therefore, she came to recognise the need to help able people to catch up with the progress made in their particular field of expertise during a career break for family or health reasons. It became clear that financial aid was often the critical factor in determining whether to be able to continue on the chosen career path.

"So she worked hard on her idea for a returners support scheme. Canvassing support and financial backing took up no small part of her limited free time in the early days. Once the Trust was established, its development has been due to the hard work and dedication of those who have been inspired by Daphne’s original concept. She would have been delighted at the progress and growth which has resulted in the thriving Trust it is today."

For further information about the Daphne Jackson Trust, please contact the Trust’s office on 01483 689166 or email djmft@surrey.ac.uk or visit daphnejackson.org

Individuals wishing to contact Dr Katie Perry directly to discuss becoming a supporter of the Trust or collaborator, please contact Katie.Perry@surrey.ac.uk

Follow 'The Daphne Jackson Trust' on Facebook and find us on Twitter @DaphneJacksonTr
THE UK NUCLEAR DETERRENT: A TECHNICAL PERSPECTIVE

Neil Gaspar, AWE

HISTORY OF THE UK NUCLEAR DETERRENT

The UK Government’s nuclear weapons policy is to maintain Continuous at Sea Deterrence (CSD). Preparations began for Britain to develop its own independent nuclear deterrent after its contribution to the American led programme during World War II. The UK nuclear weapon programme was officially started in 1947 by Dr William Penney (later became Lord Penney) at Fort Halstead, Kent. It was determined that a large site was needed for the programme, so an airfield that had been used by the US Air Force during WWII was identified and the programme moved there from 1950. Today, it is the Aldermaston site, often referred to as ‘the home’ of the UK nuclear weapons programme.

Vanguard class submarine

today’s standards, this is an astonishingly quick growth in understanding of the complex science, technology, engineering and mathematics required and overall capability.

Through to the 1990s, the nuclear weapons programme carried out research & development of the capability at Aldermaston and underground testing at the Nevada test site in the US. The underground testing supported and validated the science capability. During this period, the UK’s nuclear deterrent included Blue Danube, Polaris, Chevaline, WE177 and currently Trident. Trident has been in-service since 1994. It is delivered by submarine-launched ballistic missiles (SLBM), procured from the US and carried on four UK Vanguard class nuclear submarines.

In 1996, the Comprehensive Nuclear Test Ban Treaty (CTBT) was signed and subsequently ratified by the UK in 1998, bringing to an end five decades of nuclear tests. Testing of either a representative device or an actual warhead has two outcomes. First, the science and technical development is assured to a high level mitigating the areas that are not yet fully understood; and second, the credibility of the deterrent is established. With the cessation of testing, the science and technology methods for nuclear weapons had to change to maintain those two outcomes.

The science, technology, engineering and mathematics (STEM) that underpins the UK nuclear deterrent

AWE provides support for the entire life cycle of Trident. Over many decades, from concept and design, through maintenance, in-service support and decommissioning, AWE is the custodian of the enduring capability. AWE is also responsible for the operation of the sites and for the transportation of the warheads.

The core of AWE’s work is the routine certification of the safety and performance of the stockpile. The experience gained from the historic tests is still enormously relevant in this CTBT era. However, it is over 25 years since the last test and direct experience from that period is gradually being lost due to staff retirement. This can make applying older knowledge, data and techniques to current challenges difficult.

In addition, over the life of the warhead there are many changes that demand an increase in understanding to maintain the same level of certification. Such as, the ageing of existing materials and the introduction of new materials and processes due to changes in regulation and manufacturing.

Certification in the CTBT era is achieved through large calculations. High Performance Computers (HPC) carry out enormous simulations of the physics, materials and components. With requirements for detailed understanding increasing, there is a need for a resultant increase in HPC capability. AWE has a continuous programme to increase its HPC capability. Currently AWE has two of the most advanced and powerful supercomputer systems in the world; with each machine capable of two thousand million million calculations per second or 2 petaFLOPS. Computer technology continues to develop rapidly with increases in microprocessor speed and architecture sophistication. Whilst

Lord Penney

In 1952, the UK successfully demonstrated its first detonation of a nuclear device in the Monte Bello Islands. Six years later a series of thermonuclear tests or ‘hydrogen bombs’ were carried out in the Central Pacific. By
this sounds beneficial, increased sophistication of microprocessors presents the challenge of maintaining the provenance of the code that runs on them. The increase in speed also comes with a notable increase in running cost through power consumption.

To make use of the HPC, specialist computer code has to be written that simulates the complex science at different points in the warhead’s life. This code has to be established on the provenance of code from previous decades that has been validated against underground test data. Specialist weapon code cannot be bought commercially so AWE has to develop much of its own in-house. There are also supporting codes developed in the nuclear energy industry, academia, and conventional science and engineering. These codes do not run in isolation. Specialist materials models are developed and materials data has to be obtained for use in those models – all at extreme conditions. Validation of these codes is obtained through plasma physics and hydrodynamic experiments thus providing empirical evidence to validate and verify the calculations.

Plasma physics experiments, which require matter to be made very hot and dense, is accomplished on large-scale laser facilities such as Orion at AWE. Orion generates matter many times denser than solid, similar to that found at the centre of a giant planet such as Jupiter and at temperatures in excess of 10 million degrees. The laser, inside a facility the size of a football pitch, is delivered to a high-vacuum target chamber four metres across and focussed into a target only a few millimetres in size. The laser has to be operated in ultra-clean conditions; better than those found in a hospital’s operating theatre. The complex combination of 10 ‘long-pulse’ beams and two ‘short-pulse’ beams make this a facility unique in the world.

Although the CTBT era prevents nuclear tests, representative devices using surrogate materials can be tested. Hydrodynamic tests use large-scale radiography to interrogate the implosion of the representative devices. This part of the programme benefits from a bilateral agreement with France to develop a joint hydrodynamics capability called Teutates. Other hydrodynamic testing involves gas guns firing projectiles into targets to measure the response of specific materials to explosive shock. Complex electronic and optical sensors make fast and minute measurements of the target which are analysed to provide the material data.

The warhead contains components made from a wide range of materials, not least of all the fissile isotope of plutonium and highly characterised conventional explosive, each requiring a different manufacturing capability for a relatively small quantity of units. Each element of material manufacture requires dedicated facilities and technically skilled staff.

To completely certify the warhead, AWE has to account for all of the environments that the warhead will experience – such as remaining in storage for many years, road transport, deployment undersea and potentially riding the ballistic missile into orbit and back. The science of sustained acceleration, vibration, temperature changes, stress and many others have to be understood over timescales of seconds to years. Engineering testing and modelling, materials analysis and a continuous programme of surveillance feed into the computer design codes for certification.

KEEPING OUR NATION SAFE

AWE is also home to the UK Nuclear Threat Reduction programme which combines STEM with operational response. This programme, worthy of an article in its own right, develops AWE’s nuclear weapons expertise to support the MoD and other Government departments. This support covers a wide range activities in a number of subject fields including international treaties; detection of material outside of regulatory control, nuclear forensics; counter-terrorism and emergency response. The knowledge obtained from our nuclear weapons programme enables AWE to contribute in ways that a non-nuclear state cannot.

PARTNERING

Both national and international outreach is vital to the STEM work at AWE. Under the 1958 Mutual Defence Agreement, AWE collaborates with the equivalent US laboratories gaining vast benefit from shared expertise, facilities and test data. With UK universities, two-way relationships provide a foundation of expertise and sharing of facilities across the wide range of required subjects. AWE offers sponsorship for academics and students as well as employer engagement and professional activities to support UK STEM capability.

STEM skills are at heart of the UK’s nuclear weapons programme, driving improvements in capability and safety. They have had to adapt to an era without nuclear testing and provide continuous assurance of the credibility and safety of the deterrent. The community also continues to provide expertise and support to national security in an ever changing environment and in both cases be ready to meet future challenges to national defence.

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Students and young scientists put MPs and Ministers in the hot seat at this year’s Voice of the Future on 15 March in the House of Commons. It was a Select Committee with a difference: a role reversal. Its ‘members’ were scientists and engineers and most of its ‘witnesses’ were MPs. In the words of the distinguished former MP Andrew Miller “there is no other event like it on the planet”.

Science Minister Jo Johnson MP and a range of other political and scientific figures were quizzed by young scientists and engineers on topics as diverse as artificial intelligence, gene editing, research funding, STEM careers, post-truth politics and space exploration during Voice of the Future 2017 organised by the Royal Society of Biology on behalf of the science and engineering community (www.rsb.org.uk/VOF).

