The Journal of the Parliamentary and Scientific Committee

SCIENCE IN PARLIAMENT
sip
SUMMER 2019

Rt Hon Sir Norman Lamb MP and Stephen Metcalfe MP
Carol Monaghan MP and Chi Onwurah MP

invite you to attend a Parliamentary Reception to celebrate

Biology Week

Wednesday 9 October 2019 | 19:00 - 22:00

The Churchill Room, House of Commons, London SW1A 0AA

Please RSVP to Harriet McAra at events@rsb.org.uk by 2 October

Organised by: Royal Society of Biology

Supported by: BBSRC bioscience for the future | UK Research and Innovation

www.scienceinparliament.org.uk

Left to right, top row: Rt Hon Sir Norman Lamb MP, Carol Monaghan MP
Lower row: Chi Onwurah MP and Stephen Metcalfe MP

PROFESSOR PETER SIMPSON - OBITUARY

It is with sadness that we record the death of our former Scientific Secretary Professor Peter Simpson FIMMM CEng.

Sadly, our former Scientific Secretary Professor Peter Simpson FIMMM CEng, died on 24th April 2019 at West Middlesex Hospital, Isleworth.

Peter was a member of the Parliamentary and Scientific Committee since the last Millennium and loquaciously represented the often forgotten voice of geologists.

Formerly Professor at Imperial College and Scientist at the British Geological Survey, when a vacancy for the post of Scientific Secretary became available, Peter stepped into the role from January 2004 to March 2012 and was also Editor of Science in Parliament.

Through his amazing network of contacts at Imperial College and Cambridge University he provided the Committee with an almost endless stream of top-quality speakers. During his time the Associate Parliamentary Group on Engineering was subsumed by the Parliamentary and Scientific Committee and Peter still managed to provide quality speakers on all relevant issues of engineering.

Despite physical disability and frailty Peter was an extremely determined academic who showed tenacity through a variety of adversities including a period when his administrative secretary, at very short notice, had to take sick leave for a period of seven months.

Peter was the beloved husband of Professor Jane Plant (deceased), father to Emma and Thomas and grandfather to Max and Sonny. His boundless enthusiasm for life and his breadth of knowledge and experience inspired many.

Stephen Metcalfe MP, Chairman, Parliamentary and Scientific Committee

Welcome to the Summer 2019 edition of Science in Parliament. We have another bumper edition.

The Parliamentary and Scientific Committee has recently held several fascinating, well-attended discussion meetings on highly topical subjects as diverse as **nutrition, sustainable fashion and fake news**. These are topics with significant implications for us all, whether as consumers, scientists or politicians. Articles from these meetings appear in this edition.

It also highlights two major events - **Links Day and STEM for Britain** – that have deservedly become well-established highlights of the Parliamentary science calendar. The Attlee Suite in Portcullis House was packed for both events. Although held in by far the biggest room in Portcullis House, we could easily have filled a room twice the size, such is the appeal and following that both events have developed over the years.

The successful delivery of these logistically complex events requires excellent, dedicated behind- the- scenes team work. I should wish to thank most warmly all those involved. None more so than Dr Stephen Benn, Royal Society of Biology, for all he has done to ensure the science community is heard and respected in Westminster, through his indefatigable work in masterminding Links Day and his support as Vice-President of the Parliamentary and Scientific Committee.

Making the voice of science heard is vitally important while Parliament and the new Government are pre-occupied with the challenge of delivering on the EU referendum.

It is good news to be able to welcome Jo Johnson MP back to the Cabinet table as Universities and Science Minister. This demonstrates a commitment from the Government to the Science Community. The new PM has also spoken about the importance of investment in Science and ensuring UK remains a leading Science and Innovation nation.

The concerns of the research, pharma and chemical sectors, should there be a 'no deal' outcome, were well-documented in The Exiting the EU Select Committee report published on 19 July. But Government policy is to get a deal, although given the inherent uncertainties involved, preparation for all options is important.

Writing this at the start of the summer recess, I am not going to try to predict what will happen in the autumn, but it is clear science and technology remains a most important endeavour, and the Parliamentary and Scientific Committee will continue to push the Government to ensure its interests are strongly represented.

Finally, I should like to thank Dr William Duncan for imaginatively 'keeping the show on the road' through a transitional year as Interim Director, and to welcome **Leigh Jeffes**, as our new CEO. Leigh has a wealth of relevant experience including working with the Royal Society of Chemistry and organising its Science and the Assembly and Science and Stormont events for many years. He has managed STEM for Britain since 2018.

SCIENCE IN PARLIAMENT
sip

The Journal of the Parliamentary and Scientific Committee.
The Parliamentary and Scientific Committee is an All-Party Parliamentary Group of members of both Houses of Parliament and British members of the European Parliament, representatives of scientific and technical institutions, industrial organisations and universities.

Science in Parliament has two main objectives:

1. to inform the scientific and industrial communities of activities within Parliament of a scientific nature and of the progress of relevant legislation;
2. to keep Members of Parliament abreast of scientific affairs.

CONTENTS

PARLIAMENTARY LINKS DAY 2019
SCIENCE AND THE NEW FRONTIERS

Rt Hon John Bercow MP

It was standing room only in the Attlee Suite for this year's Parliamentary Links Day in the House of Parliament on 25 June – it is standing room every year! – which was held to discuss the broad theme of *Science and the New Frontiers.*

Hundreds of scientists all over the UK from dozens of different scientific societies joined Members of Parliament of both Houses and the Minister of Science at the single largest science event held in Parliament which brings together politicians and representatives from a wide range of STEM disciplines.

For the tenth year running – a remarkable record – Links Day was launched by the Speaker of the House of Commons the Rt Hon John Bercow MP who praised the work of the scientific societies in helping Parliament with valuable advice on science-related issues.

It was at last year's Links Day that the Speaker had personally announced his intention to sponsor a lecture on science.

He then referred to the success of the recent inaugural Speaker's Lecture on Science (held the previous month) which was given by Professor Dame Nancy Rothwell, President of the University of Manchester and Co-Chair of the Prime Minister's Council, on Science and Technology.

He hoped such a lecture would become a regular feature of the annual Parliamentary calendar.

Speaking in her capacity as the Shadow Minister of Science and Industrial Strategy, Chi Onwurah MP was the first to address the morning session.

She pledged that Labour would increase R&D spending to 3% of GDP by 2030 and would do more to improve diversity in STEM careers.

Interspersed with three Keynote Addresses – from the Shadow Minister of Science, the Chair of the Commons Science & Technology Select Committee, and the Minister for Universities and Science – were two panels of distinguished scientists who considered the subsidiary themes of *Science for Success* and *Policies for Success*.

Chi Onwurah MP

These panels were chaired firstly by Stephen Metcalfe MP (a member of the Science & Technology Select Committee who also chairs the All-Party Parliamentary & Scientific Committee) and secondly by Carol Monaghan MP (also a member of the Select Committee).

The Top Table

Carol Monaghan MP

Sir Norman Lamb MP

Those taking part in the panel discussions spanned a range of disciplines, from proton beam therapy expert Dr Richard Amos and Professor of planetary plasma physics Emma Bunce, to Dr Sarah Main FRSB from the Campaign for Science and Engineering and Dr Grant Hill-Cawthorne of the Parliamentary Office for Science and Technology.

The Panellists also discussed topics such as how science policy might change to boost success in UK science, and how money should be spent if research funding rises to 3% of GDP.

For his part Sir Norman Lamb MP highlighted the work of the Science and Technology Select Committee and stressed the importance of collaborations between policymakers and scientists.

Speaking at the end of the morning session the then Government Minister of Universities and Science, Chris Skidmore MP, said that the UK should pay to access EU research programmes in an agreement separate from the Brexit withdrawal bill and other stalled negotiations.

> *"We see the rise of populism – men peddling easy solutions to complex problems," said Lamb, who has chaired the Select Committee since 2017 "but at the same time the world faces existential challenges that can only be solved by rational policymaking and the application of evidence. The science community will be absolutely central in ensuring we meet those challenges."*
>
> Sir Norman Lamb MP

Skidmore said he was recommending the Government pay for continued access to programmes such as Horizon post-Brexit, and pushing for a good settlement for science in the upcoming Comprehensive Spending Review.

"I believe we've reached a point now…that we need to look urgently at breaking away [from the main Brexit negotiation] in order to protect science and education partnerships," said Skidmore, who was appointed as the Minister for Universities, Science, Research and Innovation in December 2018. "We have to move away from this polarising idea that nothing is agreed until everything is agreed, that it's deal versus no deal."

He said the EU Council had recently created regulations that would allow the UK access to Horizon 2020 in full if it continues to pay into the EU budget, and that he had been recommending this to the current Prime Minister Theresa May and the Cabinet.

Asked whether either of the then two remaining candidates for the Conservative leadership has signalled support for science, Skidmore said Boris Johnson had previously indicated that it would make sense to continue paying into Horizon, although those comments were from two years ago, he added.

Skidmore also said the UK should follow countries like Germany in creating a long term, 'depoliticised' plan for science which guarantees funding over a period of 10 years.

Following the morning session there was a unique Links Day Lunch Reception in the grand surroundings of the Speaker's State Apartments in Speaker's House, made possible by invitation of the Speaker. Those attending were welcomed by the Deputy Speaker Mrs Eleanor Laing MP who praised Links Day as an essential part of the life of Parliament and thanked all the organisations – led by the Royal Society of Biology – who make it possible.

THE FIRST PANEL
From left to right: Professor Molly Stevens FRSB, Royal Society of Chemistry, Professor Sanjeev Gupta, Imperial College London and the Geological Society, Professor Philip Calder FRSB and the Nutrition Society and Dr Richard Amos, Institute of Physics.

Chris Skidmore MP

Dr Stephen Benn

THE SECOND PANEL
From left to right: Sharon Todd, Chief Executive SCI, Professor Stephen Harridge, King's College London and the Physiological Society, Dr Sarah Main FRSB, Director of the Campaign for Science and Engineering, William Hardie, Royal Society of Edinburgh and Dr Grant Hill-Cawthorne, Head of the Parliamentary Office of Science and Technology.

Links Day is and remains the biggest and longest-running science event in the Parliamentary calendar and brings together researchers, policymakers and sector leaders to discuss the future of science. For those who want to plan ahead the next Parliamentary Links Day is scheduled to be on Tuesday 23 June 2020.

DIAMOND LIGHT SOURCE UNVEILS FIRST EVER IMAGES OF FUEL DEBRIS FALLOUT PARTICLES FROM FUKUSHIMA

Lorna Campbell
Communications Consultant
Diamond Light Source
Harwell Science & Innovation Campus, Didcot

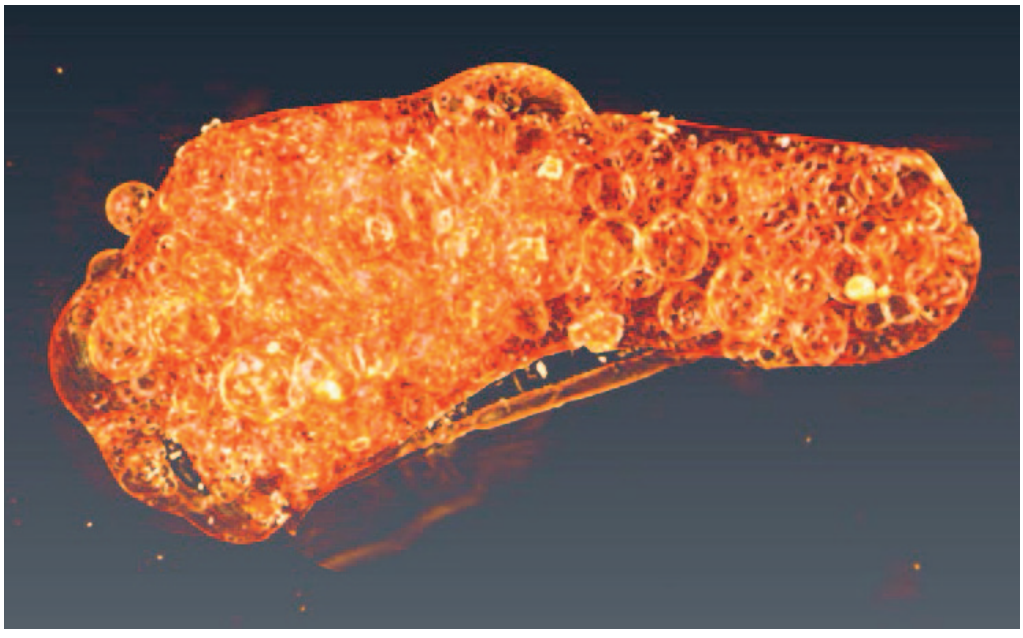
Eight years after the Fukushima nuclear meltdown in Japan, radioactive particles collected from the site are undergoing new forensic investigation in Britain in an effort to understand the exact sequence of events related to the accident.

Unique synchrotron visualisation techniques are offering new insights into the provenance of radioactive material from the Fukushima nuclear accident to understand the sequence of events related to the accident.

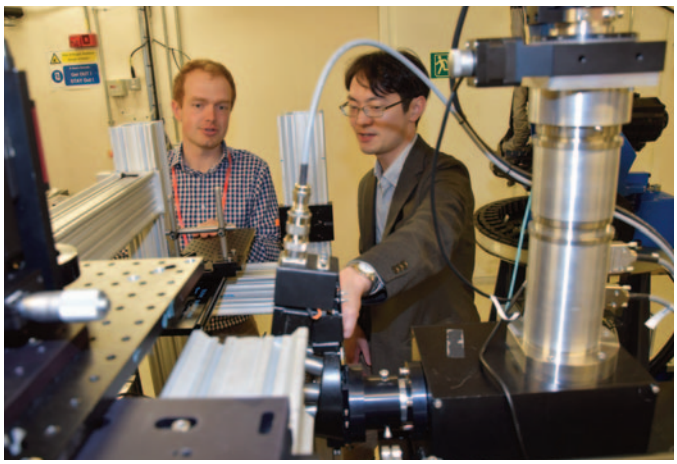
On March 11, 2011, a 9.0 magnitude earthquake struck off the Japanese coast, triggering a tsunami that killed some 18,000 people and the world's worst nuclear disaster since Chernobyl in 1986. Meltdowns at three of the Fukushima Daiichi plant's six reactors spewed radiation into the air, soil and ocean, forcing over 100,000 residents to flee. Many have still not returned.

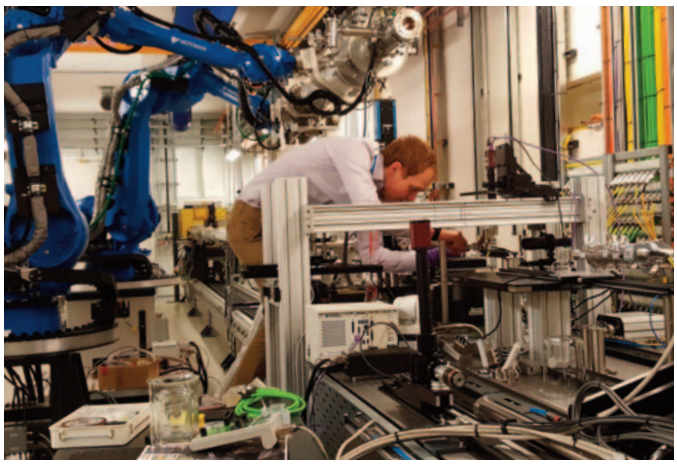
Although the three nuclear reactors at the Fukushima Daiichi Nuclear Power Plant (FDNPP) were not damaged by the earthquake, and shut down automatically, the entire site was flooded by the 15-metre tsunami, which caused a power failure and loss of cooling. Rising heat within the core of the reactors caused the fuel rods to overheat and partially melt down. A build-up of pressurised hydrogen gas caused explosions in the outer containment buildings, and radioactive material was released into the surrounding area.

Nuclear regulators assigned the highest possible severity level (7) to the incident, placing it in the same category as the Chernobyl accident in the Soviet Union in 1986. The amount of radiation released was estimated to be between 340 PBq and 800 PBq, a tenth of that released from Chernobyl [1]. However, relatively little is known about the physical and chemical nature of the radioactive particles and their long-term environmental effects.



3D image of the particle taken at Diamond Light Source





Dr Yukihiko Satou, from the Japan Atomic Energy Agency (JAEA) explains that it is working with the team from the University of Bristol and Diamond Light Source, the UK's national synchrotron, to gain detailed information from the particles, and in turn, to learn as much as possible about the accident. As part of this research project he says; "We decided to bring a radioactive particle from the Fukushima fallout to Diamond to undergo a comprehensive and independent analysis of its internal structure and 3D elemental distribution because relatively little is known about the physical and chemical nature of the radioactive particles and their long-term environmental effects." At Diamond electrons are accelerated to near light speeds until they emit light 10 billion times brighter than the sun, which is then directed into laboratories known as 'beamlines' which allow scientists to study minute specimens in extreme detail. Understanding the current state of these particles and how they behave in the environment could ultimately determine if and when the area could be declared safe for people to return.

Dr Satou oversaw the transportation of particles collected from within the restricted zone, very close to the disaster site, to Britain. He said that the first radioactive particle brought to Diamond was collected from within the restricted zone, in an area to the north of the nuclear plant and that the particles were fundamentally extracted from those attached to soil, dust and debris. It was encased with protective Kapton tape and brought to the I13 beamline, which offers a unique combination of X-ray imaging and fluorescence capabilities. .

In April 2017, a joint team comprising the University of Bristol, the Japan Atomic Energy Agency (JAEA) and Diamond Light Source, the UK's national synchrotron light source, undertook the first of several experiments. This was the first investigation of its kind at Diamond, and a small radioactive particle (450 μm x 280 μm x 250 μm) from the Fukushima Daiichi nuclear accident in 2011 underwent a comprehensive and independent analysis of its internal structure and 3D elemental distribution, to establish the source of the material and the potential environmental risks associated with it.

The research, using the combined capabilities of Diamond's I13 and I18 beamlines, sheds light on a unique combination of imaging and fluorescence measurements specially developed at Diamond. This enabled the examination of individual particles to reveal details about the accident and to look at the material from an environmental stability point of view alongside the associated risks.