The event turned the tables on MPs, Ministers and senior officials and gave students and young scientists – representing two dozen science organisations and some schools – the chance to scrutinise politicians and their advisors in a real House of Commons committee room where they experienced exactly what it is like to sit as a Select Committee.

Broadcast live on Parliamentlive.TV, the event created enough interest online that at one point ‘#VOF2017’ was trending on Twitter above Chancellor Philip Hammond’s Commons post-Budget U-turn on NI contributions for the self-employed.

In the run-up to the event literally hundreds of suggested questions had been submitted and these had to be whittled down to a manageable number or the session would have lasted all day! Unsurprisingly many of these questions overlapped and covered familiar topical themes.

Jo Johnson, appointed Minister for Universities and Science in 2015, responded to questions on academic freedom, Brexit, and investment in science, and reemphasised the Government’s commitment to investing in research, which he said would equate to the biggest increase in R&D spending in 40 years.

“Research is a big priority for this Government,” he told the committee of school students, undergraduates and early career scientists. We have made it clear we are going to put real resources behind this endeavour.”

Other panellists included Shadow Science Minister Chi Onwurah MP, the Government’s Chief Scientific Advisor Sir Mark Walport, and Members of the
Science and Technology Select Committee itself led by its then Chair Stephen Metcalfe MP.

Chi Onwurah MP had to field answers to direct questions about the Trump Presidency’s apparent attitude to science. Sir Mark Walport, who had been recently appointed Chief Executive-designate of the UK’s new overarching research body UKRI, took questions on science publishing, science careers and science regulation post-Brexit. He said much of the EU regulation on research had been influenced by the UK’s own legislation, and so the UK would be well-placed to regulate itself once it leaves the EU.

Stephen Metcalfe MP appeared with three of his Select Committee colleagues – Carol Monaghan MP, Dr Tania Mathias MP and Matt Warman MP – and got a feel for what it is like when having to reply to questions rather than being the ones asking them.

The two schools involved – Queens Park Community School and Wallington High Schools for Girls – said their A-Level science students had found the experience hugely valuable as did the young scientists and engineers drawn from the UK’s leading scientific organisations including the Royal Society, the Royal Academy of Engineering, the Royal Society of Biology, the Institute of Physics, the Council for the Mathematical Sciences, the Royal Society of Chemistry and many more.

Greg Satchell, an early career forensic scientist who works for the Thames Valley police force, said it was a ‘privilege’ to represent members of the Royal Society of Biology in Parliament.

“Very few people in my position ever get this opportunity, so being able to represent the Royal Society of Biology on behalf of scientists in my field is definitely a milestone in my career”.

A full video of the Voice of the Future hearing is available on the parlimentlive.tv website.
Disused areas which formerly hosted quarrying and mining activities often feature ‘holes-in-the-ground’ in various states of post-industrial abandonment. Revegetation programmes are being developed aimed at preparing such areas for green re-use through informed tree-planting programmes to create future biodiversity reserves. The overall aim is to establish unique long-term re-use of these sites, offering multiple benefits associated with greening and biodiversity gain.

THE PROBLEM
Across the UK, there are disused sites of former quarrying and mining activity with crater-like, irregular pit structures (holes) which may be lined with material which was previously removed to uncover resources such as minerals and metals, china clay, ball clay, coal, slate, building stone, and aggregate. While the size of the pits can vary, all have associated dumps consisting of rocks varying in size from boulders to stones, gravels and sands. There may also be evidence of residues from former extraction and purification processes: fine particles sedimented from aqueous flows may have filled nearby ponds or spread widely across local landscapes. Such residues may continue to cause release of toxic substances or contribute towards acid mine drainage and influence local watercourses away from the sites of the mines themselves.

Such surfaces are typically exposed, highly mineralised, sometimes toxin-loaded, nutrient deficient and often only semi-stable. These surfaces are generally unsuited to any future agricultural ‘food-chain’ use or for construction purposes. Often several of these legacy features combine to leave rocky scars on the landscape which are potentially long-lived and have little positive future purpose. Such sites are also generally inhospitable to natural plant development, requiring several centuries of weathering and amelioration processes to achieve adequate mineral downwash first settlement of plants.

To replace the past tradition of general abandonment, there is an important need to find uses for former mine sites. Growing experience with experimental plant establishment on a range of mine site surfaces reveals a considerable potential for targeted and structured greening of such sites. This effectively ‘paves the way’ for future site utilisation, provided an appropriate scientific approach is taken to matching appropriate species to sites, as based on detailed ecological knowledge of species selection.

REVEGETATION PROGRAMME
Proposals are being developed for the establishment of a scientifically-coordinated and species-structured, mine site revegetation programme. The focus of the programme is in Cornwall, which has an extensive mining history and current aspirations to achieve successful re-use of at least some of the former mine sites, which are regarded by many as blight on the landscape. Many of the older mine site areas are now included within the ‘Cornwall and West Devon Mining Landscape World Heritage Site’. In recognition of this, we are not proposing re-disturbing such older sites, aware of both their heritage value and that any artificial re-disturbance would also be counterproductive in re-exposing old toxic sediment layers that time has, to varying degrees, already naturally ameliorated.

In newer sites, however, strategies involve careful site matching of tree species proven to have high tolerance levels, aimed at ultimate landscape greening of some, or potentially many, site areas, to create scientifically-structured biodiversity reserves. To these ends, tree species which are potentially tolerant of specific mine-site habitats are being trialled in an integrated development where academic input based on knowledge of wild plant ecology, is combined with mine ownership and management, which harbours detailed knowledge of the mine sites.

Current research
Our research combines a focus on bioengineered landscape-greening on rocky, low-nutrient, and often initially highly vegetation-hostile terrains, with their follow-up utilisation as well-structured long-term international biodiversity reserves. Such knowledge builds towards understanding of future matching of species with habitat-tolerance potentials, while promoting greening throughout the process.
An integral part of our strategy is to attempt to achieve plantings, wherever possible, on innately low-nutrient habitats without the need for extensive prior artificial site-nutrient enhancement ‘amendment’ or modification. Former mine sites can offer, through a natural deficiency of fertiliser over-enrichment, a relatively pristine low-nutrient habitat, a key factor to enhancing biodiversity. Low-nutrient status habitats are often suited to establishing rarer plant arrays which require freedom from nutrient excesses, often encountered in surrounding landscapes such as farmlands. A carefully designed, science-based ‘tree-to-site-matching’ approach aims to identify tree species which have the potential to adapt to typically relatively hostile rock surface terrains. Current research suggests that this property is especially prevalent amongst mostly evergreen gymnospermous tree species, which can also provide pioneering woody, long-term vegetation cover.

We have chosen to trial these species deliberately in locations where previous attempts were made by commercial horticultural companies to plant relatively ‘standard’ native tree species mixes, and where that strategy failed. This intentionally gives our selective tree-establishment techniques some of the maxima of conditions of site-establishment-hostility to overcome, as an assessment of their minimal likely suitability for wider site application. We are thus not ‘doing things the easy way’, but instead are taking the most difficult route. Our largest trial to date has been running for seven years and provides a good indication of establishment success. The location is a site where commercial native tree planting achieved a 100% failure rate. Our selected tree planting strategies have so far achieved over 70% establishment success in a single ‘first round’ of planting.

Benefits of revegetation

Our pioneering ‘terra-greening’ enables planting directly into the relatively hostile habitats initially presented by outworked mine site surfaces, with little need to be added in terms of pre-treatments, achieving long-term land cover and site stabilisation. Wider ranges of species and locational plantings will be gradually developed from this experience. Such future materials, especially as seed resources, can also be returned to the wild, to their original sites of origin, for wild re-foresting of deforested areas. For the successful delivery of revegetation we need:

1. APPROVAL: local approval of long-term re-greening of former mine sites.
2. DESIGNATION: protection of sites used for re-greening programmes.
3. SITE COMMITMENT: well-coordinated joint research involving academia and mine site owners.

Academic/industrial partnership

Academic partners are typically in a good position to provide knowledge about tree species diversity, their wild ecology, site soil and rock chemistry testing, tree-species site-matching and selection of intrinsic ecology to habitat types within mine site availability, and procurement, authentication, and propagation of necessary materials. The mine site owners are in the best position to implement the more applied aspects of site planting, modest site engineering and tree protection, and habitat maintenance as may be locally necessary, onward site security and assurance of permanency of dedication of purpose. Remaining aspects, which includes recording, onward habitat development, variations in trials and plantings resulting from experience gained, require joint input and revision on the basis of accumulated experience.

Societal and environmental Impact

The revegetation programme will achieve a societal need to redress the presence of such scars on the landscape, in ways which are also likely to achieve public approval. The programme also aims to inspire younger generations who are becoming more strongly environment and biodiversity-aware, and who will be the ultimate inheritors of such achievements. The programme helps to address increasingly urgent environmental issues such as carbon capture, reduction of external impact, and formation of new habitat diversity.

THE FUTURE

This revegetation programme combines gaining important knowledge into bioengineering strategies of terra-greening on to rocky, low-nutrient, and often initially highly vegetation-hostile terrains, with knowledge about site engineering, species matching and resource planning. Once through early establishment phases, where tree-root systems have formed, it is likely that onward growth progression of trees planted today is strongly assured. Their onward presence should be regarded as an asset for future generations rather than a liability. Such biodiversity reserves then have the potential to rapidly become self-sustaining, and, with adequate site designation, their future is protected.

This programme offers potential for re-greening of mine sites, utilising sites currently of limited use, into future green areas in the landscape, which have wider habitat value, safeguard future genetic resources, act as carbon-sinks and habitat pioneers, and provide renewed purpose for scars on the landscape. We are pioneering these studies in the UK, and there is much to be learned about its implementation. Although this integrated programme is developed in Cornwall, the scientifically-founded principles and their application may be, in future, eminently exportable. When properly studied, recorded, and documented, what we are pioneering and achieving today will most likely be regarded as adding to, rather than detracting from, future Heritage Value.
WHY CAN’T WE HAVE GOOD BROADBAND NOW?

Suzanne Clear, Senior Advisor Planning and Rural Affairs, National Farmers’ Union

In modern farming, reliable broadband and mobile connectivity is vital to enable farmers and growers to remain competitive and to continue to produce the nation’s food.

The National Farmers’ Union (NFU) represents 55,000 farmer and grower businesses in England and Wales, who want future-proofed connections to superfast broadband and complete mobile phone coverage.

‘Good broadband’ according to NFU survey evidence is a service that farmers and growers need to compete and to increase productivity. It is the way to get the information they need from the wide range of technology that will make a difference on their farms. Access to good broadband service will also allow them to enjoy family life.

The NFU has set out a range of solutions as to how this can be achieved in our Spotlight on Farm Broadband and Mobile Networks Document, published in 2016. In 2017, we applied this within the context of the Government’s Agitech and Industrial Strategies.

Broadband delivery is still assessed by Government in terms of potential delivery targets, whilst farmers’ ability to do business and prepare for the opportunities and challenges of Brexit, depends on the broadband connection they receive now. To understand actual broadband coverage the NFU surveyed more than 500 members in 2015 and 2016 by phone with a further 300 responding online to each survey. The respondents provided significant information on their actual connectivity and how this impacts on their businesses.

SPEED

The results confirmed that, by and large, the £1.7bn Government funded superfast broadband programme had not reached farms; they were in the last 5% outside the programme that would not receive funding support. Only 6% of farmers who responded to the NFU survey in 2016 reported that they could achieve 24 megabits per second (Mbps), the speed the Government established for its superfast programme. Many more had very poor broadband speeds; only 56% had download speeds of 2mbps or less and 83% had an upload speed of 2Mbps or less. This is just measuring broadband by speed, there are further issues which will determine ‘good broadband’ including latency, strength of signal and reliability of coverage in all weathers and locations.

In September 2016, the EU set out ambitious new targets to achieve universal ultrafast broadband coverage (measured at 100 megabits per second by 2025). In contrast, there is doubt as to whether the UK government can achieve the Digital Economy Act’s target of a broadband Universal Service Obligation of 10 Mbps for homes and businesses by 2020. In December 2016, Ofcom reported that it may cost £49,000 to connect the most remote properties, which may not be offered access to the universal service unless they pay more or accept lower service standards. The NFU is concerned that these properties will be predominantly farms, rural businesses and remote rural homes.

We are increasingly reminded that digital service providers cannot connect broadband for all farmers economically; this is despite the opportunities to play a huge part in increasing farm connectivity and improving rural life. The majority of NFU members are still reliant on copper or aluminium wires. Some relied on dial-up services for broadband until they were withdrawn, 6% use satellite.

The message farmers have given us is simple: farms and rural areas need access to a fully functioning rural broadband market.

INNOVATORS

Farmers are the innovators who excel at growing an increasingly wide range of produce under glass; they can manage irrigation through radio technology and host grain store and anaerobic digester plants that are remotely monitored. Farmers have mechanised dairies, virtual fences and animals that wear sensors through which their health is monitored. GPS-controlled tractors are utilising technology to reduce reliance on pesticides and to monitor crop water requirements.

Yet NFU members still report having to write down information, as they don’t have a signal to get their information back to the office computer!

Mobile phone connectivity is equally as important to the farmer, and indeed our farm survey in 2016 demonstrated that there had been significant improvements in delivery of 4G in some areas, which farmers quickly embraced. Where opportunities exist, farmers are prepared to be both innovative and hands on to get infrastructure on farm. They have
embraced alternative digital technologies, dug the trenches to lay connections and hosted infrastructure on farm for their own and wider community benefit. When major suppliers approach them they just want a fair land deal.

So, perhaps the more urgent question is ‘Why can’t we have good broadband now, when we need to compete and to be our most productive?’ Here are just a few of the reasons NFU members told us why they needed good broadband, when we surveyed them in 2015 and 2016:

to raise yields; create increased revenue, cut costs; improve record keeping, enable efficient management and reduce wasted time; reduce environmental impact, improve the UK’s drive for self-sufficiency; access online applications, ensure farmers can access guidance and comply with regulations and gain detailed access to local and international market information and customers.

There are many more and inability to access regulation to ensure compliance is a particular concern. Farmers’ frustrations were made worse when the Rural Payments Agency went ‘online only’ in 2015, only to have to revert to paper forms. This move reportedly wasted millions of taxpayer’s pounds, not taking into account the impact on farm business.

On the 21st February 2016, the NFU launched ‘Feeding the future, four years on: A review of innovation needs for British farming’. This report identified that there are so many efficiencies that can be gained with better technology. Indeed, farmers identified harnessing the power of recent developments in data and digital technologies, as a key objective for future farming innovation.

We need to make the massive leap from having sub 2Mbps broadband speeds and 15% of farm coverage for mobile to a complete 5G network in a very short amount of time to remain competitive.

The good news is we are not alone in seeing the benefit of digitally connected farms. The House of Lords Science and Technology Committee’s report “Connected and Autonomous Vehicles” concluded that:

The Government must broaden its focus so that it’s work on Connected and Autonomous Vehicles (CAV) cuts across all sectors and does not focus so heavily on road vehicles. Early benefits are likely to come in sectors such as marine and agriculture therefore the Government must not allow media attention around driverless cars to cause it to lose sight of the many potential benefits that CAV can provide in areas outside the roads sector.

So why can’t we have good broadband when the Government pushes ahead to online only services, before there is sufficient digital access in place? This is especially relevant when there has not been sufficient policy or fiscal incentives to address rural market failure. Governments can both create problems and also address them, which is why the NFU set out ten ways to help the UK Government help create the best connected country in the World.

THE PROVISION OF GOOD BROADBAND IS LONG OVERDUE.

UK farm businesses and, indeed, rural businesses more generally need access to digital infrastructure to be able to be progressive, profitable and crucially to be able to compete in future world markets.

Completing geographical coverage for broadband and mobile services has to be a priority. Whilst this is especially relevant for farmers now, it will apply more widely for connected communities in the future, for commuting along roads and railways and using footpaths. Consumers of digital services will require access at all times in a 5G world.

If solutions can be found for farmers now, they will benefit us all in the future.

References
1 NFU Spotlight on Farm Broadband and Mobile Networks: One Year on.
COATINGS – THE BASIS OF THE UK’S MANUFACTURING ECONOMY

Trevor Crichton, Science Committee Chair for the Institute of Materials Finishing

In 2015/16 the surface coatings industry contributed an estimated £13.5bn to the UK economy. By improving surface characteristics and performances, it positively impacted products valued at about £173bn, directly adding value to 50% of the UK’s £358bn total manufacturing sales.

Ever since tools were first used by hominiods, improvements to their performance have been the bedrock of mankind’s technological, economic and social evolution and attributable to the tools’ critical outermost surface coatings. Surface coatings are substances applied to another material to change the surface properties resulting in promoting the longer use of engineering and structural components as well as providing reduced environmental impacts. The technologies and processes supporting the surface coating industry are known generically as surface engineering.