The research team used synchrotron radiation micro-focused X-ray fluorescence (SR-μ-XRF) and tomography (SR-μ-XRT), in combination with diffraction ptychography to investigate the internal structure of the sample. SR-μ-XRF adds chemical sensitivity, allowing the researchers to create a 3D map of the distribution of elements within the sample.

Prof Tom Scott from University of Bristol commented; "We wanted to perform multiscale

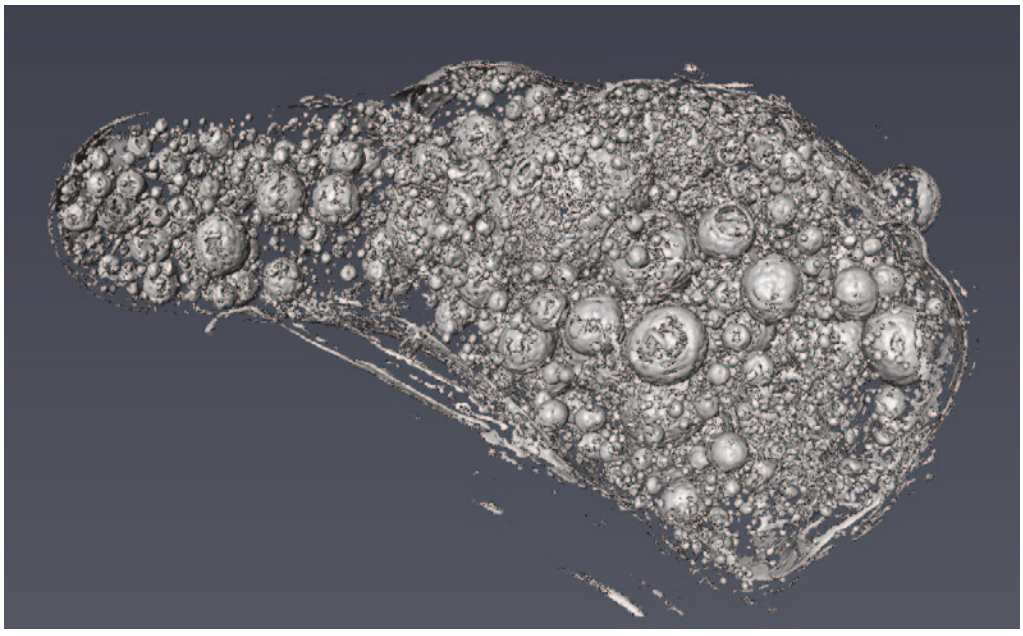


Fig. 1: The sample image shown above is 270μm in height and 540μm in width

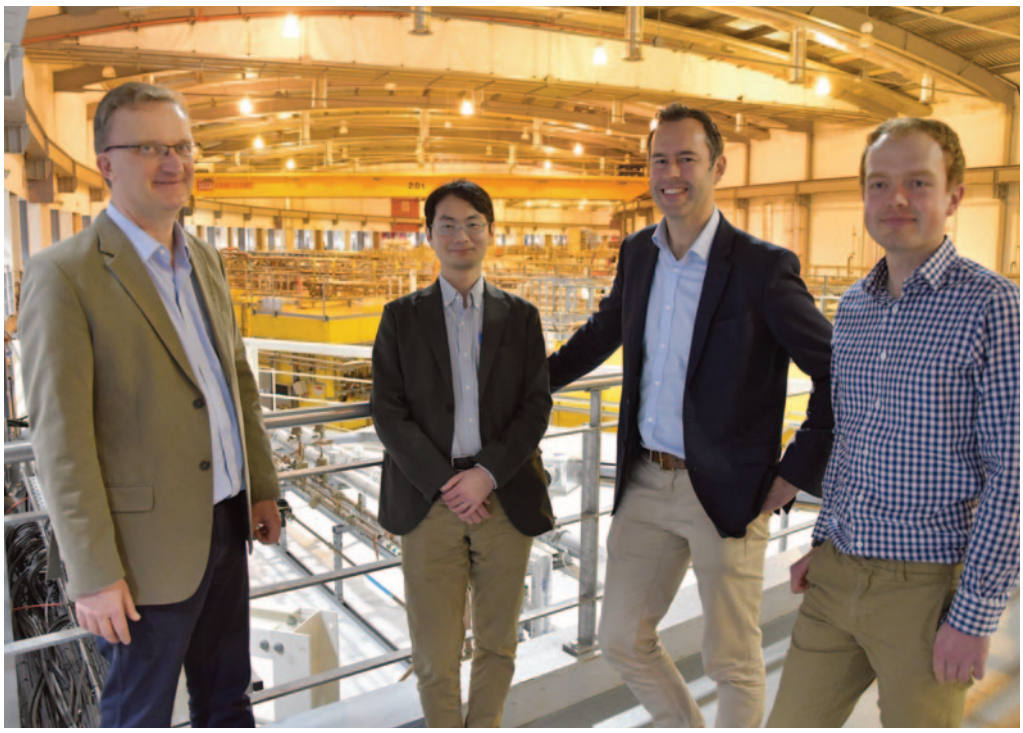
and multimodal measurements – by this I mean from micron to nanometre scale whilst looking at the chemistry, structure and functionality of the sample all in parallel. Diamond offers to the best of our knowledge the only beamline in the world where it is possible to perform such an analysis within a single experiment. The resulting visualisation has allowed for a comprehensive analysis of the particle."

Principal Beamline Scientist, Dr Christoph Rau adds;

"In close collaboration with experts from Bristol University, we worked very hard to bring this experiment together. We managed to harness these imaging techniques into one single analysis to learn more about the details of the particles brought to Diamond."

Dr Peter Martin from the Bristol team explains: "We were able to see that the structure and composition of the particle suggest that it was formed predominantly from materials from the reactor building, mainly silicon-based fibrous insulation. The likely scenario is that it was formed when the thermal insulation material in Reactor Unit 1 melted during the loss of cooling. Radiocaesium and other fission products were incorporated into the molten material, and fragments of the structural steel and concrete stuck to the surface after the hydrogen explosion."

The structures observed in the particle had a remarkable resemblance to a volcanic pumice, comprising a considerable internal void volume. The pumice-like internal structure means that the particle is susceptible to weathering and fragmentation, which would increase the effective surface area and subsequent dispersal of iron-associated radiocaesium into the environment. He further adds: "It is worth noting that the particle seems to have been stable for nearly 4 years – the time between being ejected from the plant and being collected for analysis. In addition, in the studied particle, the radioactive material is also encased within a glasslike silicon, analogous to the vitrification process used for the disposal of nuclear waste, which will further reduce the potential for radionuclides to leach out."



Fukushima Particles research group (L-R): Cristoph Rau (I13), Yukihiko Satou, (researcher from the Collaborative Laboratories for Advanced Decommissioning Science, Japan Atomic Energy Agency), with Tom Scott and Peter Martin (University of Bristol).

Previous investigations of material from Chernobyl found a similar affinity between iron and caesium, causing the formation of ferrites that greatly reduce the solubility of caesium within the environment. Similarly, the uranium in the sample was observed to exist in an insoluble form and encased within the glassy material. Building on the success of these experiments and the unique capability offered by Diamond, a consortium of UK and Japanese Universities have been awarded a joint grant by UK Research and Innovation's Engineering Physical Sciences Research Council and Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT) to carry on the research to examine larger particles closer to the site. This will underpin the distribution of material which contains fuel debris to better define the risk map.

Tom Scott concludes: "The work has significant relevance beyond nuclear accidents, and this approach and the techniques developed could in the future be used to image particles in air pollution in the UK and all over the world. For example, the 'Asian Brown Cloud', a layer of air pollution that covers parts of South Asia for several months each year, would be of great interest as it is found to be linked to health conditions killing two million people in Asia every year[2]."

The research has been supported by the Japanese Society for the Promotion of Science (JSPS), Daiwa Foundation and Saskawa Foundation, showing significant Japanese support and interest in the project. The Japanese government has now awarded further funding to the research team to examine larger particles closer to the site of the meltdown at Fukushima to better define radiation risk in the surrounding area. The research team is also currently working in Chernobyl doing some radiation fallout studies in the Red Forest about 500m from the powerplant.

References:

1. World Nuclear Association. Fukushima Daiichi Accident. Online: http://www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/fukushima-accident.aspx (Accessed 13 November 2018).
2. Ahmad K. Pollution cloud over south Asia is increasing ill health. Lancet 360 (9332):549 (2002). DOI:10.1016/S0140-6736(02)09762-3.

ABOUT DIAMOND LIGHT SOURCE: WWW.DIAMOND.AC.UK

Diamond Light Source is the UK's synchrotron science facility. Shaped like a huge ring, it works like a giant microscope, harnessing the power of electrons to produce bright light that scientists can use to study anything from fossils to jet engines to viruses and vaccines. Diamond speeds up electrons to near light speeds, producing a light 10 billion times brighter than the Sun, which is then directed off into 33 laboratories known as 'beamlines'.

Each year thousands of scientists use the UK's synchrotron and its integrated facilities (including eBIC, ePSIC), with 57% visiting and 43% accessing the facility remotely. Diamond's state-of-the-art facilities and world-class people act as agents of change, addressing 21st century challenges such as disease, clean energy and food security. Diamond research supports new medicines, technologies and advances of all kinds. More than 7,000 papers have been published because of research conducted at the facility.

Diamond & Nuclear Research - The UK's synchrotron science facility, Diamond Light Source, is a hub for renewable energy and energy recycling research, but less well known are its applications as a hub for nuclear research. Work in this area is transforming our energy future by making the nuclear fuel cycle safer, more efficient and more straightforward to use.

For example: Key to the UK's strategy for disposal is the plan for a Geological Disposal Facility (GDF). Under this plan, highly radioactive waste, immobilised in cement would be interred deep underground. The nuclear waste will be radioactive for 100,000s of years so understanding the processes in order to optimise its containment is paramount. In order for this approach to be successful, it is important to anticipate the impact of the high-level waste on the surrounding environment. Research into the behaviour of nuclear materials at all stages of the fuel cycle is critical in order to develop effective predictive models. Researchers are using Diamond to predict at a molecular scale what will happen to the radionuclides as the GDF degrades over thousands of years.

MICROPLASTICS –
KEY CHALLENGES WE NEED TO OVERCOME

Professor Richard C Thompson OBE, University of Plymouth

Few people in the UK can surely have failed to notice the recent uproar over plastics in our oceans. The research of Professor Richard Thompson OBE, and the International Marine Litter Research Unit at the University of Plymouth, has been instrumental in driving the debate but what are the key challenges we need to overcome?

Until recently, few people outside scientific circles had heard the word 'microplastics'. Tiny fibres and pieces of plastic debris, some less than the width of a human hair, they simply hadn't entered public consciousness.

It's safe to say that has since changed. Thanks to increased and improved research, and the success of television programmes such as Blue Planet II, barely a week goes by without mention of microplastics in the media, or indeed talk of them within the corridors of power.

With this enhanced awareness has come a greater public desire for action, and the question we are often asked by people is: what can I do to help? This comes from individuals and industry, fellow scientists and politicians.

The short answer is that plastic pollution is a human problem. As a result, we can all be part of the solution. However, it is not going to be a rapid process because changing the way we use plastic – and especially single-use plastics – requires a substantial cultural shift reversing behaviour that has become entrenched over six decades.

Microplastics can measure a fraction of a millimetre in length. They often enter the marine environment in that state, but can also be broken down from larger items such as plastic bags, fishing equipment or waste escaping through water treatment works.

Individually, it is perhaps hard to see the potential harm they could cause. But take a step back and some of the facts and figures involved are quite alarming:

- Some estimates suggest there are 5 trillion of these particles floating in our oceans;
- Over 70 per cent of all the litter contained within the oceans is made of plastic;
- Humankind produces 300 million tonnes of plastic every year;
- The same amount of plastic will be produced in the next eight years as was produced in the whole of the 20th century.

Our research has shown these items are now everywhere in the oceans, from our most visited coastlines to the remotest parts of the deep seas and our polar regions. It has shown them in around one third of some 500 fish we examined from the English Channel, with a recent study showing a substantial increase in the amount of plastic present over the past 60 years.

In 2015, for example, we demonstrated that almost 100,000 tiny 'microbeads' – each a fraction of a millimetre in diameter – could be released in every single application of products such as facial scrubs. This meant that every 150ml of the products could contain between 137,000 and 2.8million microscopic plastic particles.

When you put a load of clothes into your washing machine, your main concern is likely to be that everything comes out clean. It's completely understandable – after all, that is the machine's primary function.

What you're perhaps less likely to consider is that through each wash, more than 700,000 tiny microfibres might be released into the environment.

garments shed fibre – so they also last longer and hence are more sustainable.

When the Environmental Audit Committee published the Fixing Fashion report – following its Sustainability of the Fashion Industry inquiry – in February 2019, this was, in our view, one of its most important conclusions.

Put simply, the accumulation of end of life plastic is a global environmental challenge. However, it is not plastics per se that are responsible – it is the way we design, use and dispose of them.

Since first coining the term in a paper published in *Science* in 2004, we have focused much of our research on the sources of microplastics within the marine environment. Our findings have acted as catalysts in helping to galvanise public opinion, but also played a crucial role in prompting changes to government legislation.

The subsequent parliamentary inquiry, to which we contributed, agreed that this was an unnecessary cause of plastic pollution. It ultimately led to the ban of microbeads which came into force in 2018.

Microbeads was, to some degree, an easy subject to focus on. After all, it was not clear why we needed to cleanse ourselves with plastics in the first place and it immediately garnered widespread public support. Other uses of plastic will be harder to replace and he direction of travel needs to be toward more responsible use rather than elimination.

These tiny synthetic particles come off old clothes and new. But through a current Defra-funded project, we are trying to assess some of the pathways that can result in these fibres passing to the environment.

Whatever that study finds we are clearly, in this instance, not advocating something similar to the ban on microbeads. After all, the societal benefits of textiles are without question.

What is needed is a holistic approach, uniting designers and consumers in a common goal to reduce the rate at which

In my own evidence to the inquiry, I highlighted that there were three potential points of intervention. These included capturing items in wastewater treatment, modifying the laundering processes (for example, capture via filters), and changes in garment design.

Our research indicated that changing the temperature, type of detergent and conditioner has minimal effect on fibre emission compared to garment type. It also indicates substantial reductions in emissions to the environment could be achieved by changes in design practice.

In my view the principle of designing products to provide valuable life in service – with minimal environmental impact before, during and after use – needs to be applied much more widely.

It often surprises people when I openly admit, despite being a marine biologist, that plastics are not the enemy some suggest. They are lightweight, versatile, durable materials that have the potential to bring many societal and environmental benefits. The problem in is in how we have chosen to use them.

Of the 300 million tonnes per annum that I mentioned earlier, some 40% is for single-use items such as packaging. As consumers, we have been trained since the 1950s to regard end-of life plastics as throwaway disposable items of no value. So it's not surprising some escapes to the environment.

The plastic in our oceans results from a mixture of litter types differing in origin, size, shape and polymer type. And while there may be uncertainty about the absolute quantity currently in the environment, it is clear that without action both the quantity and the associated impacts will increase:

In 2017, I wrote a report on plastic pollution for the Government Office for Science's Foresight Future of the Sea project. In it, I said plastic pollution in the sea is a symptom of a more systemic issue originating on land and related to the design, the use and the disposal of plastic items. But there has never been a better time to try and do something about it. There is a real intensity to want to take action from the public, from policy and from industry.

We need more investment to ensure that we match the solutions to the appropriate parts of the problem, that we don't go for 'low-hanging fruit'. It is also critical to introduce solutions that address the problem without creating unintended consequences.

For academics across a range of disciplines, our role is to provide impartial and reliable evidence, relating to textiles in clothing or another application of plastics. We have to highlight the environmental consequences, the material design solutions, the behavioural and social science aspects. We also need to explore the legal and policy measures that might be brought in to help to nudge those directions.

It is about independent, impartial evidence that can guide industry and policy appropriately so that we don't take kneejerk reactions, rather we develop well considered environmentally appropriate solutions with which the public can engage.

In all my years of working on this, the stars have never been aligned in this way. We have, some might argue, a once-in-a-generation opportunity we need to ensure that doesn't pass us by.