SURFACE COATINGS AND THE MANUFACTURING SECTOR

Between 2011 and 2015 the total sales from the UK’s manufacturing sector grew by 5%, from £341bn to £358bn. In 2014 the UK’s surface coatings business had a turnover of about £11.2bn and represented about 7.8% of the total value of products requiring surface coatings, but the Institute of Materials Finishing (IMF) now believes that by 2015/16, this had grown by about 20% to an estimated £13.5bn, giving a total market impact value of £173bn, or 50% of the UK’s total manufacturing sales.

The surface coatings market embraces virtually all manufacturing sectors, but is dominated by three sectors - oil and gas, construction and automotive (Figure 1).

The oil and gas industries use a wide variety of coatings that can both withstand their harsh operating environments and provide maximum reliability to their functional parts; the coatings may also provide specialist intumescent and heat resistant properties.

The construction industry’s surface coatings are more based on wet paints, plastics and powder coatings, whilst both the automotive and aerospace industries use virtually the whole range of coating technologies for component protection and corrosion inhibition. It is estimated that about 60% of the aerospace industry’s maintenance costs are due to corrosion.

METAL COATINGS INDUSTRY

In 2014 there were just over 1,300 enterprises in the UK whose main activities were treating and coating metals (SIC 2561). They employed an estimated 21,600 people with an average employment level of about 17 people, so the industry is dominated by small and medium sized enterprises (SMEs). These enterprises had a gross turnover of about £1.6bn and net sales of about

Figure 1: The % share of the surface coating market, by end user.

Source: IMF –based on previously published SEAC SIG data
£1.3bn\(^6\), but these figures exclude many organisations with in-house facilities that are part of their product manufacturing system.

Metal treatment processes, such as plastic and powder coating, followed by molten metal immersion and wet paint coatings, are used to enhance product performances, resulting in major environmental benefits such as reduced carbon dioxide emissions for both the manufacture and use of the final products. Through correct product specification and design, surface engineering can also facilitate upcycling as well as reuse and recycling of critical materials and natural resources.

There is a need for both fundamental and continual education within the industry, as very few specialist courses are run by UK academic bodies. The IMI offers both professional grades and recognitions, as well as running educational courses from technician level through to Grad.IMI; each year about 140 students enrol on them. These courses are available at either distance or tutored learning and can be tailored to an employer’s needs. The Institute also runs specialist bespoke short courses that target a company’s specific needs.

**CORROSION**

It is estimated that corrosion costs the USA 6.2\% of GDP\(^7\), with the majority of costs being in utilities (34.7\%) and transport (21.5\%)\(^8\). No comparable data are available for the UK and Europe, but we believe the figures to be similar to the USA. Since 2000, corrosion’s avoidable costs have decreased by 10-15\%, but 20-25\% of these costs remain avoidable\(^9\), potentially saving the UK £27-35bn annually.

In 2010 the US Department of Defense estimated that corrosion costs represented about 3.5\% of its annual budget; only 9\% was within the military infrastructure and facilities and 91\% was incurred by the weapons systems and equipment corrosion\(^9\). UK technologies have helped reduce these costs as well as increase the arsenal’s reliability by developing self-lubricating coatings that avoid the need for liquid lubrication in handguns. The Department also made inquiries about using similar coatings for parts of the Lockheed F117 Nighthawk “stealth fighter”.

**SUSTAINABILITY**

Appropriate surface coatings are essential for economic and environmental sustainability, as demonstrated with the recent development of new paint technologies for the Forth Bridge in Scotland (Figure 2). For the first time in its 100+ year history, the bridge does not need continual painting and it is estimated that the new paint should last over 20 and possibly up to 40 years.

Without the continual repainting of the bridge, Network Rail believes the bridge could have survived for only 20-30 years\(^11\).

**IMPACTS OF LEGISLATION**

The surface engineering industry faces many challenges, such as health and environmental legislation. The industry has evolved universally through using often hazardous materials and processes that are now facing increased controls, although they can obtain limited exemptions, such as with cadmium, hexavalent chromium, lead and nickel. However, these controls can sometimes, incorrectly, assume that economic and performance-meeting substitutes can be found without creating unwanted secondary effects. For example, the prohibition of lead in solder has contributed to issues with “tin whiskers” for which the surface engineering industry is seeking methods of preventing, or mitigating, their growth (Figure 3), as they can cause electrical and electronic component failures ranging from heart pacemakers to military missiles and space satellites\(^12,13,14\).

The mechanisms of metal whisker growth are not understood, although Loughborough University is actively studying them\(^15,16\). Their potential impacts are increased as the electronics sector develops ever smaller components, as although tin whiskers are usually only a few microns in diameter, they can be up to a millimetre or so long; the “world record” is over 25mm\(^17\). They can also potentially and adversely impact the UK’s electronic and electrical components manufacturing industry, which includes integrated circuits, semiconductors, passive electronic components and solar panels. This industry has gross sales of about £2bn\(^18\) and supports an industry worth about £80bn\(^19\).

It has been suggested that tin whiskers may also be

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**Figure 2:** The Forth Rail Bridge Source: www.Networkrailmediacentre.co.uk
responsible for electronic failures in automobiles and could contribute to reduced reliability in consumer electronics, where 3% fail within 3 years. To mitigate their potential damage, NASA now requires their essential-component soldiers to contain a minimum of 3% lead.

**FUTURE OPPORTUNITIES**

Future quantum leap opportunities in surface engineering include the development of ionic liquids. These use non-aqueous chemistries and offer exciting opportunities through making possible currently unachievable new coatings and treatments for meeting the increasing performance demands from the aerospace, electronics, energy and automotive sectors; they will also strengthen and mitigate the industry’s health, safety and environmental credentials. One of the world’s leaders in this technology is the University of Leicester which is working in conjunction with major industrial partners and funding from EU Framework programmes, InnovateUK and the Royal Society to commercialise this technology.

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**MENTAL HEALTH RESEARCH – THE FUTURE BECKONS**

**MENTAL ILL HEALTH – A NATIONAL EMERGENCY**

Mental ill health is a national crisis. Every year one in four people in the UK suffer from a mental health problem, with huge impact on the individual, their family and society. Mental health problems are one of the largest causes of sickness leave from work, accounting for more than 15 million lost working days per year. The total cost of mental health problems to the economy is estimated to be £70–£100 billion per year. Suicide is the leading cause of death amongst young people aged 20–34 in the UK.

Treatments have not significantly advanced for decades and services are massively stretched meaning that many people do not get the support they need. We urgently need to do better.

**WHY RESEARCH IS CRITICAL**

The fundamental problem that limits our ability to treat mental illness is a lack of adequate understanding of the biological and psychological mechanisms underlying these conditions. Until we understand the causes of a disease or disorder it is extremely hard to improve treatment. This was the case in the rest of medicine – treatment for diseases like pneumonia and cancer only progressed once we understood their causes. Our understanding of the fundamental causes of mental health problems such as depression, autism and schizophrenia has lagged behind our understanding of conditions like cancer. There is however now real hope as research is beginning to uncover some of the key risk factors for mental illness.

**PROGRESS IN UNDERSTANDING RISK**

It has long been recognised that both genetic and environmental risk factors...
(“nature and nurture”) can influence mental health. Understanding these risk factors provides a key route to understanding the causes of mental health problems. Many mental health problems run in families and we know from a range of different studies that genetics is important in these conditions. Until recently it has proved very difficult to identify the exact genes involved. However, in the last decade there has been exponential progress in finding the genes for conditions like autism, schizophrenia and bipolar disorder, with the UK playing a significant role in this research. This has been possible through advances in technology (for example DNA sequencing) and major international collaboration. Genetic studies have shown that genes involved in synapses (the connections between nerve cells) as well as genes affecting the brain’s immune system and genetic control are important in these conditions. This means we are now beginning to understand the causes of mental disorders, and to identify new targets for treatments.

We also know that environmental factors – including early life events and influences such as stress can also influence risk for mental ill health. Again considerable progress has been made in understanding the relationship between factors such as birth problems, childhood maltreatment and stress and mental health problems. These areas also offer opportunities for novel interventions to prevent mental disorders, be it through psychological treatments, societal changes or new medications.

THE TOOLS TO DEVELOP NEW TREATMENTS
To take forward the promise of this new understanding of risk for mental ill health into better treatments, we need to understand how genetic and environmental factors affect the brain. Studying the brain is however difficult due to both its complexity and inaccessibility. Fortunately, recent advances in neuroscience now make such research possible. In particular, the ability to take peripheral cells (such as a skin sample) from patients and turn them into brain cells in a dish (so called induced pluripotent stem cell technology) means we can directly study the functions of brain cells from patients. Such cells also provide a new way of testing novel treatments. Advances in brain scanning also mean that we have unprecedented means to investigate the structural, functional and chemical changes in the brain associated with mental health problems. The coincidence of these advances in neuroscience with the greater understanding of risk means that this is a time of enormous opportunity for the development of new treatments for mental disorders.