- **Plastic pollution can be harmful to the economy in the UK, its Overseas Territories and internationally;**
- **Entanglement in, or ingestion of, plastics can cause injury and death to a wide range of marine organisms, including commercially important fish and shellfish;**
- **It is hazardous for mariners and reduces the amenity value of coastlines;**
- **There are also emerging concerns of potential negative consequences for human well-being.**

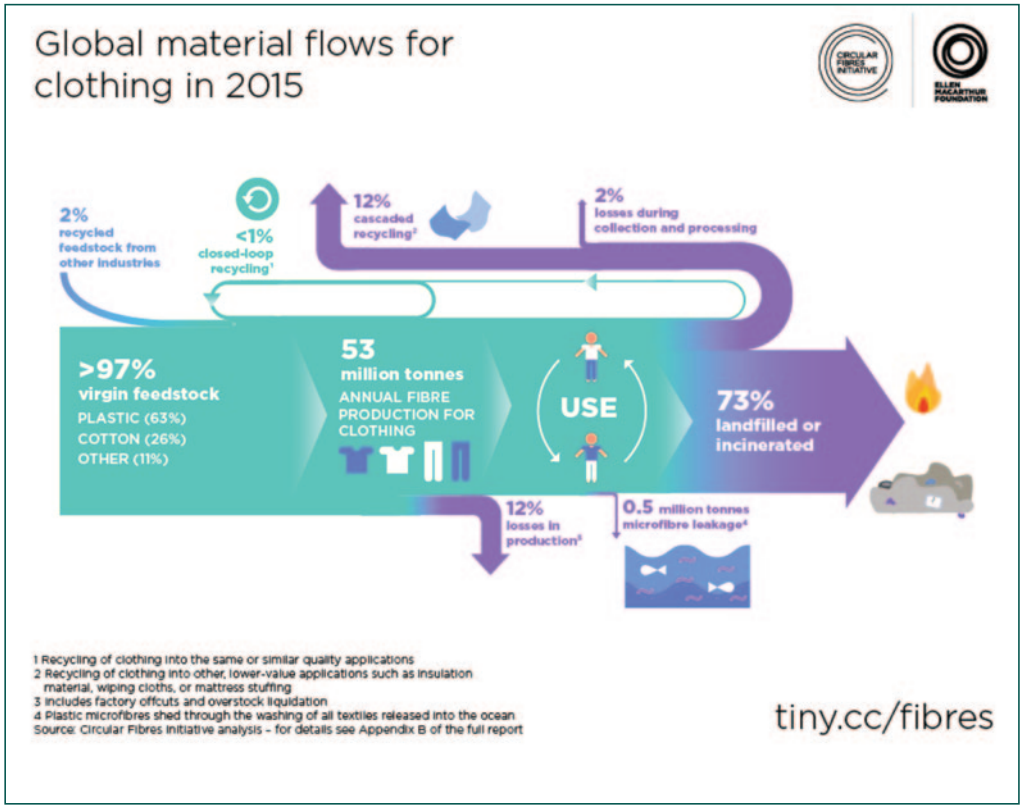
THE CASE FOR RETHINKING THE GLOBAL TEXTILES SYSTEM, STARTING WITH FASHION

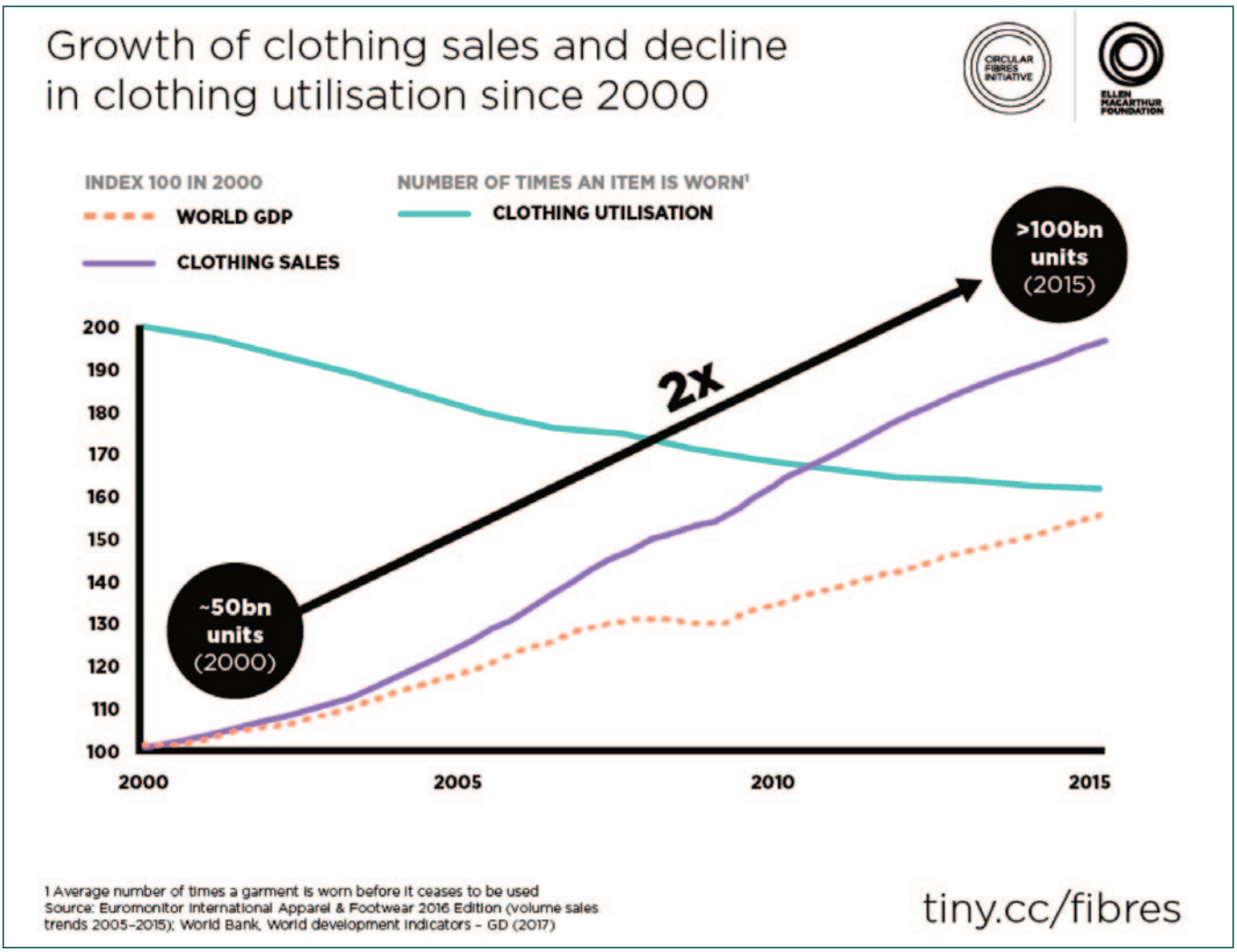
Laura Balmond

Fashion is a vibrant industry that employs hundreds of millions and generates significant revenues. The fashion industry directly contributed £32.3billion to the UK GDP in 2017[1]. Clothing is a fundamental part of everyday life, but to continue thriving, the fashion industry needs to address major issues, including waste, pollution, greenhouse gas emissions, and impact on biodiversity. Many of these issues directly relate to the current operating model of the industry, which can be defined as linear - meaning take-make-waste.

Since the 20th century the industry has become highly globalised with garments designed in one country, manufactured in another and sold worldwide at an ever-increasing pace. As a direct result of this approach, in the last 15 years the industry has doubled its production. Meanwhile, the time clothing is worn before it is thrown away has fallen by around 40%.[2] Clothing is increasingly being considered as disposable. When it is thrown away, 73% ends up in landfill or incineration - the equivalent of one rubbish truck every second. What does get collected for recycling – around 12% – will likely end up being shredded and used in lower value applications. Less than 1% of what is collected will be used to make new clothing.[3]

This wasteful linear model is also very expensive to operate, and high costs are associated with disposal. For example, the estimated cost to the UK





economy of landfilling clothing and household textiles each year is approximately GBP 82 million (USD 108 million). Clothes that are sent for landfill or incineration represent a loss of material value of more than USD 100 billion every year. [4]

Clothing that has not being designed to be kept in use and ultimately be recycled into new clothing is attracting attention from policymakers. Some countries, including China, that have previously provided markets for used clothes are now applying a ban or restriction on imports of used clothing. [5] This year, the UK Environmental Audit Committee called for fashion brands to take responsibility for the waste they create, publishing the report 'Fixing fashion: clothing consumption and sustainability'.

This 'take-make-waste' system is not only extremely costly and wasteful, but also very polluting.

Moving away from the current linear and wasteful textiles system is crucial to avoid negative impacts for people and the environment and to keep the 2°C average global warming limit within reach. The textiles industry relies mostly on non-renewable resources – 98 million tonnes in total per year – including oil to produce synthetic fibres, fertilisers to grow cotton, and chemicals to produce, dye, and finish fibres and textiles.[6] In 2015, greenhouse gas (GHG) emissions from textiles production totalled 1.2 billion tonnes of CO2 equivalent, more than those of all international flights and maritime shipping combined. If the fashion industry continues on its current path, by 2050 it could use more than 26% of the carbon budget associated with a 2°C global warming limit.

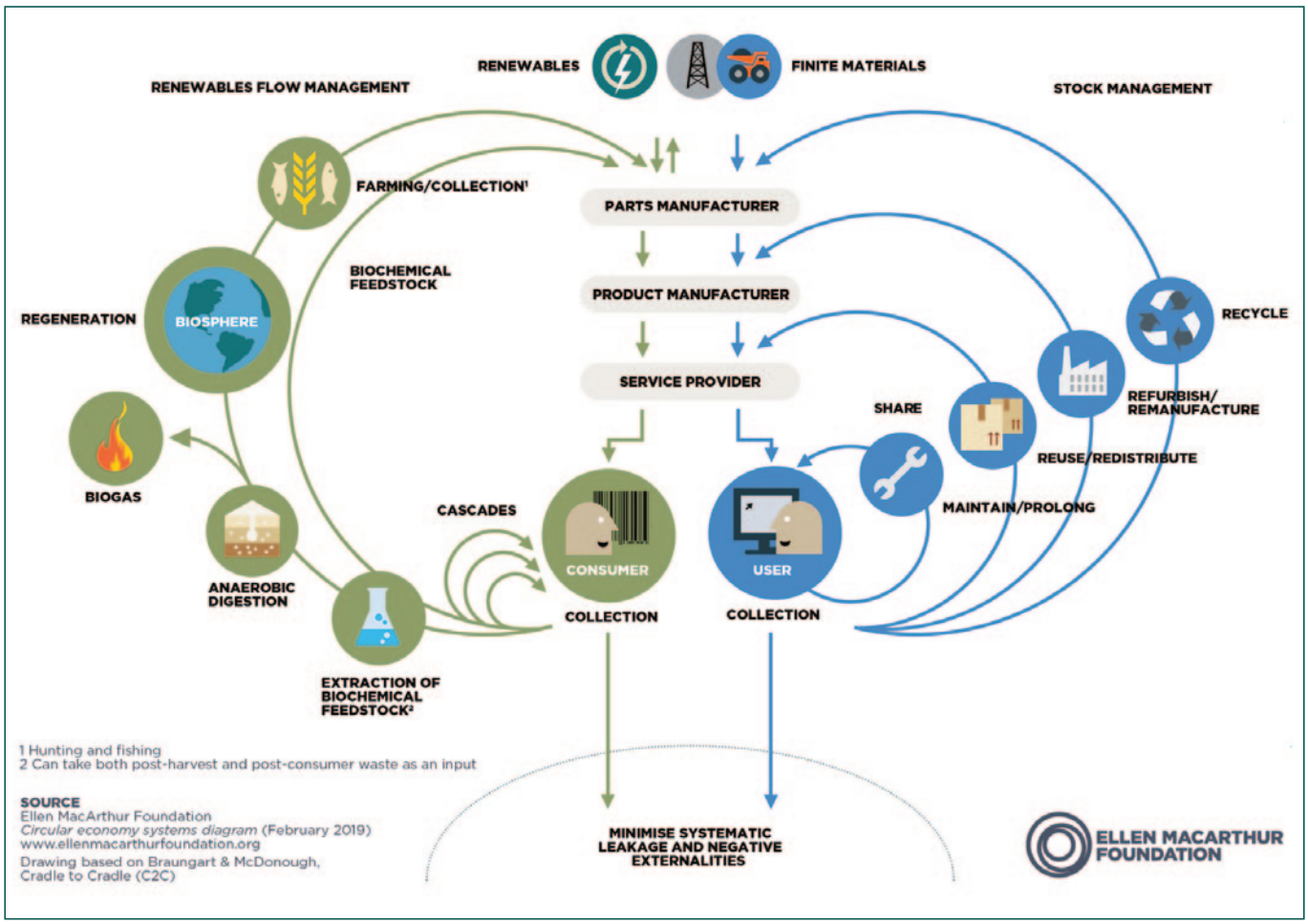
In recent years, the textiles industry has been identified as a major contributor to the issue of plastic entering the ocean. Approximately two thirds of textiles are made from synthetic materials, dominated by plastic-based polyester, polyamide and acrylic. [7,8] Washing clothing releases microfibres, very short textile fibres less than 5 millimetres long. As a result, globally around half a million tonnes of plastic microfibers are released every year - 16 times more than plastic microbeads from cosmetics. Natural or cellulose-based fibres are often treated with textile finishing treatments which may prevent microfibres from biodegrading safely in the environment or allow substances of concern to be released in the digestive system of species that ingest them. [10]

The time has come to transition to a textile system that delivers better outcomes.

BOX: CIRCULAR ECONOMY CONCEPT AND PRINCIPLES

In a circular economy, economic activity builds and rebuilds overall system health. The concept recognises the importance of the economy needing to work effectively at all scales – for large and small businesses, for organisations and individuals, globally and locally.

Transitioning to a circular economy does not just amount to adjustments aimed at



reducing the negative impacts of the linear economy. Rather, it represents a systemic shift that builds long-term resilience, generates business and economic opportunities, and provides environmental and societal benefits. It is based on three principles:

- **Design out waste and pollution.**
  A circular economy reveals and designs out the negative impacts of economic activity that cause damage to human health and natural systems. This includes the release of greenhouse gases and hazardous substances, the pollution of air, land and water, as well as structural waste such as traffic congestion.
- **Keep products and materials in use.**
  A circular economy favours activities that preserve more value in the form of energy, labour and materials. This means designing for durability, reuse, remanufacturing and recycling to keep products, components and materials circulating in the economy. Circular systems make effective use of biologically-based materials by encouraging many different uses before nutrients are returned to natural systems.
- **Regenerate natural systems.**
  A circular economy avoids the use of non-renewable resources where possible and preserves or enhances renewable ones, for instance by returning valuable nutrients to the soil to support regeneration.

A circular economy for fashion offers significant economic, environmental and societal benefits

The fashion industry can break away from its 'take-make-waste' approach by embracing circular economy principles (see box: Circular economy concept and principles). Such an approach would see:

- new business models increase the use of clothes;
- clothes made from safe and renewable materials;
- and used clothes turned into new ones.

Business models that increase clothing use offer growth and profitability opportunities, as well as the potential to better meet customer needs. Online reseller ThredUp reports that resale has grown 21 times faster than traditional retail over the last three years. [11] The popularity of resale and rental has been demonstrated by rapid growth of market disruptors such as luxury resale platform the RealReal, rental service Rent the Runway, and resale platform Depop.

A new level of collaboration is required. Large retailers are showing that exploration of new business models does not have to happen alone. For example, H&M Group's & Other Stories have teamed up with resale platform Sellpy so that customers can sell on their second-hand garments. Outdoor brand The North Face are collaborating with repair service The Renewal Workshop to repair and refresh returned garments or second-hand garments and resell them under The North Face Renewed label.

Business model innovation must be matched by a design rethink. Providing designers with the tools to design for circularity is essential to make fashion circular. It is essential to design for durability, to keep clothes in use, and to align design and material choices with available recycling technologies. By focusing on how a product will be made, how it will be used, and what will happen to it

afterwards, designers can unlock the full value of clothing.

Efforts are already being employed by brands, retailers, and other organisations to change the industry and although promising progress is being made, it is often too fragmented or only effective at small scale. Achieving a circular economy for fashion will demand unprecedented levels of alignment and collaboration towards the common vision.

A system-level change approach is required, and the initiative Make Fashion Circular, by the Ellen MacArthur Foundation brings together industry leaders, including Burberry, Gap Inc., H&M, HSBC, NIKE Inc., PVH, and Stella McCartney as Core Partners to create unstoppable momentum towards a circular economy for clothes.

Policymakers can contribute to shifting the system

Policymakers can take an active role in the transition to a circular economy and create the right enabling conditions. Clear policies and strategies that set direction, incentivise and enable upstream solutions, and communicate clear commitment can encourage private and public investment in relevant research and business development.

Some current policies, typically focused on individual areas rather than taking a systemic view, can cause unintended barriers to adopting circular economy models. Detailed analysis of regulations, conducted with relevant stakeholders, could identify these barriers and provide a basis for recommending policy changes that support a circular future for fashion. For example, removing barriers that are caused by the definition of used textiles as waste, or addressing barriers to trade, such as import or export bans or setting targets or incentives for collection.

Policymakers could also play an important role in stimulating demand by incentivising the use of recycled materials and/or disincentivising the use of virgin materials. Public procurement policies can increase demand for reused and recycled materials by specifying targets for recycled content in clothing used by the public sector. Focusing infrastructure investments on schemes such as integrated after-use collection systems and sorting and reprocessing facilities could also support circular economy activity and investment by the private sector.

ABOUT THE ELLEN MACARTHUR FOUNDATION

The Ellen MacArthur Foundation was launched in 2010 to accelerate the transition to a circular economy. The Foundation works across seven key areas: insight and analysis; business; institutions, governments, and cities; systemic initiatives; circular design; learning; and communications.

Find out more at ellenmacarthurfoundation.org

References:

1 British Fashion Council. See https://www.britishfashioncouncil.co.uk/pressreleases/London-Fashion-Week-September-2018-Facts-and-Figures

2 Ellen MacArthur Foundation, A new textiles economy: Redesigning fashion's future, p.18 (2017)

3 Ellen MacArthur Foundation, A new textiles economy: Redesigning fashion's future, p.20 (2017)

4 Ellen MacArthur Foundation, A new textiles economy: Redesigning fashion's future, p.20 (2017)

5 See http://www.greenpeace.org/international/Global/international/briefings/toxics/2016/Fact-Sheet-Timeout-forfast-fashion.pdf and https://www.independent.co.uk/environment/china-foreign-waste-ban-recycling-a8011801.html

6 Ellen MacArthur Foundation, A new textiles economy: Redesigning fashion's future, p.20 (2017)

7 Henry, B., et al., *Microfibres from apparel and home textiles: Prospects for including microplastics in environmental sustainability assessment*, Science of the Total Environment, (2018).

8 Textile Exchange, *Preferred Fibre Report*, (2018), P.6

9 Bruce, N., et al., Microfiber pollution and the apparel industry (2016)

10 Zhao, S., et al, *Microscopic anthropogenic litter in terrestrial birds from Shanghai, China: Not only plastics but also natural fibers* (2016)

11 ThredUp, 2019 Resale Report. See https://www.thredup.com/resale

HOW DO WE NURTURE THE POSITIVE ASPECTS OF THE LIFE SCIENCE REVOLUTION WHILE MINIMISING THE NEGATIVE ?

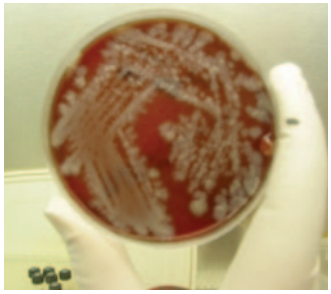
Professor Les Baillie PhD
School of Pharmacy and Pharmaceutical Sciences
Cardiff University

Throughout history, societies have devoted considerable effort in the creation of ever more destructive weapons. From the first recorded use of spears in 500,000 BC [1] to the detonation of a nuclear weapon over Japan in August 1945, we as a species have displayed a remarkable ability to develop even more sophisticated ways of killing ourselves. This propensity for self destruction has reached its zenith in the development of nuclear, chemical and biological weapons of mass destruction.