WHAT WE NEED TO DO NEXT
The UK has great strengths in mental health and neuroscience research, but this is currently distributed across different centres. Mental health research receives only 6% of our national spending on health research, despite the huge burden of these disorders. What we need now is a national strategy to bring together our excellent researchers in these fields and to generate a national programme for mental health research bringing together the diverse expertise required to make progress. Such a strategy could parallel that recently developed for dementia research, and ideally would benefit from close synergies in the study of these important brain disorders. A national strategy for mental health research, allied with appropriate investment, would also provide a strong message to help tackle the stigma that still exists in association with mental disorders, and would provide a platform against which to support and improve our mental health services. Finally, given the huge unmet need in mental health and the great opportunity for advances in treating a range of brain disorders, a clear national programme of research in this area in the UK will provide an important basis for ongoing industrial investment in our health sector.
NEWS FROM POST

The last few months at POST have seen a number of changes. On the staff front, Chris Tyler has left to be Head of Public Policy at the University College London’s Science, Technology, Engineering and Public Policy (STEaPP) department, while Chandika Nath takes over as acting Head of POST. Aaron Goater has been seconded to the Committee on Climate Change and we welcome Jack Miller as our new energy adviser. Sarah Foxen joins us as a social science adviser focusing particularly on academic engagement.

A new Parliament means a new Board for us. The POST Board oversees our work programme, and comprises members of both Houses (four Peers and ten MPs) as well as four external scientists and four ex-officio members. We are delighted that Lord Winston, Lord Oxburgh and Lord Haskel will remain on our Board. The Earl of Selborne has stepped down as chair of the Lords Science and Technology Committee and so we welcome Lord Patel, the Committee’s new chair, to our Board. Work is underway to confirm Commons appointments and we hope to have membership finalised in time for our first meeting in October.

We also welcome Bernard Silverman (former Chief Scientific Adviser to the Home Office), who replaces Sir David Davies as an external board member.

We sincerely thank both the Earl of Selborne and Sir David Davies for their support and contributions to POST.

On the research front, we have also been busy. Since March we’ve published nine POSTnotes and three POSTbriefs, the details of which are below. There are a number of new briefings due for publication when the House returns in September: Clinical Trials Regulation in the UK, Risk Assessment for Nanoparticles, Research and Gambling, Regulating Advanced Therapies, Benefits of Earth Observation, Alternative Gases for UK Heating, Risk Assessment of Nanoparticles and Communicating Risk.

**RECENT POSTNOTES**

**Quantum Technologies**

April 2017  
POSTnote 552

Quantum Technologies use the behaviour of matter and light that is normally only observed at very small scales. This POSTnote introduces recent advances, applications, and UK initiatives to support their development and commercialisation. It also reviews policy concerns such as privacy, access to new technologies and secure communications.

**Global Health Inequalities**

May 2017  
POSTnote 553

This POSTnote reviews trends in global health inequalities in the context of the transition from the Millennium Development Goals to Sustainable Development Goals.

**Cyber Security of UK Infrastructure**

May 2017  
POSTnote 554

The Government has identified ‘cyber’ as one of six Tier 1 threats to UK national security. This POSTnote focuses on the cyber security of the UK’s critical national infrastructure, describing measures to improve cyber security and challenges in implementing them. It also reviews the new National Cyber Security Strategy, along with international policy and legislation.

**Rising Sea Levels**

June 2017  
POSTnote 555

Sea level rise increases the frequency and severity of coastal flooding and rates of coastal erosion. Sea level rise will continue far beyond the 21st century, even if global temperature increase is limited to 2°C above pre-industrial levels. This POSTnote sets out the causes and likely future levels of sea level rise and its implications. It updates POSTnote 363 on Sea Level Rise, published in September 2010.

**Security of UK Food Supply**

July 2017  
POSTnote 556

This note outlines current UK trade in food and animal feed, examines the challenges raised to the security of UK food supply by withdrawal from the EU and analyses the policy options available for improving UK food security.

**Environmentally Sustainable Agriculture**

July 2017  
POSTnote 557

Agricultural practices can reduce water quality, degrade soils and cause biodiversity loss. This in turn can disrupt natural processes that support food production. Environmentally sustainable agriculture seeks to reduce environmental damage and restore such processes. This POSTnote summarises associated land management options, agricultural policies and the constraints imposed by a new trading environment.

**Supply of Medical Isotopes**

July 2017  
POSTnote 558

This POSTnote highlights the critical role of radioactive isotopes used in medicine, and outlines the challenges for the UK in ensuring their future supply.

**Online Information and Fake News**

July 2017  
POSTnote 559

Internet search engines and social media platforms are an increasingly popular way of accessing news and information. In 2017, the proportion of UK adults consuming news online exceeded those who watched news on TV (74% versus 69%). This note considers how people access news online, how algorithms (sequences of instructions) and social networks influence the content that users see, and options for mitigating any negative impact.
Migrants and Housing
August 2017  POSTNote 560
Migration is often cited in public debate as a significant factor in the
demand for UK housing. This POSTnote provides an overview of
available research on migrants and housing. It examines definitions
and data sources on migration and its implications. It also outlines
the possible impact of migrants on housing, including variation by
tenure type, migrant characteristics and region. Finally, it considers
the impact of housing on migrants and local communities.

HOUSE OF COMMONS SELECT
COMMITTEES SEPTEMBER 2017

Following the General Election in June 2017, the House of Commons Select Committees have been re-forming in the new Parliament. At time of
publication, most of the Committees have elected a Chair but had not elected other members of the Committee. Details of Committees with relevance
to Parliamentary and Scientific Committee Members are shown below. Further details of membership of House of Commons Select Committees and
their inquiries can be found at http://www.parliament.uk/business/committees/

BUSINESS, ENERGY AND INDUSTRIAL STRATEGY
COMMITTEE
The Business, Energy and Industrial Strategy Committee is
appointed by the House of Commons to examine the administration, expenditure and policy of the Department for Business, Energy and Industrial Strategy (BEIS) and its associated
public bodies.
The BEIS Committee is chaired by Rachel Reeves MP.
Contact: Business, Energy and Industrial Strategy Committee,
House of Commons, London SW1A 0AA Telephone: 020 7219
5777
Email: beiscom@parliament.uk

EDUCATION COMMITTEE
The Education Committee monitors the policy, administration and
spending of the Department for Education and its associated arms
length bodies, including Ofsted. The Committee is an investigative
Committee rather than a legislative Committee: it sets its own
programme and chooses subjects for inquiries.
The Committee’s Chair is Rt Hon. Robert Halfon MP.
Contact: Education Committee, House of Commons, London
SW1A 0AA Telephone: 020 7219 1376 Email: educom@parliament.uk

ENVIRONMENT, FOOD AND RURAL AFFAIRS
COMMITTEE
The Environment, Food and Rural Affairs Committee (EFRA) is
appointed by the House of Commons to examine the expenditure,
administration and policy of the Department for Environment, Food
and Rural Affairs (Defra) and its associated public bodies. The
Committee chooses its own subjects of inquiry on environmental,
agricultural subjects.
Following the 2017 General Election, Neil Parish MP was re-elected
as Chair of the EFRA Committee.
Contact: Environment, Food and Rural Affairs Select Committee
House of Commons, London, SW1A 0AA Telephone: 020 7219
7341
Email: efracom@parliament.uk

ENVIRONMENTAL AUDIT COMMITTEE
The remit of the Environmental Audit Committee is to consider the
extent to which the policies and programmes of government
departments and non-departmental public bodies contribute to
environmental protection and sustainable development, and to
audit their performance against sustainable development and
environmental protection targets. Unlike most select committees,
the Committee’s remit cuts across government rather than focuses
on the work of a particular department.
The Chair of the Environmental Audit Select Committee is Mary
Creagh MP.
Contact: Environmental Audit Committee, House of Commons,
London SW1A 0AA Telephone: 020 7219 5776
Email: eacom@parliament.uk

EXITING THE EUROPEAN UNION COMMITTEE
The Exiting the European Union Committee is appointed by the
House of Commons to examine the expenditure, administration
and policy of the Department for Exiting the European Union and
matters falling within the responsibilities of associated public bodies.
Following nominations and elections among MPs, Rt Hon Hilary
Benn MP was re-elected Chair of the committee for the 2017 Parliament.