While the raw materials required to make chemical and biological weapons are relatively easy to obtain compared to radioactive isotopes, until recently, the knowledge and tools needed to develop them as effective weapon systems were restricted to nation states. This may no longer be the case as evidenced by the Sarin gas attack on the Tokyo subway and the anthrax postal attacks in the United States. Advances in life sciences, coupled with a willingness to share knowledge across the internet and the emergence of a generation of 'hobby' scientists has created the conditions in which individuals with ill intent may consider bioterrorism as a viable future option.

THE RISE OF THE HACKER

Who could have known that the first simple message sent in 1969 would lead to the creation of a globally connected online world? A group of hobby scientists collectively known as hackers played a key role in the development of the internet.



The Ames strain of *Bacillus anthracis* isolated from a letter sent during the anthrax postal attack in the US

What started out as a group of university-based enthusiasts rapidly grew following the introduction of home computers in the late 1970s. Access to relatively cheap systems allowed individuals outside universities to interact with the technology and helped create the online world as it exists today.

While there is much that is positive about the cyber world, it has like many human creations, its dark side. Early on members of this unregulated citizen science community realised that hacking could be used for personal gain. Individuals and groups engaged in criminal activities such as pirating software, breaking into systems to steal sensitive information and more recently, influencing the outcome of elections.

Perhaps the best known negative is the computer virus; a malicious program which alters the way a computer operates and spreads from one computer to another in a manner similar to human viruses, such as the Influenza virus. This ability to spread and cause damage to critical systems highlights the destructive power of a relatively simple entity. Imagine what would happen if this was a real virus and the critical system was the population of the UK.

THE RISE OF THE BIOHACKER

The late 1960's, early 1970's saw a similar blossoming of knowledge in the world of biology with the cloning of the first gene in 1972. This was followed by the first genetically modified mouse in 1974 and the first commercial product, Insulin in 1978. Indeed the technology has continued to develop at a similar pace to that of the cyber world, such that in

the near future (10-20 years) we may have the ability to create new, synthetic, self-sustaining life forms and change the very nature of what it is to be human.

The UK has one of the strongest and most productive life science industries in the world. It focuses on the application of biology and technology to health improvement, including biopharmaceuticals, medical technology, genomics, diagnostics and digital health. In 2015 the sector generated approx. £20.7 billion in turnover and employed 90,000 individuals [2]. Until recently, the involvement of individuals operating outside of the confines of universities and research institutions in this biological revolution has been limited, due to the complexity of the technology and facilities needed to engage in such activities. This is no longer the case as the knowledge necessary to identify and clone a gene is available online if you know where to look. In parallel, the economic potential of life sciences has spawned the development of a range of low cost, easy to use cloning kits which can be purchased on the internet in a manner akin to home brewing. Specialist equipment can also be purchased online or accessed via citizen science communities such as DIYbio.org who believe that biotechnology and a greater public understanding of science has the potential to benefit everyone. They provide experienced researchers to mentor and oversee self-selected individuals with little or no formal training who wish to take up a new hobby, or are interested in starting a new life science business.

As was the case with computing, the active engagement of citizens in life sciences is likely to stimulate a burst of creativity which could lead to whole new areas of science, exploration and economic prosperity. Equally it could have unwelcome negative effects. Imagine the impact of the release of a genetically engineered virus either by mistake or by a deliberate act. Biological viruses have the ability to evolve and once released from a contained environment such as a laboratory, could mutate to become more virulent. Take for example the Influenza virus which regularly mutates causing repeated outbreaks of seasonal flu. Following the end of the First World War, a mutated variant known as Spanish Flu emerged which was unusually deadly and claimed the lives of millions of individuals.

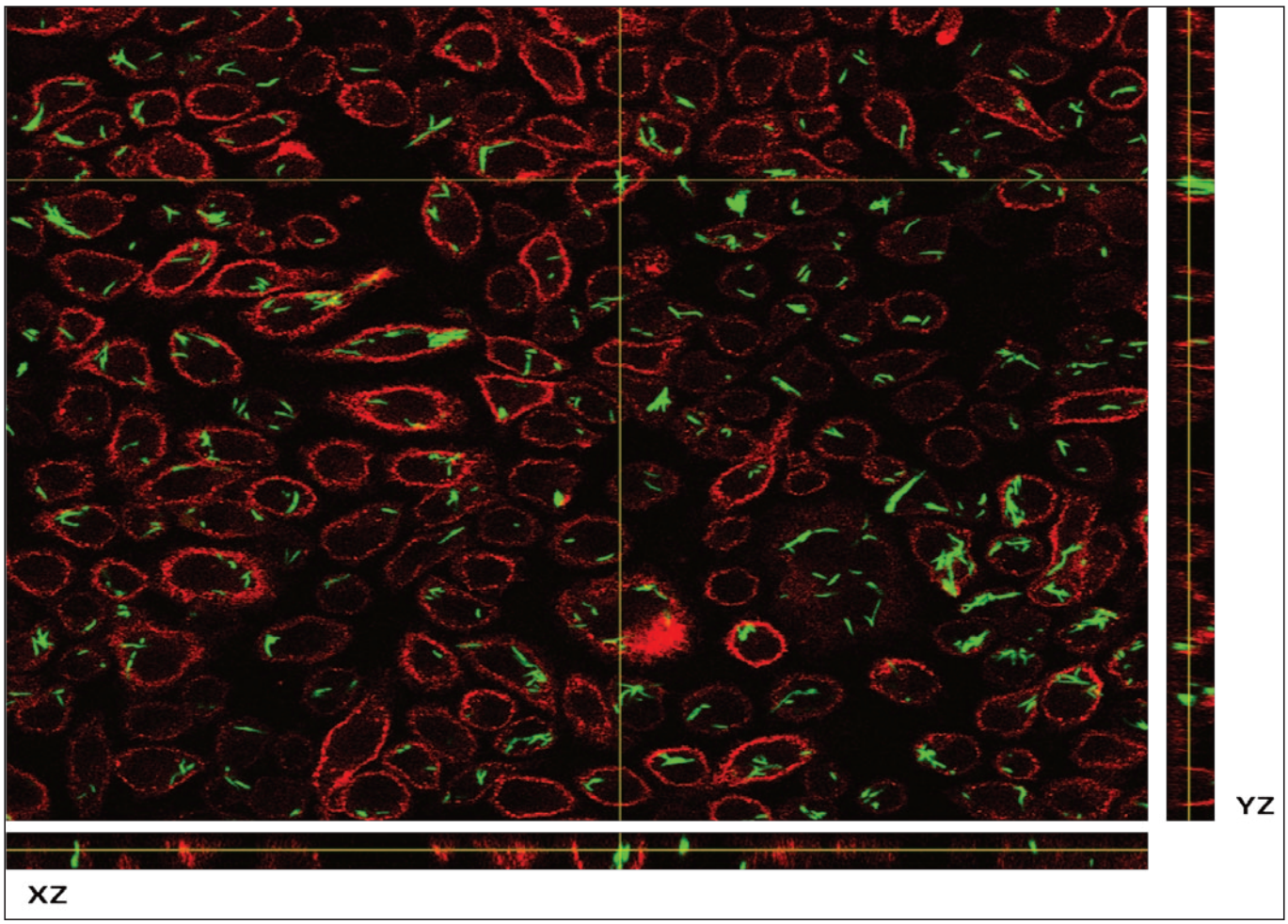
It is because of this potential to evolve and become more virulent that experiments to modify biological agents undertaken in University, Government and industrial facilities are subject to extensive regulation and oversight and are performed in secure, contained laboratories which are regularly inspected by competent authorities. Communities such as DIYbio operate voluntary codes of ethics and once trained, an individual would be able to continue his research in the comfort of his own home, free from any form of oversight . The ideal scenario for individuals with ill intent [3].

As was the case with the cyberworld, individual biohackers, the biological version of hackers, have emerged who are prepared to circumvent existing regulations or simply ignore them if they do not fit with their world view. In October 2017, Aaron Traywick, the former CEO of a US biotech start up company, staged a live demonstration of a novel gene-therapy for HIV by injecting an infected volunteer. He later went on to inject himself with an untested Herpes virus treatment.

While it is illegal to sell 'do-it-yourself' gene therapy products in the US, it is not illegal to sell kits which can be used by hobby scientists to modify other life forms for non-commercial purposes. Josiah Zayner, CEO of a US based biohacking start-up company which operates from his garage, sells kits to the general public to create fun products such as fluorescent beer in which yeast is engineered to express a green fluorescent protein derived from jellyfish.

While this sounds like harmless fun, Zayner has taken the approach one step further by experimenting on himself, using a revolutionary gene editing technology called CRISPR. Although unsuccessful in his attempts to increase his own muscle strength, he currently sells the technology to the public. One could argue that

A university laborator versus a DIY kitchen based laboratory



Bacteria which have been genetically engineered to express a green fluorescent protein derived from jellyfish. *(Credit; Evans Ahortor, Cardiff University)*

individuals who choose to experiment on themselves only have themselves to blame for the consequences. But what is the moral position if the technology is, for example, used to modify unborn individuals who are in no position to consent?

In 2018 Dr He Jiankui announced the birth of twin girls whom he claims to have genetically engineered using CRISPR to be resistant to HIV. Through his actions, he flouted established norms for safety and human protection and as a consequence lost his job [4]. While one can see an argument for modifications which correct existing genetic defects and enhance resistance to disease, it is much more difficult to justify changes which enhance physical attributes and intelligence, the so called 'designer' babies. Some may argue that the technology is still in its infancy and we have time to agree on how best to proceed. In practise, it may already to be too late as the actions of Dr Jiankui demonstrate.

CONCLUSIONS

Rapid advances in life sciences in terms of new techniques and ways of working are creating new regulatory challenges. We need to develop approaches which balance legitimate public concerns over the misuse of technology against the enormous potential that it has to benefit humankind. Striking the right balance will be key to ensuring that legitimate, curiosity driven research is not stifled and the public are not put at risk.

References

1. Jayne Watkins et al., 2012. Evidence for Early Hafted Hunting Technology. Science Vol.338, Issue 6109, pp942-946

2. https://www.parliament.uk/documents/commons-committees/Exiting-the-European-Union/17-19/Sectoral%20Analyses/21-Life-Sciences-Report.pdf

3. Les Baillie and Callum Cooper. Agents of Terror 'Garage laboratories' raise biosecurity risk. Jane's Intelligence Review February 2014, p50-53

4. https://www.nature.com/articles/d41586-019-00673-1

Parliamentary and Scientific Committee Showcases Britain's Future

Scientists Engineers Technologists Mathematicians

On Wednesday 13h March 2019, 180 early career researchers from universities and research institutions from across the United Kingdom came to Westminster to take part in STEM for Britain the annual poster competition and exhibition organised by the Parliamentary and Scientific Committee and designed to encourage interaction with MPs and Parliament.

During the course of the day these scientists, engineers, technologists and mathematicians had the opportunity to show their posters and explain their research to over 60 Parliamentarians from both Houses.

The competition comprised of five specialist sections: Biological and Biomedical Sciences; Chemistry, Physics, Engineering, and Mathematical Sciences.

Gold, Silver and Bronze winners in each category received certificates and cash prizes, with medals going to the Gold winners.

For the first time The Physiological Society Prize was also presented.

At the end of the day the winners of the five Gold medals competed for the Westminster Medal in memory of Dr Eric Wharton, founder of STEM for Britain. Here, with the quality of the science already ready proven with a Gold medal, the judges had to decide which of the five posters best demonstrated the presenter's skill in communicating the scientific concept.

Judging panels for each category were formed of distinguished scientists, engineers and mathematicians from the Royal Academy of Engineering, the Royal Society of Chemistry, the Institute of Physics, the Royal Society of Biology, the Council for the Mathematical Sciences and The Physiological Society.

The judges' initial task had been to select the 180 posters for the exhibition and final of the competition from nearly 400 high quality entries.

The event is a two-way process designed to strengthen the dialogue between Parliament and the science, technology, engineering and mathematical communities.

STEM for Britain would not be possible without the help of all the major learned societies involved in organising the event, especially the Royal Academy of Engineering, the Royal Society of Chemistry, the Institute of Physics, the Royal Society of Biology, the Council for the Mathematical Sciences, The Physiological Society and the Nutrition Society.

And also all the organisations which have generously supported the event, including the Clay Mathematics Institute, Warwick Manufacturing Group, UK Research & Innovation, the Institute of Biomedical Science, the Heilbronn Institute for Mathematical Research, The Comino Foundation and the Society for Chemical Industry.

However, the researchers who exhibited and displayed their work are the true 'engine room' of R&D. The success of the UK in the competitive knowledge economy of the 21st Century is going to depend crucially on their expertise.

The support of a number of important organisations is vital for STEM for Britain…

UK Research and Innovation

"Early-career researchers play a vital role in the UK's world leading research and innovation base. UK Research and Innovation is pleased to be able to support STEM for Britain in its work connecting them with policy makers.

To remain a leader in research and innovation, the UK has to continue to invest in talent and skills in new and disruptive technologies. This is why UKRI has committed to supporting 1000 new PhD students in artificial intelligence through a £100 million investment, with a further £100 million from partners including businesses and universities. These students will go on to improve healthcare, tackle climate change and create new commercial opportunities, becoming the research and business leaders of the future."

Dr Alex Marsh, Deputy Director of Strategy at UKRI

"The Institute of Biomedical Science is proud to sponsor STEM for Britain which is an excellent opportunity for biological and biomedical scientists to showcase their research and raise awareness of their valuable work to politicians and the public."

Allan Wilson, IBMS President

"The inclusion of mathematics in STEM for Britain recognises the vitality and strength of the discipline in the UK and the huge part that all branches of mathematics play in underpinning science and technology."

Professor Martin Bridson, President, Clay Mathematics Institute

"WMG is delighted to sponsor the STEM for Britain engineering awards for 2018. Britain needs an economy built on technical innovation, improved productivity and long-term investment, it is crucial therefore that we support innovative research which has the potential to change the way we live.

At WMG, we have focused on the practical applications of the highest quality scientific research for nearly four decades, driving innovations in fields as diverse as battery technology and healthcare. In the future, the engineers presenting today can make a similar impact on our society."

Professor Dave Mullins, Acting Head of Department, WMG at the University of Warwick

"SCI's charitable objective is to bring together chemistry-related sciences and industry to promote applied science for the benefit of society.

The current global challenges we face are significant and complex and require a multi-disciplinary, innovative approach.

Supporting early-stage and early-career research scientists, engineers, and technologists is an essential part of that mission.

SCI is proud to be part of STEM for Britain and to support the work of past SCI member, Dr Eric Wharton, who initiated the event's forerunner, SET for Britain in 1997."

Sharon Todd, Executive Director, SCI

"As a Research Institute whose focus is on fundamental mathematics and its applications to UK national interests, and on supporting mathematical research across the country, HIMR is delighted to be associated with STEM for Britain and offers its warmest congratulations to all of the Award winners."

Professor Jon Keating FRS, Chair Heilbronn Institute for Mathematical Research.

The Comino Foundation is an educational charity that focuses on creativity, science and engineering mostly at primary and secondary school level. We are particularly concerned about the ability of the current education system to provide the right skills for the digital age and also to develop creativity and 'making' as crucial parts of this. Many of the creative subjects are being dropped by secondary schools and as a result those joining the workforce for the first time struggle with problem-solving and developing initiative. STEM for Britain demonstrates for us the need for these skills to be at the forefront of our emerging workforce if this country is to succeed in the future.

John Slater, Chairman

ENGINEERING EXHIBITION WINNERS

The STEM for Britain 2019 Awards:

Gold Award: SOPHIE MORSE, Biomedical Engineering, Imperial College London - *'Getting Drugs to the Brain Using Ultrasound and Microbubbles'*

Silver Award: LACHLAN JARDINE, Department of Engineering, University of Cambridge - *'The Effect of Cooling on Turbine Performance'*

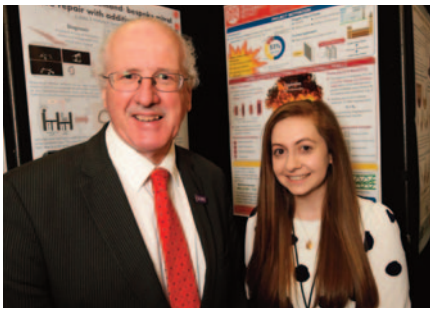
Bronze Award: Kari CLARK, Department of Electronic and Electrical Engineering, University College London - *'Sub-Nanosecond Clock and Data Recovery in an Optically Switched Data Centre Network'*

LR: Lachlan Jardine, Sophie Morse, and Kari Clark

Our sincere thanks to the **Warwick Manufacturing Group** for generously supporting the Engineering Awards and to Dr David Clark, Principal Fellow, WMG, for kindly presenting the prizes, together with Prof Mary Ryan, Royal Academy of Engineering.

We are also grateful to the Panel of Engineering judges for their work: Professor Mary P Ryan (Chair), Professor Bashir Al-Hashimi, Dr Donal Cronin, Professor Brian G Falzon, Professor Jeff Magee, Professor Albert A Rodger, Professor Mark Sandler, Professor Ravi Silver, Professor Constantinos Soutis, and Professor Robert J K Wood.