HEALTH COMMITTEE
The Health Committee is appointed by the House of Commons to examine the policy, administration and expenditure of the Department of Health and its associated bodies. The Committee chooses its own subjects of inquiry.

Dr Sarah Wollaston MP has been re-elected as Chair of the Health Committee for the 2017 Parliament.

Contact: Health Committee, House of Commons, London SW1A 0AA Telephone: 020 7219 6182 Email: healthcom@parliament.uk

SCIENCE AND TECHNOLOGY COMMITTEE
The Science and Technology Committee exists to ensure that Government policy and decision-making are based on good scientific and engineering advice and evidence. The Science and Technology Committee is unusual amongst departmental select committees in that it scrutinises the Government Office for Science (GO-Science), which is a “semi-autonomous organisation” based within the Department for Business, Energy and Industrial Strategy.

GO-Science “supports the Government Chief Scientific Adviser and works to ensure that Government policy and decision-making is underpinned by robust scientific evidence”. The committee therefore has a similarly broad remit and can examine the activities of departments where they have implications for, or made use of, science, engineering, technology and research.

 Rt Hon Norman Lamb MP was elected as Chair of the Science and Technology Committee on 12 July 2017.

Contact: Science and Technology Committee House of Commons, London SW1A 0AA Telephone: 020 7219 2793 Fax: 020 7219 0896 Email: scitechcom@parliament.uk

TRANSPORT COMMITTEE
The Transport Committee is charged by the House of Commons with scrutiny of the Department for Transport. Its formal remit is to examine the expenditure, administration and policy of the Department of Transport and its associated public bodies.

Lilian Greenwood MP was elected as Chair of the Transport Committee on 12 July 2017.

Contact: Transport Committee, House of Commons, London SW1A 0AA Telephone: 020 7219 3266 Email: transcom@parliament.uk Twitter: @CommonsTrans

HOUSE OF LORDS SELECT COMMITTEES SEPTEMBER 2017

This article provides details of House of Lords Select Committees with relevance to the interests of the Parliamentary and Scientific Committee.

ARTIFICIAL INTELLIGENCE COMMITTEE
The Select Committee on Artificial Intelligence was appointed on 29 June 2017 to consider the economic, ethical and social implications of advances in artificial intelligence, and to make recommendations. The Committee was established following the recommendation of the Liaison Committee. It will report by 31 March 2018.

The Committee is Chaired by Lord Clement-Jones.

The focus of the Committee’s inquiry will include:

• The current state of artificial intelligence
• The pace of technological change and the development of artificial intelligence
• The impact of artificial intelligence on society
• The public perception of artificial intelligence
• The sectors most, and least likely, to benefit from artificial intelligence
• The data-based monopolies of some large corporations

• The ethical implications of artificial intelligence
• The role of the Government and
• The work of other countries or international organisations.

The deadline for submitting evidence is 6 September 2017.

Contact: Select Committee on Artificial Intelligence, House of Lords, London. SW1A OPW Telephone: 020 7219 4384 Fax: 020 7219 4931 Email: HLAIAdHoc@parliament.uk

EU ENERGY AND ENVIRONMENT SUB-COMMITTEE
The EU Energy and Environment Sub-committee is a sub-committee of the EU Committee. The Sub-Committee focuses on a range of policy areas related to agriculture, fisheries, environment and energy. Attention is given to agricultural issues, particularly legislation relating to the Common Agricultural Policy (CAP) and animal health and welfare issues. The Common Fisheries Policy (CFP) and wider environmental issues are also examined, as are policies relating to energy and climate change.

The Committee is Chaired by Lord Teverson.
INQUIRY: Brexit: energy security inquiry
The EU Energy and Environment Sub-Committee is conducting a short inquiry to examine the implications of Brexit for energy security in the UK. The inquiry aims to highlight the issues the Government will need to consider when developing a new energy relationship with the EU.

Contact: EU Energy and Environment Sub-Committee, House of Lords, London SW1A 0PW Telephone: 0207 219 3015, Fax: 0207 219 6715

SCIENCE AND TECHNOLOGY COMMITTEE
The Science and Technology Committee has a broad remit “to consider science and technology”. It scrutinises Government policy by undertaking cross-departmental inquiries into a range of different activities. These include:

- public policy areas which ought to be informed by scientific research (for example, health effects of air travel),
- technological challenges and opportunities (for example, genomic medicine) and
- public policy towards science itself (for example, setting priorities for publicly funded research).

In addition, the Committee undertakes from time to time shorter inquiries, either taking evidence from Ministers and officials on topical issues, or following up previous work.

The Chair of the Committee is Lord Patel.

INQUIRY: Life Sciences and the Industrial Strategy
The Government set out in its Industrial Strategy Green Paper its intention to create a new Life Sciences strategy to make the UK the best place in the world to invest in life sciences. To tackle challenges like cancer and dementia it is important that the UK has a strong life sciences sector. But the sector faces a number of challenges and opportunities, including Brexit and making innovative new treatments available on the NHS.

This inquiry will investigate issues such as whether the Government has the necessary structures in place to support the life sciences sector, how the NHS can use procurement to stimulate innovation in the life sciences; and the content of the new Life Sciences industrial strategy, when published.

The Committee is inviting written evidence on the issue, to be received by Friday 15 September 2017, and will start taking oral evidence on the inquiry in October.

Contact: Science and Technology Select Committee, Committee Office, House of Lords, London SW1A 0PW Telephone: 020 7219 5750 Fax: 020 7219 4931 Email: hlsscience@parliament.uk
Each year the Research Councils invest around £3 billion in research covering the full spectrum of academic disciplines from the medical and biological sciences to astronomy, physics, chemistry and engineering, social sciences, economics, environmental sciences and the arts and humanities. Research UK is the strategic partnerships of the seven Research Councils. It aims to:

- increase the collective visibility, leadership and influence of the Research Councils for the benefit of the UK;
- lead in shaping the overall portfolio of research funded by the Research Councils to maximise the excellence and impact of UK research, and help to ensure that the UK gets the best value for money from its investment;
- ensure joint-up operations between the Research Councils to achieve its goals and improve services to the communities it sponsors and works with.

**Biotechnology and Biological Sciences Research Council (BBSRC)**

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BBSRC invests in world-class bioscience research, innovation and training on behalf of the UK public. Our aim is to further scientific knowledge to promote economic growth, wealth and job creation and to improve quality of life in the UK and beyond. BBSRC research is helping society to meet major challenges, including food security, green energy and healthier lifestyles and underpins important UK economic sectors, such as farming, food, industrial biotechnology and pharmaceuticals.

**Economic and Social Research Council**

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The ESRC is the UK’s largest organisation for funding research on economic and social issues and is committed to supporting the very best research with wide-ranging impact. Social science contributes to greater knowledge and understanding of the many complex challenges our society faces today and by ensuring that ESRC-funded research makes the biggest possible impact, our research shapes public policies and makes business, voluntary bodies and other organisations more effective, as well as shaping wider society. We also develop and train the UK’s future social scientists.

**Medical Research Council**

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Over the past century, the MRC has been at the forefront of scientific discovery to improve human health. Founded in 1913 to tackle tuberculosis, the MRC now invests taxpayers’ money in the highest quality medical research across every area of health. Thirty-one MRC-funded researchers have won Nobel prizes in a wide range of disciplines, and MRC scientists have been behind such diverse discoveries as vitamins, the structure of DNA and the link between smoking and cancer, as well as achievements such as pioneering the use of randomised controlled trials, the invention of MRI scanning, and the development of therapeutic antibodies. We also work closely with the UK’s Health Departments, the NHS, medical research charities and industry to ensure our research achieves maximum impact as well as being of excellent scientific quality.

**Natural Environment Research Council**

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NERC is the UK’s leading public funder of environmental science. We invest £380 million each year in cutting-edge research, postgraduate training and innovation in universities and research centres. Our scientists study the physical, chemical and biological processes on which our planet and life itself depends – from pole to pole, from the deep Earth and oceans to the atmosphere and space. We partner with business, government, the public and the wider research community to shape the environmental research and innovation agenda. Our science provides knowledge, skills and technology that deliver sustainable economic growth and public wellbeing.

**EPSRC**

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EPSRC is the UK’s main agency for funding research and training in engineering and physical sciences, investing around £800m a year in research and postgraduate training, to help the nation handle the next generation of technological change. The areas covered range from information technology to structural engineering, and mathematics to materials science. This research forms the basis for future economic development in the UK and improvements for everyone’s health, lifestyle and culture. EPSRC works alongside other Research Councils with responsibility for other areas of research.