Sid-Ali Amamra, WMG, University of Warwick with Nusrat Gharni MP, Parliamentary Under-Secretary of State for Transport


Jim Shannon MP and Clare Burnett, Queen's University Belfast


Dr Xiao Han, University of Newcastle, with Nick Brown MP


Andy Slaughter MP with Luis Badesa-Bernardo of Imperial College London


Prof Mary Ryan, Royal Academy of Engineering, Stephen Metcalfe MP, Dr Stephen Benn, and Dr David Clark, Principal Fellow, WMG, sponsor of the Engineering prizes


Yasir Noori, University of Southampton with Dr Alan Whitehead MP

All photographs for STEM for Britain 2019 by John Deehan Photography

BIOLOGICAL AND BIOSCIENCES EXHIBITION WINNERS

The Stem for Britain 2019 Awards:

Gold Award: REBECCA SHEPHERD, Lancaster Medical School, Lancaster University - *'Exploring Adipocytes to Improve Bone Health'*

Silver Award: MAX GROGAN, Faculty of Life Sciences and Medicine, King's College London - *'Microbial and Metabolomic Responses to Serotonin in the Murine Gut'*

Bronze Award: SOPHIE HARRINGTON, Crop Genetics, John Innes Centre - *'Understanding the Molecular Regulation of Senescence in Wheat'*

The Physiological Society Prize: KATERINA PETROPOULOU, Medicine, Imperial College London - *'Preventing Type 2 Diabetes Using Wrinkled Peas'*

Our sincere thanks to the **Institute of Biomedical Sciences** for generously supporting the Biosciences Gold and Silver Awards and to the Comino Foundation for supporting the Bronze Award and to Alison Geddis, President, IBMS and John Slater, Trustee, Comino Foundation, for presenting the awards along with Dr Mark Downs, Chief Executive, Royal Society of Biology, Mark Hollingsworth, Chief Executive, the Nutrition Society, and Prof Bridget Lumb, President of The Physiological Society.

We are also grateful to the Panel of Biosciences Judges for their work: Professor Alyson Tobin (Chair), Professor Malcolm Bennett, Dr Guy S Bewick, Professor David Blackbourn, Professor John Coggins OBE, Dr Simon Cork, Dr Federico Formenti, Professor Phil Gilmartin, Dr Sarah Hall, Dr Celia Knight, Dr Kevin O'Dell, Dr Sarah Pitt, Dr Mark Roberts, Professor Simon van Heyningen and Professor Susan Wray.

LR: Sophie Harrington, Rebecca Shepherd and Mark Grogan

Katerina Petropoulou, Stephen Metcalfe MP and Prof Bridget Lumb, President of The Physiological Society


Alison Geddis, President of the Institute of Biomedical Science, sponsor of the Biosciences Gold and Silver prizes


Stella Felsinger of the University of Durham, with Dr Roberta Blackman-Woods MP

Ciara Sugrue, University of Loughborough with Nicky Morgan MP

MATHEMATICAL SCIENCES EXHIBITION WINNERS

The Stem for Britain 2019 Awards:

Gold Award: KRISTIAN KIRADJIEV, Mathematical Institute, University of Oxford - *'Modelling Removal of Toxic Chemicals from Flue Gas'*

Silver Award: MARINA JIMENEZ-MUNOZ, University of Kent - *'How Do Bird Population Vary Across Britain? Spatially-Explicit Integrated Population Models'*

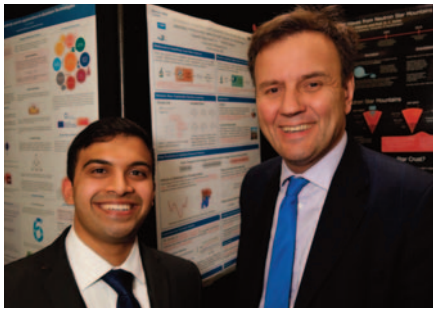
Bronze Award: FRANCESCA ROMANA CRUCINIO, Department of Statistics, University of Warwick - *'Sequential Monte Carlo for Fredholm Equations of the First Kind'*

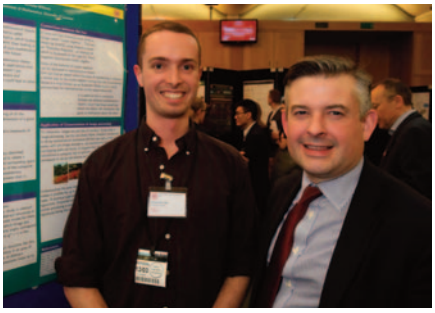
LR: Francesca Romana Crucinio, Kristian Kiradjiev and Marina Jimenez-Munoz

Our sincere thanks to the **Clay Mathematics Institute** for generously supporting the Gold and Silver Awards and the **Heilbronn Institute of Mathematical Research** for supporting the Bronze Award, and to Prof Martin Bridson, President of the Clay Mathematics Institute, and Prof Sir Ian Diamond, Chair of the Council for Mathematical Sciences, for presenting the prizes.

We are also grateful to the Panel of Mathematical Sciences Judges for their work: Professor Tim J Pedley (Chair), Professor Martin Bridson, Professor Steven Gilmour, Dr Vincent Knight, Professor Elizabeth Mansfield, and Professor Demetrios Papageorgiou.


Thomas Crawford, University of Cambridge with Daniel Zeichner MP


Miten Mistry, University College London with Greg Hands MP


Nicholas Williams, University of Leicester with Jonathan Ashworth MP


Stephen Metcalfe MP, Chair of the Parliamentary and Scientific Committee


Prof Martin Bridson, President, Clay Mathematics Institute, supporter of the Gold and Silver Mathematics prize

Dr William Duncan, Executive Director, Parliamentary and Scientific Committee, Sir Ian Diamond, Chair of the Council for Mathematical Sciences and the Earl of Selborne

PHYSICAL SCIENCES - CHEMISTRY EXHIBITION WINNERS

The Stem for Britain 2019 Awards:

Gold Award: DAVID FALLON, Flexible Discovery Unit, Strathclyde University and GlaxoSmithKline - *'The Design and Synthesis of Bromodomain Photoaffinity Probes'*

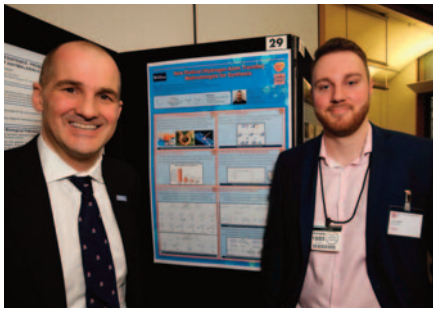
Silver Award: FELICITY NOAKES, Department of Chemistry, University of Sheffield - *'Investigating the Cytoxcity of Water-Soluble Organic Intercalating Ligands as Potential Cancer Theranostics'*

Bronze Award: ISABEL WILKINSON, Department of Chemistry, University of Oxford - *'Target Identification Studies of a Utrophin Modulator for Treatment of Duchenne Muscular Dystrophy'*

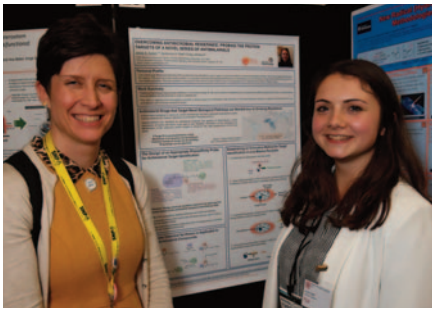
LR: Isabel Wilkinson, David Fallon and Felicity Noakes

Our sincere thanks to Dame Carol Robinson, President of the Royal Society of Chemistry for presenting the prizes.

We are also grateful to the Panel of Chemistry Judges for their work: Dr Peter J Machin (Chair), Professor Paul M Cullis, Professor Helen Fielding, Dr Bryan Hanley, and Professor Peter Knowles.


Jake Berry MP and Oliver Turner of Glaxo Smith Kline


Faisal Rashid MP and Aisha Bismillah, University of Birmingham


Alison Thewlis MP and Jessie Turner, University of Strathclyde


Ahmed Ibrahim Osman-Ahmed, Queen's University Belfast and Anil Pal, University of Birmingham


Dame Carol Robinson, President, Royal Society of Chemistry and Dr Stephen Benn, Vice President, Parliamentary and Scientific Committee


Sarah Harrison and Elizabeth Ratcliffe from the Royal Society of Chemistry

PHYSICAL SCIENCES - PHYSICS EXHIBITION WINNERS

The Stem for Britain 2019 Awards:

Gold Award: KATIE LEY, Department of Physics, University of Surrey - *'Radiation Dosimetry Has Never Looked So Stylish: Glass Jewellery Beads as Thermo-Luminescent Dosimeters'*

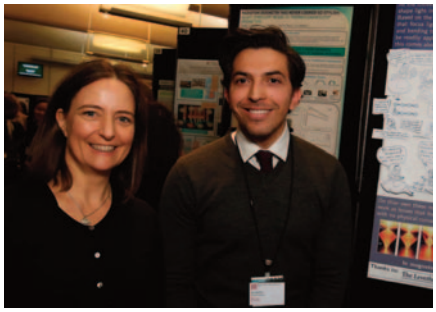
Silver Award: LORENZO ZANISI, Department of Physics and Astronomy, University of Southampton - *'Galaxies, Dark Matter and Blood Pressure'*

Bronze Award: AMALIA THOMAS, Department of Applied Mathematics and Theoretical Physics, University of Cambridge - *'Force Networks in Photoelastic Avalanches'*

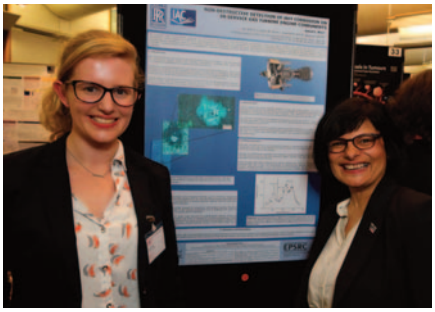
LR: Amalia Thomas, Katie Ley and Lorenzo Zanisi

Our sincere thanks to Dr James McKenzie, Vice-President, Business, Institute of Physics, for presenting the prizes.

We are also grateful to the Panel of Physics Judges for their work: Dr Mark Telling (Chair), Dr Jennifer Brookes, Dr Liz Conlon, Dr Elizabeth Cunningham and Dr Klaus Suhling.


Carol Monaghan MP with Rair Macedo, University of Glasgow


Steve McCabe MP and Elizabeth Labella, University of Birmingham


Astrid Blee, University of Bristol and Thangham Debbonaire MP


Kristina Small, University of Manchester, and Catherine McKinnell MP


Dr James McKenzie, Vice President, Business, Institute of Physics


Melissa Brobby from the Institute of Physics

THE WESTMINSTER MEDAL

The finalists…

LR: Kristian Kiradjiev, Gold – Maths, Sophie Morse, Gold – Engineering, Rebecca Shepherd, Gold – Biosciences, Katie Ley, Gold – Physics, and David Fallon, Gold - Chemistry

At the end of the day, the winners of the five Gold medals competed for the Westminster Medal, in memory of Dr Eric Wharton, founder of STEM for Britain. Here, with the quality of the science already proven with a Gold medal, the judges decided on which of the five posters best demonstrated the presenter's skill in communicating the scientific concept.

And the winner was…Sophie Morse!

LR: Nick Bourne, SCI London Group Member (Westminster Medal Supporter), Inna Baigozina-Goreli, SCI Trustee, (Westminster Medal Supporter), Sophie Morse (Westminster Medal Winner), Sue Wharton (STEM for Britain), Dr Stephen Benn (Vice President, Parliamentary & Scientific Committee)

We sincerely thank **The Society of Chemical Industry** for generously supporting the Westminster Medal and are grateful to Inna Baigozina-Goreli, SCI Trustee, for presenting the award.

STEM4Brit 2019 stats

STEM4Brit 19 was an expectedly challenging year for the social media side of the event. The world of social media had its attention focussed on the Brexit negotiations which very much took the spotlight of any news coming out of Westminster. Despite the challenges, our analytics were either comparable or better than the previous year. We gained a further 200 followers from the previous year while the number of engagements with our tweets stayed the same at around 190,000.

As with previous years the tweets that gain the most coverage often involve MPs or are associated with a popular topic. Topic's such as cancer or Alzheimer's gain lots of traction and are spread widely, this not only increases the coverage of the topic but our event will also be shown to entire new audiences around the world. The gender of the audience has shifted over to more female interaction this year, coupled alongside the entries being

The wide reach of social media means our event is often publicised around the world, this year there has been articles mentioning students attending our event as far as

Radio BBC Lancashire
Papers BucksHerald, LDMagazine
Companies GSK Transnet

Charlie Owen
Social Media Consultant

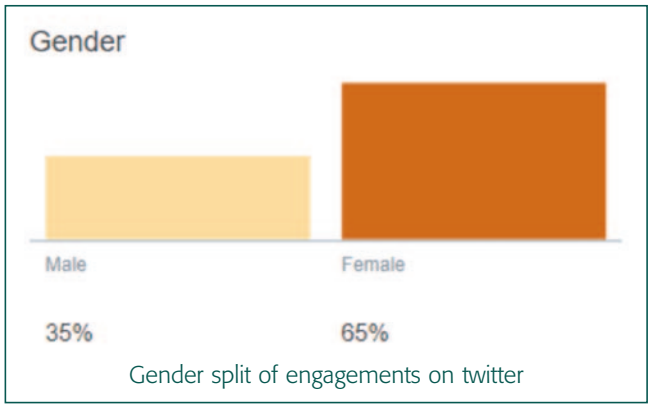
191K 7,123.5%

Profile visits

8,709 816.7%

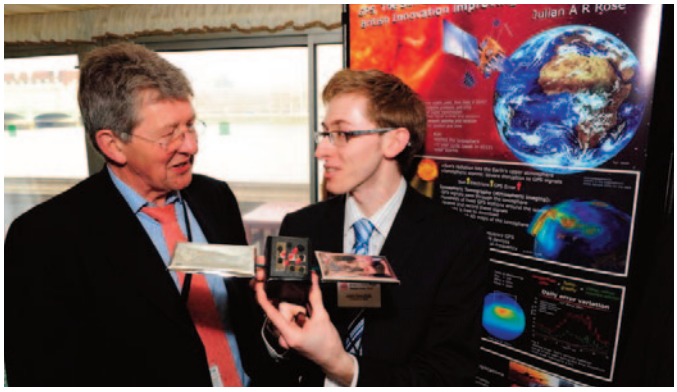
Mentions

348 2,385.7%



Gender split of engagements on twitter

What does STEM for BRITAIN mean to me?



STEM for Britain 2010 Engineering Winner and Overall Winner with Don Foster MP

It was an absolute privilege to present my work at the Parliamentary and Science Committee's STEM for Britain (SfB) almost 10 years ago. For young researchers to be given the opportunity to engage directly with MPs, Peers and experts, within the beating heart of Westminster, is truly unique and something for Britain to be very proud of.

I was lucky enough to be awarded both the Engineering and Westminster medals - one of the most rewarding and motivating experiences of my career. It has been a great pleasure to return in the years since, not only to feel the real buzz in the room again, but to learn about the latest UK research coming from the next generation of future STEM leaders.

The P&SC's STEM Organising Committee, chaired by Stephen Metcalfe MP and supporters and sponsors (RAE, RSC, IOP and Monitise in 2010 etc) do an incredible job of bringing STEM to Parliamentarians each year. Now, as 2020 fast approaches, I am looking forward to working with the them (and SfB alumni) to support future generations.

As if presenting my work to academics wasn't terrifying enough, what would MPs make of it?

When I embarked upon my PhD in 2007 the prospect of presenting my work at the Houses of Parliament at such an early stage in my career was tremendously exciting but also daunting. My training was geared towards presenting research to academics and it wasn't until a couple of years-in that public engagement became important to me – thanks largely to SfB.

Back then, I had some experience of a very different challenge, presenting STEM to hundreds of children of all ages at an annual science fair. Whilst SfB felt like an entirely different ball game, I applied the same rules and set about making my research fun, engaging and accessible to all.

I hand crafted a 3D model of a satellite (my work was about GPS!) from foam and bits of scrap. I took this along with my poster and practiced delivering my message, 3 years of research, in just 3 minutes, in preparation for the judges!

My point is, attending STEM for Britain, let alone winning, gave me a real boost, professionally and personally. It challenged my thinking, took me outside of my comfort zone and equipped me with the confidence to seize similar challenges still today.

What have I been doing since?

From a very early age I took things apart and much to my parents' relief, put them back together again! As most engineers do, I have a hunger for knowledge and a craving to learn how things work. This passion and drive have continuously taken me on a path surrounded by STEM: from working with the European Space Agency (ESA), managing a Government funded academic network and to working at Dyson.

Post PhD I went on to work as a Knowledge Transfer Fellow, working with industry and commercialising research. I was later awarded funding by ESA to bring emerging scientists and engineers from across Africa together, to review the state of the space monitoring and satellite communication capabilities across the continent.

Afterwards, I came across the opportunity to blend my engineering and science background, together with my passion for communication: managing a Government funded EPSRC Grand Challenge Network, focused on tackling the challenges over the next 50 years e.g. depleting natural resources, antibiotic & drug resistance and an ageing population.

A key part of my role was to bring an inter-disciplinary community together, to inspire and provoke new ideas and to foster new collaborations. Regular community-engagement was at the center of the Network, with a particular focus on early-career researchers. I seized the challenge and grew the Network by over 60% and set about securing further funding for its next chapter.

What am I doing now?

STEM is at the heart of my role at Dyson. Here, I work in the top-secret Research building where we develop exciting new technologies and concepts.

Working at Dyson is fast-paced, challenging and very enjoyable! My role in technology scouting (and external research) means that I investigate technologies from hundreds of start-ups, established companies and universities from across the globe each year. I establish traction early on across the research, innovation and development teams, should an external opportunity have the potential to complement Dyson technologies or products (ahead of opening up commercial discussions).

What advice would I give to my younger self? Say yes to every opportunity, evolve, adapt and most importantly, stand up for what you believe in.

I can't wait for STEM for Britain 2020, and I look forward to seeing you there on 9 March!

By Dr Julian Rose

Julian, Thao Nguyen and Stephen Benn

STEM for Britain is very much a team effort and would not be possible without the help of all the major Learned Societies involved…

"With the advent of UKRI and a separation from the European Union, the UK research and development landscape is clearly set for change. Now, more than ever, it is vital that scientists communicate what they are doing, and why, to inform science policy and policy for science. Both Discovery and Applied research have key roles to play and STEM for Britain provides an ideal platform to convey the excitement and opportunity of research to politicians and other policy makers. Those allocating public funds, and the public who provide it, need to be able to access clear information on the research they fund and early career researchers have a critical role to play in that communication. Bioscience holds the solution to many of our global challenges from new medicines to food security. And the research displayed at STEM for Britain is a shining example of the UK's current and future research potential."