**Science & Technology Facilities Council**

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The Science and Technology Facilities Council is one of Europe’s largest multidisciplinary research organisations undertaking and supporting a broad range of research across the physical, life and computational sciences. We operate world class, large-scale research facilities in the UK and Europe and provide strategic advice to the UK Government on their development. We partner in two of the UK’s Science and Innovation Campuses. We also manage international research projects in support of a broad cross-section of the UK research community, particularly in the fields of astronomy, nuclear physics and particle physics.
Association of the British Pharmaceutical Industry

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The Association of the British Pharmaceutical Industry (ABPI) represents innovative research-based biopharmaceutical companies, large, medium and small, leading an exciting new era of biocomics in the UK. Our industry, a major contributor to the economy of the UK, brings life-saving and life-enhancing medicines to patients. Our members are researching and developing over two-thirds of the current medicines pipelines, ensuring that the UK remains at the forefront of helping patients prevent and overcome disease. Topics we focus on include:

- All aspects of the research and development of medicines including clinical research and licensing
- Stratified medicine
- Vaccines, biosimilars, small and large molecules, cell therapy and regenerative medicine

Contact: Professor Richard Brook OBE FREng
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AIRTO – Association of Innovation, Research & Technology Organisations – is the foremost membership body for the UK’s innovation, research and technology sector, representing 80% of organisations in the sector. AIRTO’s members deliver vital innovation and knowledge transfer services which include applied and collaborative R&D, (frequently in conjunction with universities), consultancy, technology validation and testing, incubation of commercialisation opportunities and early stage financing. AIRTO members have a combined turnover of over £5.5bn from clients both at home and outside the UK, and employ over 47,000 scientists, technologists and engineers.

Contact: Tony Harding
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Website: www.amps-tradeunion.com

We are a Trades Union for Management and Professional Staff working in the pharmaceutical, chemical and allied industries.

We have produced a training programme funded by the EU on diversity and helping women managers remain in the workplace after a career break. This training programme is aimed at both men and women and is intended to address the shortfall in qualified personnel in the chemical and allied industries.

We are experts in performance based and field related issues and are affiliated to our counterparts in EU Professional Management Unions.

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British Antarctic Survey (BAS), an institute ofNERC, delivers and enables world-leading interdisciplinary research in the Polar Regions. Its skilled science and support staff based in Cambridge, Antarctica and the Arctic, work together to deliver research that uses the Polar Regions to advance our understanding of Earth as a sustainable planet. Through its extensive logistic capability and know-how BAS facilitates access for the British and international science community to the UK polar research operation. Numerous national and international collaborations, combined with an excellent infrastructure help sustain a world leading position for the UK in Antarctic affairs. For more information visit www.bas.ac.uk @basnews

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The Biochemical Society works to promote the molecular biosciences, facilitating the sharing of expertise, supporting the advancement of biochemistry and molecular biology and raising awareness of their importance in addressing societal grand challenges. We achieve our mission by:

- bringing together molecular biologists;
- supporting the next generation of biochemists;
- promoting and sharing knowledge and;
- promoting the importance of our discipline.

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Twitter: @BESPolicy

The British Ecological Society is an independent, authoritative learned society, and the voice of the UK’s ecological community. Working with our members we gather and communicate the best available ecological evidence to inform decision making. We offer a source of unbiased, objective ecological knowledge, and promote an evidence-informed approach to finding the right solutions to environmental questions.

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BIVDA is the UK industry association representing companies who manufacture and/or distribute the diagnostics tests and equipment to diagnose, monitor and manage disease largely through the NHS pathology services. Increasingly diagnostics are used outside the laboratory in community settings and also to identify those patients who would benefit from specific drug treatment particularly for cancer.

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www.foodafactoflife.org

The British Nutrition Foundation (BNF), a registered charity, delivers impartial, authoritative and evidence-based information on food and nutrition. Its core purpose is to make nutrition science accessible to all, working with an extensive network of contacts across academia, education and the food chain, and through BNF work programmes focussing on education in schools and nutrition science communication.
The Council for the Mathematical Sciences is an authoritative and objective body that works to develop, influence and respond to UK policy issues affecting mathematical sciences in higher education and research, and therefore the UK economy and society by:

- providing expert advice;
- engaging with government, funding agencies and other decision makers;
- raising public awareness; and
- facilitating communication between the mathematical sciences community and other stakeholders.

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The Energy Institute (EI) is the chartered professional body for the energy sector, supporting over 22,000 individuals and 200 companies worldwide. The EI provides learning and networking opportunities, professional recognition and technical and scientific knowledge resources on energy in all its forms and applications.

The EI’s purpose is to develop and disseminate knowledge, skills and good practice towards a safe, secure and sustainable energy system. It addresses the depth and breadth of the energy sector and informs policy by providing a platform for debate and scientifically-sound information.

A registered charity, the EI serves society with independence, professionalism and a wealth of expertise in all energy matters.

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FirstGroup are the leading transport operator in the UK and North America and each day, every one of our 110,000 employees works hard to deliver vitally important services for our passengers. During the last year around 2.2 billion passengers relied on us to get to work, to school or college, to visit family and friends, and much more.

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IFST is the independent qualifying body for food professionals in Europe. Membership is drawn from all over the world from backgrounds including industry, universities, government, research and development and food law enforcement.

IFST’s activities focus on disseminating knowledge relating to food science and technology and promoting its application. Another important element of our work is to promote and uphold standards amongst food professionals.

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Gambica is the UK trade association for instrumentation, control, automation and laboratory technology. The Association seeks to promote the successful development of the industry and assist its member companies through a broad range of services, including technical policy and standards, commercial issues, market data and export services.

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The Geological Society is the national learned and professional body for Earth sciences, with 12,000 Fellows (members) worldwide. The Fellowship encompasses those working in industry, academia and government, with a wide range of perspectives and views on policy-relevant science, and the Society is a leading communicator of this science to government bodies and other non-technical audiences.

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IFSE is the UK’s professional body for innovators. It accredits and certifies innovation practices. We influence the inter-relationship between education, business, and government through research and collaborative networks. Our Innovation Manifesto highlights our commitment to support the development of innovative people and organisations. IFSE runs think-tanks, conducts research, develops new business models and tools and supports organisations to benchmark their innovation capabilities.

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EngineeringUK is an independent organisation that promotes the vital role of engineers, engineering and technology in our society. EngineeringUK partners business and industry, Government and the wider science and technology community, producing evidence on the state of engineering, sharing knowledge within engineering, and inspiring young people to choose a career in engineering, matching employers’ demand for skills.

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Gambica Association Ltd

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Institute of Marine Engineering, Science and Technology (IMarEST)

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Established in London in 1889, the IMarEST is a leading international membership body and learned society for marine professionals, with over 15,000 members worldwide. The IMarEST has an extensive marine network of 50 international branches, affiliations with major marine societies around the world, representation on the key marine technical committees and non-governmental status at the International Maritime Organization (IMO) as well as other intergovernmental organisations.

Institute of Measurement and Control

Contact: Dr. Patrick A Finlay Chief Executive Officer The Institute of Measurement and Control 87 Gower Street, London WC1E 6AF Tel: +44 (0) 20 73874949 E-mail: ceo@instmc.org Website: www.instmc.org Reg Charity number: 269815

The Institute of Measurement and Control is a professional engineering institution and learned society dedicated to the science and application of measurement and control technology for the public benefit. The InstMC has a comprehensive range of membership grades for individuals engaged in both technical and non-technical occupations. Also, it is licensed by the Engineering Council to assess and register individuals as Chartered Engineers (CEng), Incorporated Engineers (IEng) and Engineering Technicians (EngTech).

The InstMC works to develop the knowledge and skills of individual engineers, fostering communication and advancing the science and practices within the industry.

IOP Institute of Physics

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The Institute of Physics is a leading scientific membership society working to advance physics for the benefit of all. We have a worldwide membership from enthusiastic amateurs to those at the top of their fields in academia, business, education and government. Our purpose is to gather, inspire, guide, represent and celebrate all who share a passion for physics. And, in our role as a charity, we’re here to ensure that physics delivers on its exceptional potential to benefit society.

Alongside professional support for our members, we engage with policymakers and the public to increase awareness and understanding of the value that physics holds for all of us. Our subsidiary company, IOP Publishing, is a world leader in scientific communications, publishing journals, ebooks, magazines and websites globally.

IChemE Institute of Chemical Engineers

With over 44,000 members in 120 countries, IChemE is the global membership organisation for chemical engineers. A not for profit organisation, we serve the public interest by building and sustaining an active professional community and promoting the development, understanding and application of chemical engineering worldwide.