Dr Mark Downs,
Chief Executive of the Royal Society of Biology

'The Nutrition Society is delighted to have participated in STEM for Britain 2019. The event is a unique opportunity for early career researchers in the fast-growing field of nutrition science research to achieve wider exposure for their cutting-edge research projects through interaction with Parliamentarians.

The Society looks forward to continuing its support to STEM for Britain for many years to come, and is particularly pleased to be awarding a Nutrition Society prize for the first time in 2020.'

Mark Hollingsworth
Chief Executive Officer

"STEM for Britain is a great platform to showcase - in Parliament - examples of ground-breaking research that is being carried out by some of our early-career young scientists.

"The event enables Members of Parliament, from both Houses, to learn about new UK research from the scientists themselves, and then share it with their constituencies.

"The researchers gain an understanding of the importance of engagement with Parliamentarians on issues involving science, engineering, medicine, technology and mathematics and of challenges and breakthroughs in other scientific areas.

"Fostering these kinds of relationships is so important to furthering and widening understanding of all sciences, and thereby helping policy makers to take decisions from a knowledgeable standpoint.

"Everyone who took part should be immensely proud; both of the role they play in scientific research and also in sharing their work and achievements with key parliamentarians.

Professor Dame Julia Higgins
President of the Institute of Physics

"STEM for Britain is one of the highlights of the parliamentary calendar. We are proud to support it and in 2019 present The Physiological Society Prize for the first time.

"The world faces great challenges in the years to come that will not be addressed by science or politics alone, but by us working together for a common purpose.

"Physiology is the science behind many of these challenges, from our ageing population to treatment of disease.

"Events like STEM for Britain are vitally important for scientists and politicians to engage with each other on these key issues."

Professor Bridget Lumb,
President of The Physiological Society

"I'm delighted at the superb engineering research on display at STEM for Britain this year. This annual showcase provides a glimpse of the world-leading research taking place in universities across the UK and it's fantastic to see excellent engineering being recognised with the award of the prestigious Westminster Medal for Sophie's research on innovative drug delivery to the brain. This event provides a great opportunity for Parliamentarians to meet researchers from their constituencies and to see how varied the world of engineering is and the many ways in which it benefits our society."

Professor Dame Ann Dowling OM DBE FREng FRS,
President of the Royal Academy of Engineering

"It is wonderful to showcase the importance of the mathematical sciences to a wider audience. It is paramount to encourage early-career research scientists, engineers, technologists and mathematicians and the STEM for Britain event is a very effective way of doing this."

Sir Ian Diamond,
Chair of the Council for the Mathematical Sciences

The STEM for Britain event reflects our ambitions for the Royal Society of Chemistry itself and continues to go from strength to strength.

"The competition is an excellent opportunity to recognise and celebrate some of our most talented young scientists. Our elected representatives also get to hear directly about some of the most exciting research that is happening in their constituencies and around the UK.

"We would like to congratulate all of the STEM for Britain finalists and thank them for their impressive contributions to innovative and successful science. The strength and depth of the competition shows that we are in a strong position to keep UK science leading the way for the world."

Dr Helen Pain, Deputy Chief Executive,
Royal Society of Chemistry

STEM for Britain 2020 will take place in the Houses of Parliament on Monday 9th March during British Science Week

Applications are invited from Monday 23rd September 2019 from early-career research scientists, engineers, technologists and mathematicians who wish to exhibit posters in one of the following five areas:

- Biological and Biomedical Sciences
- Chemistry
- Engineering
- Mathematical Sciences
- Physics

The closing date for applications is Monday 2nd December.

A wide range of important scientific, engineering and mathematics institutions and organisations are lending their support to this event, including the Royal Society of Biology, The Physiological Society, the Royal Society of Chemistry, the Royal Academy of Engineering, the Council for the Mathematical Sciences, the Institute of Biomedical Science, the Clay Mathematics Institute, the Nutrition Society, the Heilbronn Institute, the Institute of Physics, Warwick Manufacturing Group, United Kingdom Research and Innovation, the Biochemical Society, and the Society of Chemical Industry.

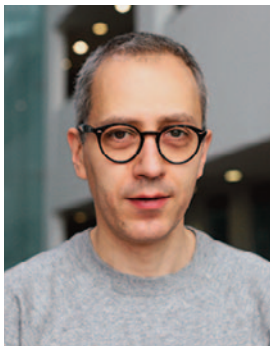
This reflects the importance we all attach to the encouragement of researchers at this stage in their careers.

Prizes will be awarded for the posters presented in each discipline which best communicate high level science, engineering or mathematics to a lay audience.

The Westminster Medal for the overall winner will be awarded in memory of the late Dr Eric Wharton, who did so much to establish SET for Britain as a regular event in the Parliamentary calendar.

From 23rd September full details of the competition and exhibition including the application form can be found on the STEM for Britain website at: www.stemforbritain.org.uk

BREXIT TWEETS AND THE POLARISED TERRAIN OF DIS/MISINFORMATION



Dan Mercea
Department of Sociology,
City University London,
Northampton Square, London
EC1V 0HB

Marco Bastos
Department of Sociology,
City University of London,
London, UK

Dan Mercea is Reader in the Department of Sociology at City, University of London. He is the author of *Civic Participation in Contentious Politics: The Digital Foreshadowing of Protest*.

Marco Bastos is Senior Lecturer in Media and Communication in the Department of Sociology at City, University of London and an affiliate of Duke University's Network Analysis Center.

The decision of the UK electorate to leave the European Union has seemed hard to understand (Becker, Fetzer, & Novy, 2017), although polls in the run up to the 2016 referendum did not make it look completely unpredictable (Barnes, 2016). In the public domain, questions have since arisen regarding the transformation of campaign communication in the wake of revelations of strategic use by Vote Leave (Cummings, 2016) and the scandal-ridden Cambridge Analytica consultancy firm of social media user data for micro-targeted political advertising.

Likewise, social media were harnessed for state-sponsored dis/misinformation campaigns executed by troll accounts propagating deception and conflict, often in coordination with automated bot accounts purposefully employed to scale up dissemination (Badawy, Addawood, Lerman, & Ferrara, 2019). These developments highlight multiple vulnerabilities of rule-based liberal democracies whose extant political divides have been amplified for political and/or geo-political gain through strategic communication transgressing national borders, electoral laws, and data protection principles (House of Commons Digital, 2019).

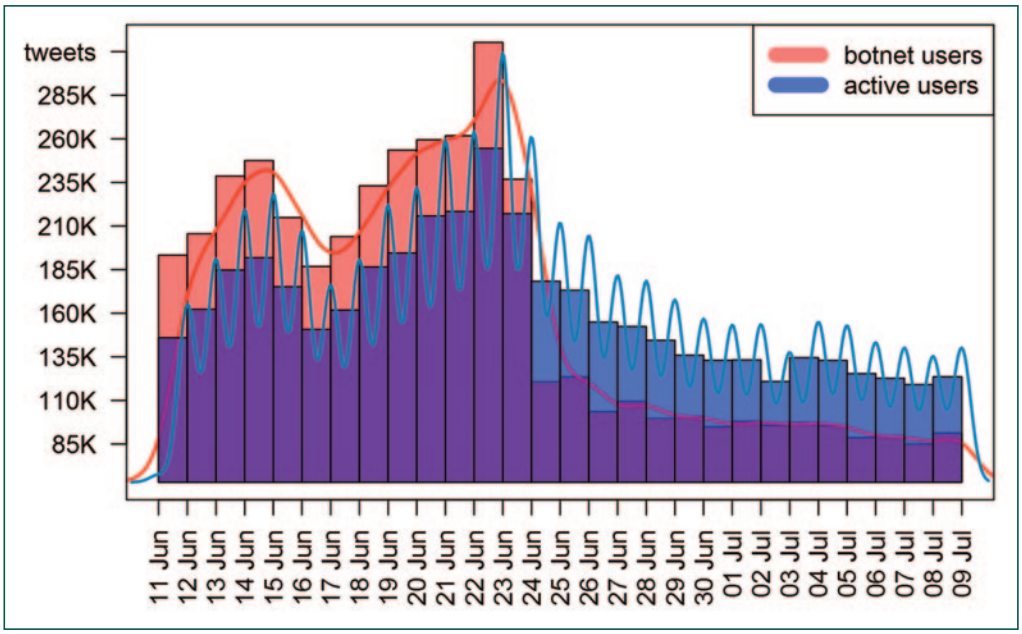


Figure 1: Bastos, M. T. and D. Mercea (2019). "The Brexit Botnet and User-Generated Hyperpartisan News." Social Science Computer Review 37(1): 38-54.

The studies we conducted with Twitter data collected during the referendum campaign evidenced activity of bot-like accounts tweeting for or against Brexit (Bastos & Mercea, 2019). Firstly, accounts presenting bot-like features tweeted more in favour of the Leave (37 percent) than the Remain (17 percent) campaign. They participated in the supply of hyperpartisan content condensed to be sharable, to heighten polarised identities, and balkanize audiences. Bots generated faster message cascades compared to active users and were largely dedicated to retweeting active users or other bots. They successfully joined or set off cascades more rapidly that active users but were less capable than active users to engender large retweet cascades of over one thousand users.

Secondly, by triangulating the geographic location of UK users, we found that politically homogenous Leave messages spread over short geographical areas (Bastos, Mercea, & Baronchelli, 2018). We tested and ruled out that this effect was the product of either very active super-users or exceptional

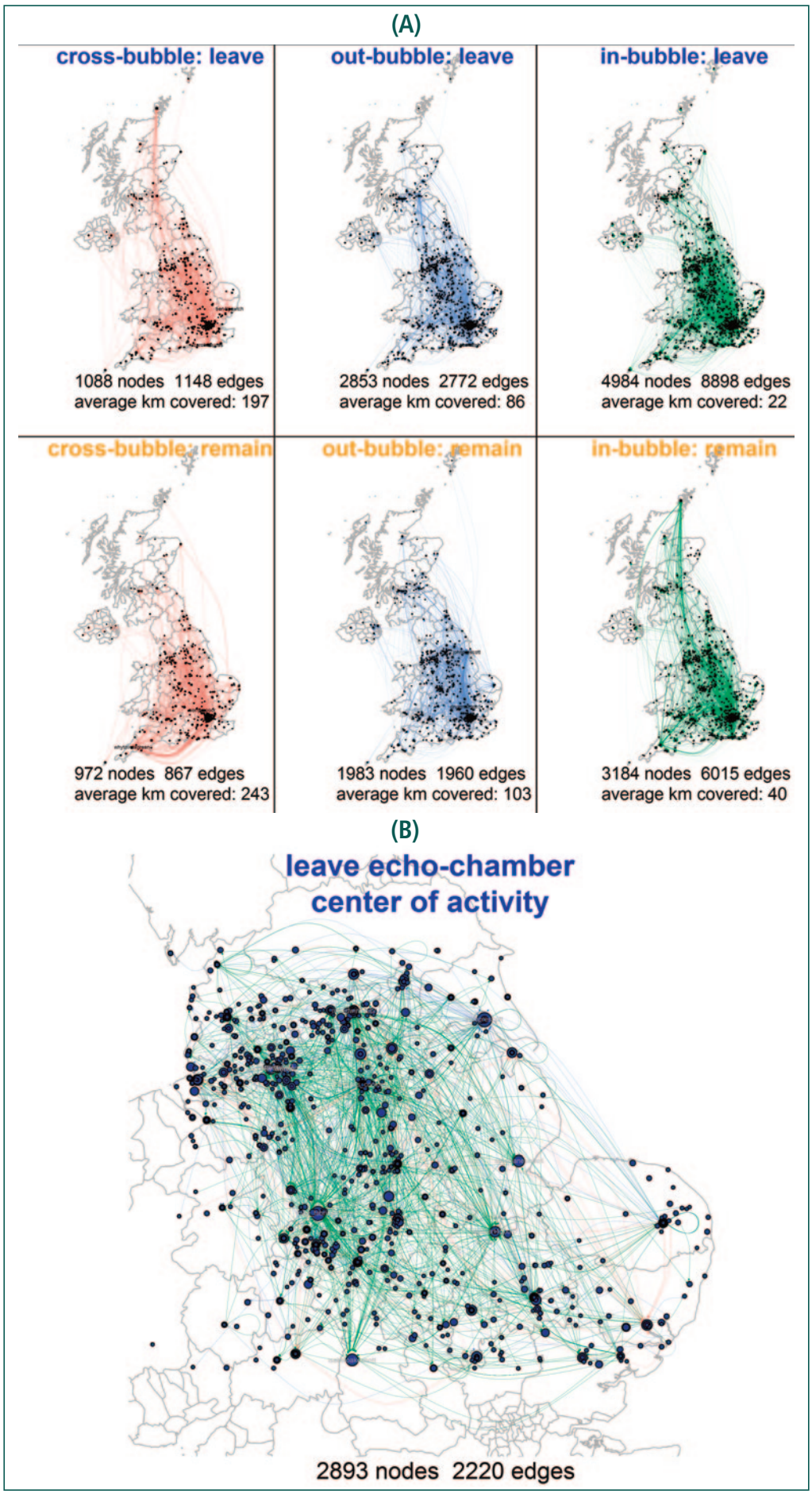


Figure 2: Bastos, M., D. Mercea, et al. (2018). "The geographic embedding of online echo chambers: Evidence from the Brexit campaign." PLOS ONE 13(11): e0206841.

events occurring during the referendum campaign such as the murder of Labour MP Jo Cox. Politically homogenous Remain messages, on the other hand, linked users geographically further away from each other. Corroborating foregoing studies differentiating between liberal and conservative Twitter users (Barberá & Rivero, 2015), Remainers appeared to try to reach across the ideological divide in their communities more often than Leavers.

These results indicate that communication around the Brexit referendum on Twitter likely mapped onto physical social networks. We expect that Leave and Remain social networks – the latter of which was more likely made up of people who live, work, and study in locations further removed from their hometowns (Becker et al., 2017) – were a reflection of both their geographical and their social locations. This observation, in turn, renews an invitation that analyses of the causes of ideological polarisation account not just for the intricacies of communication on social platforms (Benkler, Faris, Roberts, & Zuckerman, 2017), but also for social divisions such as those that characterised the Brexit vote.

To this end, thirdly, we examined correlates of the vote and found that the use of hashtags to advocate either side of the campaign did not alone reflect the result of the referendum. We additionally found that communication infused with nationalistic messages or which dwelled on the economic implications of the vote helped predict the outcome alongside socio-demographic data aggregated at the level of Parliamentary Constituencies (Bastos & Mercea, 2018). Among the latter, indicators of material inequality – chief

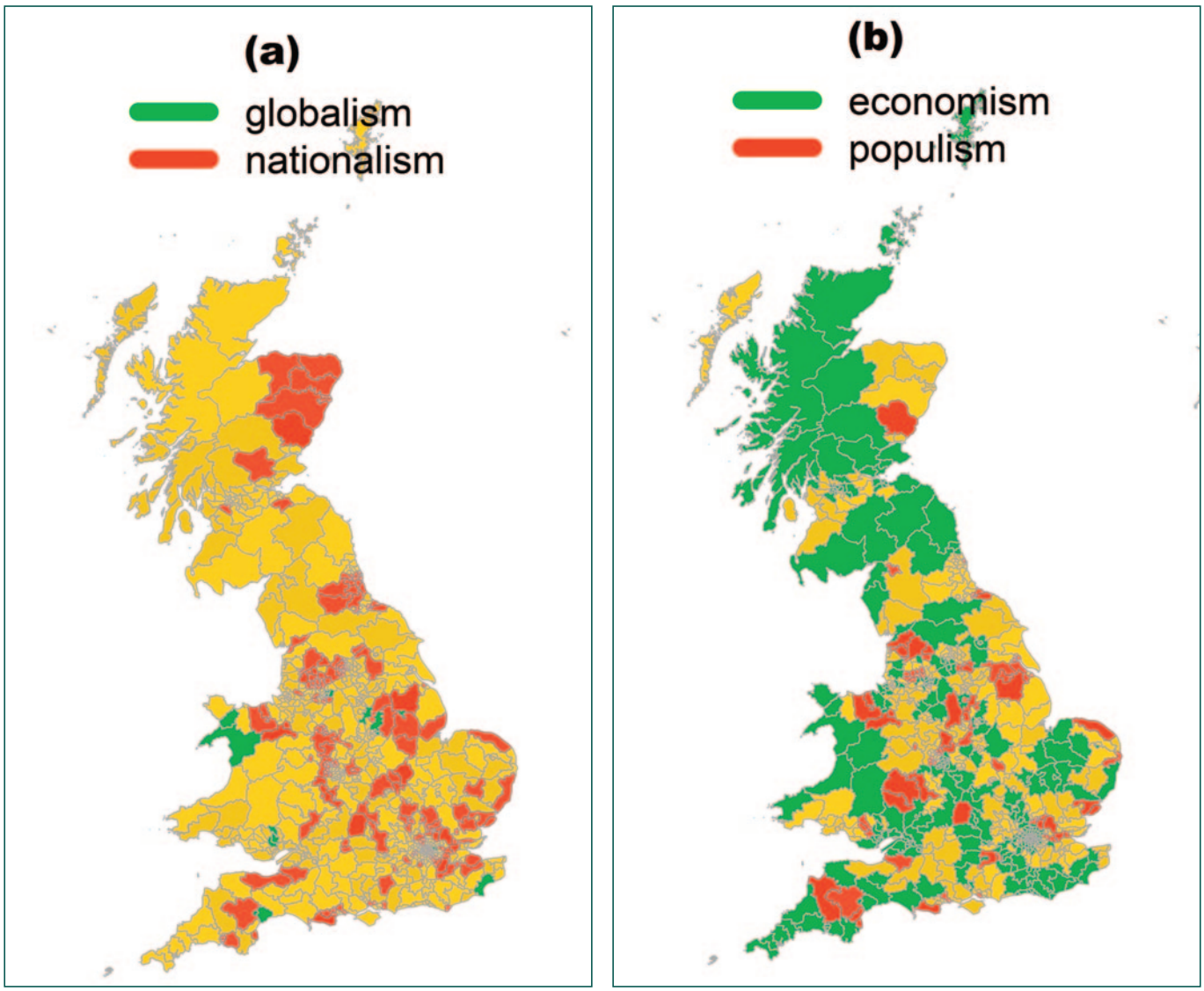


Figure 3: (a,b,c) – Bastos, M. T. and D. Mercea (2018). "Parametrizing Brexit: Mapping Twitter Political Space to Parliamentary Constituencies." Information, Communication & Society 21(7): 921-939.