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Kensington, London W8 4AQ City of London, E14 4AA Wellington, NZ

Institution of Civil Engineers

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Established in 1818 and with over 86,000 members in 167 countries worldwide, ICE is a leading source of expertise in infrastructure and engineering policy and is widely seen as the independent voice of infrastructure. ICE provides advice to all political parties and works with industry to ensure that civil engineering and construction remain major contributors to the UK economy.

Institution of Mechanical Engineers

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The Institution provides politicians and civil servants with information, expertise and advice on a diverse range of subjects, focusing on manufacturing, energy, environment, transport and education policy. We regularly publish policy statements and host political briefings and policy events to establish a working relationship between the engineering profession and parliament.
The Marine Biological Association has been delivering its mission “to promote scientific research into all aspects of life in the sea, including the environment on which it depends, and to disseminate to the public the knowledge gained.” The MBA represents its members in providing a clear independent voice to government on behalf of the marine biological community. It also has an extensive research programme and a long history as an expert provider of advice for the benefit of policy makers and wider society.

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The National Physical Laboratory (NPL) is the United Kingdom’s national measurement institute, an internationally respected and independent centre of excellence in research, development and knowledge transfer in measurement and materials science. For more than a century, NPL has developed and maintained the nation’s primary measurement standards - the heart of an infrastructure designed to ensure accuracy, consistency and innovation in physical measurement.

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The Microbiology Society is the largest learned microbiological society in Europe with a worldwide membership based in universities, industry, hospitals, research institutes and schools. The Society publishes key academic journals, organises international scientific conferences and provides an international forum for communication among microbiologists. The Society promotes the understanding of microbiology to a diverse range of stakeholders, including policy-makers, students, teachers, journalists and the wider public, through a comprehensive framework of communication activities and resources.

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L’Oréal employs more than 3,800 researchers world-wide and dedicates over €850 million each year to research and innovation in the field of healthy skin and hair. The company supports women in science research through the L’Oréal UNESCO For Women In Science Programme and engages young people with science through the L’Oréal Young Scientist Centre at the Royal Institution. L’Oréal also collaborates with a vast number of institutions in the UK and globally.

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PHARMAQ is the only global pharmaceutical company with a primary focus on aquaculture. Our mission is to provide environmentally sound, safe and efficacious health products to the global aquaculture industry through targeted research and the commitment of dedicated people. We have a product portfolio that includes over 20 fish vaccines and with specialist feed additives, anaesthetics, antibiotics, sea lice treatments and biocide disinfectants. Through our sister company, PHARMAQ Analytics, we also offer a range of diagnostics services that can be used to help safeguard fish welfare and improve productivity.

Risk Solutions

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Risk Solutions helps our clients make better decisions in a complex and uncertain world.

Using traditional qualitative and quantitative methods, combined with cutting-edge participatory approaches, we work with clients from across the public and private sectors, their stakeholders and customers, to bring a depth of understanding of the issues and to develop consensus about how to tackle them.

Our small, highly motivated and client focused team delivers:
• policy design, appraisal and decision support
• risk assessment and risk based strategies and plans
• evaluation, assurance and organisational review, and
• training, coaching and guidance.

The Royal Institution (Ri) has been at the forefront of public engagement with science for over 200 years and our purpose is to encourage people to think further about the wonders of science. We run public events and the famous CHRISTMAS LECTURES®, a national programme of Masterclasses for young people in mathematics, engineering and computer science, educational activities at the L’Oréal Young Scientist Centre and policy discussions with science students. And through the Ri Channel we share the stories behind cutting-edge science with people around the world.
THE ROYAL SOCIETY

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The Royal Society is the academy of science in the UK and the Commonwealth comprising 1400 outstanding individuals representing the sciences, engineering and medicine. The Society has played a part in some of the most fundamental, significant and life-changing discoveries in scientific history and Royal Society scientists continue to make outstanding contributions to science across the wide breadth of research areas. Through its Fellowship and permanent staff, it seeks to ensure that its contribution to shaping the future of science in the UK and beyond has a deep and enduring impact, supporting excellence in science and encouraging the development and use of science for the benefit of humanity.

Society for Underwater Technology

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The SUT is a multidisciplinary learned society that brings together individuals and organisations with a common interest in underwater technology, ocean science, and offshore/subsea engineering. The society was founded in 1966 and has members from over 40 countries, including engineers, scientists, other professionals and students working in these areas.

Society of Chemical Industry

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Established by Royal Charter in 1881, SCI is a unique multi-disciplinary community. Set up by a prominent group of forward thinking scientists, inventors and entrepreneurs, SCI continues to be a multi-science and industry network based around chemistry and related sciences. Our charitable objective is to promote links between science and industry for the benefit of society. Our passion is invention and creation.

We deliver our charitable objective by:

• Supporting the commercial application of science into industry
• Tackling global challenges across Agrifood, Energy, Environment, Health and Materials

SCIENCE DIRECTORY
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Established in 1964, the University of Essex is
ranked as one of the Top 20 universities in the
Research Excellence Framework and is awarded
Gold in the Teaching Excellence Framework. It is
home to world-leading expertise in analytics and
data science, with research peaks spanning the
social sciences, sciences, and humanities. Pioneers
of quantitative methods and artificial intelligence
techniques, Essex is also in the UK top 10 for
Knowledge Transfer Partnerships, and works with
businesses to embed innovation into operations,
through KTPs, knowledge exchange and contract
research.

Universities Federation
for Animal Welfare

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Registered in England Charity No: 207996

UFAN, the international animal welfare science
society, is an independent scientific and educational
charity. It works to improve animal lives by:
• supporting animal welfare research
• educating and raising awareness of welfare
issues in the UK and overseas
• producing the quarterly scientific journal Animal
Welfare and other high-quality publications on
animal care and welfare
• providing advice to government departments
and other concerned bodies.

The Welding Institute

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The Welding Institute is the leading institution
providing engineering solutions and knowledge
transfer in all aspects of manufacturing, fabrication and
whole-life integrity management. Industrial membership provides access to innovative
problem-solving from one of the world’s foremost
independent research and technology organisations.
Non-Corporate services include membership and
registration, education, training and certification for
internationally recognised professional development
and personnel competence assurance.
TWI provides Members and stakeholders with
authoritative and impartial expert advice, know-how
and safety assurance through engineering, materials
and joining technologies.
SCIENCE DIARY

PARLIAMENTARY AND SCIENTIFIC COMMITTEE
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follow us on Twitter @ParSciCom

Tuesday 10 October 2017, 5:30pm
Discussion meeting followed by drinks reception
Science and Brexit
Held in partnership with the Confederation of British Industry, Royal Society and Universities UK

Tuesday 14 November 2017, 10:00am
Discussion Meeting
Data

Tuesday 21 November 2017, 12:30pm
Parliamentary and Scientific Committee Annual Lunch

Monday 4 December 2017, 5:30pm
Discussion Meeting;
Science and Food Manufacturing

ROYAL SOCIETY OF BIOLOGY
11 October 2017 19:00-22:00 | Biology Week: Parliamentary Reception
Churchill Room, Houses of Parliament SW1A OAA
https://www.rsb.org.uk/events?event_id=1905

6 December 2017 19:00-22:00 | Christmas Parliamentary Reception (for science and engineering)
Churchill Room, Houses of Parliament SW1A OAA
https://www.rsb.org.uk/events?event_id=1906

25 April 2018 19:00-22:00 | Royal Society of Biology Accreditation Award Ceremony
Terrace Pavilion, Houses of Parliament SW1A OAA
https://www.rsb.org.uk/events?event_id=1911

26 (TBC) June 2018 10:00-12:30 | Parliamentary Links Day
The Attlee Suite, Portcullis House, Houses of Parliament, London SW1A 2LW
Please contact Karen Patel and Stephen Benn at events@rsb.org.uk for more details.

THE ROYAL SOCIETY
Details of all events can be found on the events calendar at events@royalsociety.org.
For scientific meetings queries:
scientific.meetings@royalsociety.org

THE ROYAL INSTITUTION
Details of all events and booking information can be found at www.rigb.org/whats-on.

PARLIAMENTARY OFFICE OF SCIENCE AND TECHNOLOGY
POST organises events that connect
Parliamentarians to leading experts from the research community and other sectors including government, the third sector and business on a range of topics. Details can be found at www.parliament.uk/mps-lords-offices/offices/bicameral/post-events/

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Biology Week

Invite you to attend a Parliamentary Reception to celebrate

Carol Monaghan MP and Chi Onwurah MP

Rt Hon Norman Lamb MP and Stephen Metcalfe MP