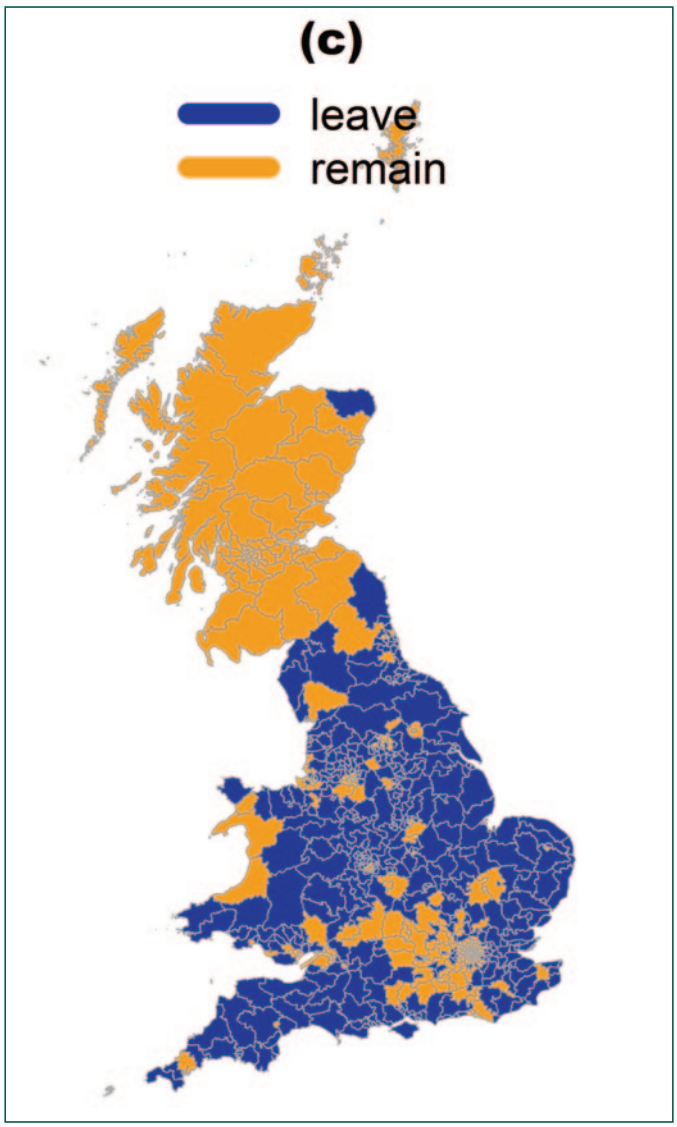
among which was the percentage of economically active residents—stood out as an important predictor.

The Brexit debate on Twitter was largely motivated by nationalist and economic concerns, with three quarters of messages (74 percent) displaying nationalist sentiments as opposed to 26 per cent that expressed globalist values. Similarly, almost two-thirds of tweets (62 percent) focused on economic issues underpinning Brexit instead of expressing populist sentiments (38 per cent). Perhaps surprisingly, tweets embracing nationalist content did not originate from economically fragile areas that were generally supportive of Brexit, like the North of England, but from various other regions across the country, including remain-backing areas like Scotland.

Likewise, the relatively low profile of populist messages berating a globalist pro-EU elite – which nonetheless grew in volume in the run-up to the vote – was a notable finding. While nearly 40 percent of tweets contained populist sentiments, these messages were concentrated in a handful of constituencies. Populist sentiments, touching on economic issues, prevailed in only 10 percent of constituencies. In less than 5 percent, globalist sentiments dominated over nationalist ones. The 72 constituencies with the highest support for the Leave vote presented predominantly nationalist sentiments. Conversely, only 17 of these constituencies had a Twitter debate mainly defined by populist sentiments, with 55 of them being classified as concerned with the economic outlook.

Fourth, we note that the independent study of political communication on social platforms – particularly dis- and misinformation – is fraught with growing difficulties. Among the notable stumbling blocks are restrictions that all but stopped access to the public Application Programming Interface of Facebook. Researchers relied on APIs to collect public page or group data, although not without some controversy. The Cambridge Analytica scandal, for example, threw into question the ethical standards of individual scientists, their data collection and use practices. In its wake, questions regarding the use of algorithms and human moderators in the governance of communication on social media have risen in prominence. Yet, the ability to independently audit them has been severely limited, despite the evident public interest to safeguard democratic elections and public deliberations than inform them.

As colleagues have recently shown (Acker & Donovan, 2019), metadata that social



media generate to classify and keep track of user activity is an increasingly scarce though valuable resource. Researchers calling for renewed access to it (Bruns, 2019) seek to understand both how platforms personalise user experience to render it more amenable to advertising and how state and non-state actors masquerading as advertisers use insights made available to them to inject misleading, false, or polarising content and 'junk' metadata that skews public communication on social platforms and their wider media ecosystem.

Timely, ethical and transparent research into dis/misinformation needs to happen in a conducive environment that maintains public standards of accountability for participating parties—social platforms, political actors, academic institutions— and is predicated on shared democratic values and legal standards. It is hard to see how this climate would materialise as long as social platforms' bottom lines are wedded to content that scales and trends (Proferes & Summers, 2019) regardless of its facticity and to their expanding user bases. Yet, platforms have a clear incentive to foster that climate in as far as it can renew trust among user, policymakers and researchers in their governance of social communication.

References

Acker, A., & Donovan, J. (2019). Data craft: a theory/methods package for critical internet studies. *Information, Communication & Society,* 1-20. doi:10.1080/1369118X.2019.1645194

Badawy, A., Addawood, A., Lerman, K., & Ferrara, E. (2019). Characterizing the 2016 Russian IRA influence campaign. *Social Network Analysis and Mining,* 9, 31. doi:10.1007/s13278-019-0578-6

Barberá, P., & Rivero, G. (2015). Understanding the Political Representativeness of Twitter Users. *Social Science Computer Review*, 33, 712-729. doi:doi:10.1177/0894439314558836

Barnes, P. (2016, 22 June 2016). EU Referendum Poll Tracker. Retrieved from https://www.bbc.co.uk/news/uk-politics-eu-referendum-36271589

Bastos, M., & Mercea, D. (2018). Parametrizing Brexit: mapping Twitter political space to parliamentary constituencies. *Information, Communication & Society,* 21, 921-939. doi:10.1080/1369118X.2018.1433224

Bastos, M., Mercea, D., & Baronchelli, A. (2018). The geographic embedding of online echo chambers: Evidence from the Brexit campaign. *PloS one*, 13, e0206841. doi:10.1371/journal.pone.0206841

Bastos, M. T., & Mercea, D. (2019). The Brexit Botnet and User-Generated Hyperpartisan News. *Social Science Computer Review,* 37, 38-54. doi:10.1177/0894439317734157

Becker, S. O., Fetzer, T., & Novy, D. (2017). Who voted for Brexit? A comprehensive district-level analysis. *Economic Policy,* 32, 601-650. doi:10.1093/epolic/eix012

Benkler, Y., Faris, R., Roberts, H., & Zuckerman, E. (2017, 3 March 2017). Breitbart-led right-wing media ecosystem altered broader media agenda. *Columbia Journalism Review. Retrieved from http://www.cjr.org/analysis/breitbart-media-trump-harvard-study.php*

Bruns, A. (2019). After the 'APIcalypse': social media platforms and their fight against critical scholarly research. *Information, Communication & Society,* 1-23. doi:10.1080/1369118X.2019.1637447

Cummings, D. (2016). On the Referendum #20: The Campaign, Physics, and Data Science- Vote Leave's Voter Intention Collection System (VICS) Now Available for All *Dominic Cummings's Blog.*

House of Commons Digital, C., Media and Sport Committee. (2019). *Disinformation and Fake News: Final Report. Retrieved from https://publications.parliament.uk/pa/cm201719/cmselect/cmcumeds/1791/1791.pdf*

Proferes, N., & Summers, E. (2019). Algorithms and agenda-setting in Wikileaks' #Podestaemails release. *Information, Communication & Society,* 1-16. doi:10.1080/1369118X.2019.1626469

HOUSE OF COMMONS SELECT COMMITTEES

Current work and Inquiries

SCIENCE & TECHNOLOGY COMMITTEE

The Science and Technology Select Committee exists to ensure that Government policy and decision-making are based on good scientific and engineering advice and evidence. The Science and Technology Select Committee is unusual amongst departmental select committees in that it scrutinises the Government Office for Science (GO-Science), which is a "semiautonomous 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. Sir 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

CURRENT INQUIRIES include

- **UK telecommunications infrastructure**

  Inquiry announced 07 June 2019. Oral evidence session taken place. Following these the Chair, Sir Norman Lamb MP, wrote on 10 July to the Secretary of State for Digital, Culture, Media and Sport to say that, subject to various important caveats, there were no technical grounds for excluding Huawei entirely from the UK's 5G or other telecoms networks, but ethical concerns must also be taken into account. He urged the Government to publish the outcome of its Telecoms Supply Chain Review by the end of August.

- **Commercial and recreational drone use in the UK**

  Inquiry announced 07 March 2019 into the ethical and safety implications of the growing use of civilian drones.

  Oral evidence sessions taking place. Submissions still possible.

- **Commercial genomics**

  Inquiry announced 04 March 2019 into commercial genomic testing to establish what safeguards need to be put in place to protect those who get tested.

  Written submissions still being accepted.

- **Work of the Science Minister and Government Chief Scientific Adviser**

  Inquiry announced 11 December 2018. Oral evidence given by Chris Skidmore MP on 17 June when then Minister for Universities, Science, Research and Innovation. One-off accountability hearings continue

- **Balance and effectiveness of research and innovation spending**

  Inquiry announced 20 July 2018. Report in preparation

RECENTLY CONCLUDED INQUIRIES include

- **Work of the Chief Medical Officer**

  Inquiry announced 06 June 2019. Oral evidence given by CMO then published on 10 June. Inquiry concluded.

- **19th Report - The work of the Biometrics Commissioner and the Forensic Science Regulator**

  Inquiry announced 12 February 2019. Report published 18 July 2019.

  This shows that issues with biometrics and forensics pose a significant risk to effective functioning of the criminal justice system

  Here is link to summary
  https://publications.parliament.uk/pa/cm201719/cmselect/cmsctech/1970/197003.htm#_idTextAnchor

- **18th Report - Digital Government**

  Inquiry announced 25 July 2018. Report published 10 July 2019.

  This concluded that the Government must improve its digital capabilities in order to enhance the relationship between the citizen and the State.

  Here is link to conclusions and recommendations
  https://publications.parliament.uk/pa/cm201719/cmselect/cmsctech/1455/145510.htm

- **17th Report - Japanese knotweed and the built environment**

  Inquiry announced on 23 October 2018. Report published 16 May 2019.

  This reported the 'latest research suggests that the physical damage to property from Japanese knotweed is no greater than that of other disruptive plants and trees that are not subject to the same controls and do not have such a substantial 'chilling' effect on the sale of a property. ……. Japanese knotweed is particularly hard to eradicate compared with other plants, requiring multi-year treatment with herbicide or excavation. ……..'

  Government response awaited

- **16th Report - 'My Science Inquiry'**

  Inquiry announced 09 November 2018. Report published 27 February 2019.

  Here is link to report
  https://publications.parliament.uk/pa/cm201719/cmselect/cmsctech/1716/171602.htm

- **15th Report - Evidence-based early years intervention: Government's Response to the Committee's Eleventh Report of Session 2017–19**

  Inquiry announced 26 October 2017. Report published as 11th report on 14 November 2018.
  https://publications.parliament.uk/pa/cm201719/cmselect/cmsctech/506/50609.htm

  Govt response published 08 February 2019. Commenting on it, the Chair of the Science and Technology Committee, said:

  "The Government Response to our Report is inadequate. It is extremely frustrating to see the Government largely dismiss our recommendations, opting instead to list existing programmes and shifting responsibility onto local authorities. We already know that this isn't working as well as it could or should be. ……

  "We now hope to work with the new Government Inter-ministerial group – set up to support families with young children – and have asked them to reconsider our Report. The evidence we have gathered presents a valuable opportunity for evidence-based early intervention to address childhood adversity, transforming lives for the better and saving taxpayers' money in the process."

- **14th Report - Impact of social media and screen-use on young people's health**

  Inquiry announced on 21 February 2018. Report published 31 January 2019.

  Here is link to conclusions and recommendations
  https://publications.parliament.uk/pa/cm201719/cmselect/cmsctech/822/82209.htm

  Government response published on 21 May 2019.

  Commenting on this the Chair of the Science and Technology Committee, said:
  "I welcome today's response to our Report into the impact of social media and screen-use on young people's health. The recent Online Harms Government White Paper made significant announcements, endorsing key recommendations from the Report and we are encouraged by the Government's willingness to tackle this issue.

  "It is vital that progress is made to legislate and to prepare an effective statutory code of practice. Social media companies have a duty of care for children and young people using their sites and we are pleased to see that the Government has decided to make this a central focus moving forward.

  "We will continue to watch and wait. In the next year my Committee may choose to hold another evidence session on the issues covered in our Report to check that the Government's actions meet its ambitions."

- **12th Report - Quantum technologies**

  Inquiry announced on 08 February 2018. Report published 06 December 2018.

  Here is link to summary
  https://publications.parliament.uk/pa/cm201719/cmselect/cmsctech/820/82011.htm

  Government response published on 11 March 2019.

BUSINESS, ENERGY AND INDUSTRIAL STRATEGY

This Select 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

CURRENT WORK includes

- **The safety of electrical goods in the UK follow-up**

  Inquiry announced on 2 July 2019

- **Future of Steel in the UK**

  Inquiry announced on 8 June 2019. Deadline for submissions 2 September

- **Supporting regional investment and growth**

  Inquiry announced on 5 April 2019. Oral evidence sessions taking place

- **Financing energy infrastructure**

  Inquiry announced on 27 February 2019.

- **Rolling out smart meters**

  Inquiry announced on 9 January 2019

- **Energy efficiency**

  Inquiry announced on 19 November 2018

- **Gas storage**

  Inquiry announced on 17 October 2018

- **Automation and the Future of Work**

  Inquiry announced on 24 May 2018

- **Clean Growth Strategy inquiry**

  Inquiry announced on 27 November 2018

RECENTLY CONCLUDED INQUIRIES include

- **21st Report - Energy efficiency: building towards net zero HC 1730**

  Inquiry announced on 19 November 2018. Published 12 July 2019

- **20th Report - Carbon Capture Usage and Storage: third time lucky? HC 1094**

  Inquiry announced on 29 May 2018. Published 25 April 2019

- **17th Report - Industrial Strategy: Sector Deals HC 663**

  Inquiry announced on 8 December 2018. Published 18 March 2019

ENVIRONMENTAL AUDIT COMMITTEE

The remit of the Environmental Audit Select 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

CURRENT WORK includes

- **Net zero government**

  Inquiry announced 04 July 2019 examining what the UK Government must do to align its own estate and activities with net zero emissions by 2050 or sooner.
  Accepting written submissions.

- **Electronic waste and the Circular Economy**

  Inquiry announced 27 June 2019
  Accepting written submissions.

- **Invasive Species**

  Inquiry announced 04 April 2019 into the growing threat from invasive species
  Oral evidence sessions taking place.

- **Sustainability in the Department for Transport**

  Inquiry announced 28 March 2019
  Oral evidence sessions taking place.

- **Voluntary National Review of UK progress against the Sustainable Development Goals**

  Inquiry announced 21 March 2019

- **Planetary Health**

  Inquiry announced 23 November 2018 into the risks relating to nutrition for UK and global human populations. Deadline for evidence passed.

- **Climate change and biodiversity**

  Inquiry announced 23 October 2017. No public meetings scheduled and no evidence published

- **Sustainable tourism**

  Inquiry announced 23 October 2017 into the environmental impact of travel and tourism
  No public meetings scheduled and no evidence published.

RECENTLY CONCLUDED WORK includes

- **Toxic Chemicals in Everyday Life**

  Inquiry announced 12 February 2019. Report published on 10 July 2019
  Awaiting Government response

- **Draft Environment (Principles and Governance) Bill**

  Inquiry announced 20 December 2018. Report published on 25 April 2019
  Awaiting Government response

- **Chemicals Regulation after the UK has left the EU**

  No report issued

- **Chinese Waste Import Ban**

  No report issued

- **Sustainability of the fashion industry**

  Report issued 19 February 2019
  Government response published on 4 June 2019.

- **Sustainable Development Goals in the UK follow-up**

  Report on Hunger, Malnutrition and Food Security in the UK published on 10 January 2019
  Government response published on 26 June 2109

- **Sustainable seas**

  Report published on 17 January 2019
  Government response published 9 May 2019

- **The Changing Arctic**

  Report published on 29 November 2018
  Government response published on 16 March 2019

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

RECENTLY CONCLUDED WORK includes

- **Drugs policy: medicinal cannabis**

  Inquiry announced 07 December 2018
  Report published on 3 July 2019
  Government response awaited

- **Sexual health**

  Inquiry announced 01 August 2018
  Report published on 2 June 2019
  Government response awaited

CURRENT WORK includes

- **Drugs policy Inquiry announced 04 February 2019**

  Oral evidence on going

- **Availability of Orkambi on the NHS**

  Inquiry announced 30 November 2018
  Awaiting outcome of negotiations between NHS England and Vertex Pharmaceuticals

- **Budget and NHS long-term plan**

  Inquiry announced 15 November 2018
  Accepting written submissions. Closing date 22 August

HOUSE OF LORDS SELECT COMMITTEES

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 Committee is chaired by Lord Patel KT FMedSci FRSE.

WORK IN PROGRESS

- **Ageing: Science, Technology and Healthy Living**
  Inquiry announced 25 July 2019
- **Science research funding in universities**
  Inquiry announced 13 May 2019 into the current system of research funding for universities in England

RECENT REPORTS ISSUED

- **Forensic science**
  Inquiry announced 23 July 2018. Report published on 1 May 2019.

  The UK was once regarded as world-leading in forensic science but an absence of high-level leadership, a lack of funding and an insufficient level of research and development now means the UK is lagging behind others. The forensic science market is not properly regulated creating a state of crisis and a threat to the criminal justice system

  Government Response published 5 July 2019.
  Awaiting debate.

EU ENERGY AND ENVIRONMENT SUB-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.

WORK IN PROGRESS

- **Veggie tubes**
  Inquiry announced 12 June 2019 into the EU Parliament proposal to restrict how vegetarian foods are named
- **Post-Brexit carbon pricing**
  Inquiry announced 18 February 2019 into carbon pricing options in both 'deal' and 'no deal' scenarios
- **Implementation and enforcement of the EU landing obligation**
  Inquiry announced 15 November 2018 into the EU landing obligation
- **No deal preparations**
  Inquiry announced 17 October 2018 into preparations for a no deal Brexit

RECENT REPORTS ISSUED

- **REACH regulations**
  Report published 7 November 201. Government response published 16 January 2019. Debated 26 March 2019.
- **Brexit: food security**
  Report published 10 May 2018. Government response published 19 July 2018.

  Debated 25 April 2019.
- **Brexit: plant and animal biosecurity**
  Report published on 24 October 2018. Government response published 16 January 2019. Debated on 15 May 2019.

FOOD, POVERTY, HEALTH AND THE ENVIRONMENT SELECT COMMITTEE

This was appointed on 13 June 2019. The Committee is chaired by Baroness Boycott. Its inquiry into the links between inequality, health inequalities and food sustainability was announced on 24 July.

The deadline for submissions is Thursday 12 September 2019.

The Committee will report by 31 March 2020.

PARLIAMENTARY OFFICE OF SCIENCE AND TECHNOLOGY (POST)

POST at 30

2 Jul 2019 - 16 Oct 2019, 11:00 - 15:00

Join POST at the Portcullis House Atrium, to celebrate 30 years of bridging research and policy, and to find out what services POST offers

POST is a bicameral body that bridges research and policy, providing reliable and up-to-date research evidence for the UK Parliament. It is overseen by a Board of MPs, Peers and external experts.

POST briefings are impartial, non-partisan, and peer-reviewed. Timely and forward thinking, they are designed to make scientific research accessible to the UK Parliament

POSTnotes are four-page summaries of public policy issues based on reviews of the research literature and interviews with stakeholders from across academia, industry, government and the third sector. They are peer reviewed by external experts. POSTnotes are often produced proactively, so that parliamentarians have advance knowledge of key issues before they reach the top of the political agenda.

Those produced so far in 2019 are:

608: Online Safety Education
607: Improving Witness Testimony
606: Compostable Food Packaging
605: Plastic Food Packaging Waste
604: Climate Change and Fisheries
603: Climate Change and UK Wildfire
602: Developments in Wind Power
601: Sustaining the Soil Microbiome
600: Climate Change and Agriculture
599: Early Interventions to Reduce Violent Crime
598: Advances in Cancer Treatment
597: Climate Change & Vector-Borne Disease in Humans in the UK
596: Chemical Weapons
595: Reservoirs of Antimicrobial Resistance
594: Limiting Global Warming to 1.5°C
593: Cyber Security of Consumer Devices

Ongoing and future projects approved by the POST Board.

BIOLOGY AND HEALTH

In production

- Causes of obesity
- Climate change and vector-borne disease
- Outward medical tourism
- Industry influence on public health policy
- Researching gambling

Scheduled

- Blockchain technology in the food chain: provisional start date September 2019
- Regulating germline therapies
- Resilient food supply chains

ENERGY AND ENVIRONMENT

In production

- Climate change and fisheries
- Climate change and wildfire frequency
- Environmental gain
- Food waste
- Heat networks
- Insect population decline

Scheduled

- A global deal for nature: provisional start date October 2019

PHYSICAL SCIENCES AND ICT

In production

- Online safety education for young people
- Civilian drones
- Critical materials

Scheduled

- Key EU space programmes

SOCIAL SCIENCES

In production

- Improving eyewitness testimony
- Integrating health and social care
- Research glossary

Scheduled

- Alternative Sentencing: provisional start date October 2019

POSTbriefs are responsive policy briefings based on mini-literature reviews and peer reviews. They are available online only. Those produced so far on 2019 ar

- 32: 5G technology
- 31: Evaluating UK natural hazards: the national risk assessment

The POST Board oversees POST's objectives, outputs and future work programme. It meets quarterly.

Officers

- Chair: Adam Afriyie MP
- Vice-Chair: Professor the Lord Winston, FmedSci, FRSA, FRCP, FRCOG, FREng
- Secretary: Claire Quigley

House of Lords

- Lord Oxburgh, KBE, FRS
- Lord Haskel
- Lord Patel KT, FMedSci, FRSE

House of Commons

- Dr Roberta Blackman-Woods MP
- Thangam Debbonaire MP
- Norman Lamb MP
- Stephen McPartland MP
- Stephen Metcalfe MP
- Dr Alan Whitehead MP

Non-parliamentary

- Professor Elizabeth Fisher, FMedSci
- Paul Martynenko, FBCS
- Professor Sir Bernard Silverman, FRS, FAcSS
- Professor Sarah Whatmore, FBA

Ex-officio

- Dr Grant Hill-Cawthorne, Head of the Parliamentary Office of Science and Technology
- Penny Young, House of Commons Librarian and Managing Director of Research & Information
- Lynn Gardner, Principal Clerk, Committee Office, House of Commons
- Edward Potton, Head of Science and Environment Section, House of Commons Library
- Nicolas Besly, Clerk of Select Committees, House of Lords

Head of POST

- Dr Grant Hill-Cawthorne: 020 7219 2952

PARLIAMENTARY OFFICE OF SCIENCE AND TECHNOLOGY

Houses of Parliament
Westminster
London SW1A 0AA

HOUSE OF COMMONS LIBRARY

The House of Commons Library is an independent research and information unit. It provides impartial information for Members of Parliament of all parties and their staff. This service supports MPs in their work scrutinising Government, proposing legislation, and supporting constituents.

The Library provides confidential, impartial and bespoke briefing to Members of the House of Commons and their offices on a daily basis supporting the full range of parliamentary work, from policy development to constituency issues.

One of the main products the Commons Library produces is research briefings. These provide in-depth and impartial analysis of all major pieces of legislation. The briefings also cover areas of policy, frequently asked questions and topical issues. These research briefings are published online and are available to MPs and the general public. You can also find the research briefings on the Commons Library website.

The Library has produced many research briefings around the debate on Brexit. These include:

Brexit: a reading list of post-EU Referendum publications by Parliament and the Devolved Assemblies

Published Wednesday, July 31, 2019
Commons Briefing papers CBP-7912

EU preparations for a no-deal Brexit

Published Tuesday, July 30, 2019
Commons Briefing papers CBP-8547

The Science and Environment Section (SES) is one of eight teams in the Research Service in the House of Commons Library. In 2019 they have published, and continue to update, briefings on issues varied as:

UK Carbon Budgets

Published Tuesday, July 9, 2019
Commons Briefing papers CBP-7555 on the UK Carbon Budgets, including information on the Climate Change Act 2008, the Committee on Climate Change's proposals for the fifth carbon budget, the Government's Clean Growth Strategy and progress against carbon budgets. Information on the Paris Agreement and possible impact of Brexit is also included.

Animal Sentience and Brexit

Published Monday, July 8, 2019
Commons Briefing papers CBP-8155

The Government is reviewing the recognition of animal sentience and the need for UK legislation after Brexit. It has also announced it will legislate to increase the maximum sentence for animal cruelty offences.

Electric vehicles and infrastructure

Published Friday, June 28, 2019
Commons Briefing papers CBP-7480

This explains what electric vehicles are and how successive governments have planned for infrastructure and provided vehicle grants and incentives to encourage and accommodate their growth. It also sets out how the electricity grid is preparing to accommodate any increased demand from EV charging and looks at comparative emissions from EVs and conventional vehicles.

Legislating for net zero

Published Thursday, June 27, 2019
Commons Briefing papers CBP-8590

This provides an explanation of the introduction of the UK's net zero by 2050 target. It provides the context for the emissions reduction target and a brief overview of relevant commentary and analysis of the Government's proposals.

The Universal Service Obligation (USO) for Broadband

Published Monday, June 24, 2019
Commons Briefing papers CBP-8146

This provides information about the Government's Universal Service Obligation (USO) for broadband.

Plastic waste

Published Monday, June 17, 2019
Commons Briefing papers CBP-8515 on plastic waste in the UK, including statistics on plastic waste and information on UK Government and devolved Government plans and ambitions to reduce avoidable plastic waste and examples of voluntary initiatives from the plastics industry, environmental groups and retailers.

Full-fibre networks in the UK

Published Tuesday, June 4, 2019
Commons Briefing papers CBP-8392 on the Government's policy for building a UK-wide full-fibre broadband network by 2033. It covers what is full-fibre broadband compared to superfast broadband and the Government's strategy for promoting full-fibre set out in its Future Telecoms Infrastructure Review (FTIR), published in July 2018.

Animal Experiment Statistics

Published Thursday, April 25, 2019
Commons Briefing papers SN02720

In 2017, there were 3.79 million procedures completed involving regulated living animals, which was the lowest annual number since 2010. This note summarises and analyses trends in data, including the growth of universities as the dominant seat of research on animals, the use of different species, and the decline of research for toxicological purposes.

Research and development spending

Published Wednesday, April 10, 2019
Commons Briefing papers SN04223

R&D spending in the UK. Including analysis of R&D by region and industry, and international comparisons of R&D.

Brexit and medicines regulation

Published Tuesday, April 9, 2019
Commons Briefing papers CBP-8148

This briefing paper provides an overview of current medicines regulation in the UK and EU, Brexit negotiations so far on this issue, and views on future regulation. It also discusses the potential impacts of a no deal Brexit scenario, and Government preparations for these.

Mobile Coverage in the UK

Published Friday, February 22, 2019
Commons Briefing papers SN0706 on mobile coverage in the UK. It provides mobile coverage statistics and information about recent reforms and proposals aimed at improving mobile coverage in rural areas.

5G

Published Friday, February 22, 2019
Commons Briefing papers CBP-7883 on 5G - the fifth generation of mobile technology. Included is an explanation of 5G and its expected uses; policy challenges associated with 5G and information about the roll-out of 5G in the UK including forthcoming spectrum auctions

Civilian drones

Published Monday, February 11, 2019
Commons Briefing papers CBP-7734

This paper outlines current regulations for the use of recreational and commercial drones in the UK. It also presents recent policy development in the UK and internationally, as well as emerging technological and regulatory issues related to drone integration into domestic airspace.

New Nuclear Power

Published Thursday, January 17, 2019
Commons Briefing papers CBP-8176

This summarises current progress on nuclear power, including conventional reactors, advanced designs, waste disposal and nuclear research.

Climate change conference (COP24): Katowice, Poland

Published Wednesday, January 9, 2019
Commons Briefing papers CBP-8450

This short House of Commons Library Briefing Paper provides a brief overview of the twenty-fourth UN conference on climate change, held in December 2018, including information on the Paris Agreement, the Talanoa Dialogue and the People's Seat.

2018 REPORTS INCLUDE

- R&D spending in the UK. Including analysis of R&D by region and industry, and international comparisons of R&D.
- UK funding from the EU
- Full-fibre networks in the UK
- Superfast Broadband in the UK
- Brexit: energy and climate change
- New Nuclear Power
- Shale gas and fracking
- Brexit: energy and climate change
- Full-fibre networks in the UK
- Automated and Electric Vehicles Act 2018
- Distributed Ledger Technology
- In Vitro Fertilisation: 40th Anniversary
- NHS and Healthcare Data
- Security of UK Telecommunications
- Animal Sentience and Brexit
- Leaving the EU: Antimicrobial Resistance
- Antimicrobial Resistance and Immunisation
- Small Modular Nuclear Reactors
- Biometric Technologies

UK Research and Innovation

Contact: Ewan Nicholas
Senior Manager,
Public Affairs
Polaris House,
North Start Avenue,
Swindon, SN2 1ET

Tel: 01793 234 111
E-mail: ewan.nicholas@ukri.org
Website: www.ukri.org

Operating across the whole of the UK with a combined budget of more than £6 billion, UK Research and Innovation brings together the seven Research Councils, Innovate UK and Research England.

We are an independent organisation with a strong voice for research and innovation, both to government and internationally, we are supported and challenged by an independent chair and board. We are principally funded through the Science Budget by the Department for Business, Energy and Industrial Strategy (BEIS).

Our mission is to be a trusted partner and to ensure research and innovation continues to flourish in the UK. We will support and help connect the best researchers and innovators with customers, users and the public. We will invest every pound of taxpayers' money wisely in a way that maximises impact for citizens, in the UK and across the world.

Arts & Humanities Research Council

Contact: Mike Collins
Head of Communications
AHRC, Polaris House, Swindon, SN2 1EU
Tel: 01793 416083
E-mail: m.collins@ahrc.ukri.org
Website: www.ahrc.ukri.org

AHRC funds world-class, independent researchers in a wide range of subjects. Their research provides social and cultural benefits and contributes to the economic success of the UK but also to the culture and welfare of societies around the globe.

Biotechnology and Biological Sciences Research Council

Contact: Dr Kate Turton
Head of Engagement and Insight
BBSRC, Polaris House, North Star Avenue, Swindon SN2 1UH
Tel: 01793 413355
E-mail: kate.turton@bbsrc.ukri.org
Website: www.bbsrc.ukri.org

BBSRC invests in world-class bioscience research and training. Their research is helping society to meet major challenges, including food security, green energy and healthier, longer lives and underpinning important UK economic sectors.

Economic & Social Research Council

Contact: Susie Watts
External Affairs Strategy Lead
ESRC, Polaris House, Swindon, SN2 1EU
Tel: 01793 413119
E-mail: Susie.watts@esrc.ukri.org
Website: www.esrc.ukri.org

ESRC is the UK's largest funder of research on the social and economic questions facing us today. Their research shapes public policy and contributes to making the economy more competitive, as well as giving people a better understanding of 21st century society.

EPSRC Engineering and Physical Sciences Research Council

Contact: Ciara McLoone
Communications Manager for Government and Parliament
EPSRC, Polaris House, Swindon, SN2 1ET
Tel: 01793 444 080
E-mail: Ciara.mcloone@epsrc.ukri.org
Website: www.epsrc.ukri.org

EPSRC funds engineering and physical sciences research, covering fields from healthcare technologies to structural engineering, manufacturing to mathematics, advanced materials to chemistry.

Innovate UK

Contact: Nick Spickernell
Government & Parliamentary Analyst
Innovate UK, Polaris House, Swindon, SN2 1ET
Tel: 07767 272711
E-mail: Nick.spickernell@innovateuk.ukri.org
Website:
www.gov.uk/government/organisations/innovate-uk

Innovate UK works with people, companies and partner organisations to find and drive the science and technology innovations that will grow the UK economy. They drive growth by working with companies to de-risk, enable and support innovation.

MRC Medical Research Council

Contact: Darren O'Keefe
Public Affairs and Policy Manager
Tel: 0207 395 2297
E-mail: Darren.O'Keefe@mrc.ukri.org
Website: www.mrc.ukri.org

MRC is at the forefront of scientific discovery to improve human health. Their scientists tackle some of the greatest health problems facing humanity in the 21st century, from the rising tide of chronic diseases associated with ageing to the threats posed by rapidly mutating micro-organisms.

Natural Environment Research Council

Contact: Sarah Miles
External Affairs Manager
NERC, Polaris House, Swindon, SN2 1EU
Tel: 01793 442 505
E-mail: Sarah.Miles@nerc.ukri.org
Website: www.nerc.ukri.org

NERC is the driving force of investment in environmental science. Their leading research, skills and infrastructure help solve major issues and bring benefits to the UK, such as affordable clean energy, air pollution, and resilience of our infrastructure.

Research England

Contact: Ben Johnson
Associate Director, Insight and Engagement
Research England, Nicholson House, Lime Kiln Close, Stoke Gifford, Bristol, BS34 8SR
Tel: 0117 931 7038
E-mail: Ben.Johnson@re.ukri.org
Website: re.ukri.org

Research England is a new council within UK Research and Innovation. Taking forward the England-only responsibilities of HEFCE in relation to research and knowledge exchange, Research England will create and sustain the conditions for a healthy and dynamic research and knowledge exchange system in English universities.

Science & Technology Facilities Council

Contact: Natalie Bealing MCIPR
Head of Stakeholder Engagement
Tel: 01235 445484
E-mail: natalie.bealing@stfc.ukri.org
Website: www.stfc.ukri.org

STFC is a world-leading multi-disciplinary science organisation. Their research seeks to understand the Universe from the largest astronomical scales to the tiniest constituents of matter, yet creates impact on a very tangible, human scale.

Association of the British Pharmaceutical Industry

Contact: Audrey Yvernault
Head of Policy and Public Affairs
7th Floor, Southside, 105 Victoria Street,
London SW1E 6QT
Tel: 020 7747 7136
Email: AYvernault@abpi.org.uk
Website: www.abpi.org.uk

The Association of the British Pharmaceutical Industry (ABPI) represents innovative research-based biopharmaceutical companies, large, medium and small, leading an exciting new era of biosciences 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 pipeline, ensuring that the UK remains at the forefront of helping patients prevent and overcome diseases. 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: Dr Jane Gate, Executive Director
AIRTO Ltd: Association of Innovation
Research & Technology Organisations Ltd
c/o National Physical Laboratory
Hampton Road, Teddington
Middlesex TW11 0LW
Tel: 020 8943 6600
E-mail: enquiries@airto.co.uk
Twitter: @airtoinnovation
Website: www.airto.co.uk

AIRTO, the Association of Innovation, Research and Technology Organisations, comprises approximately sixty principal organisations operating in the UK's Innovation, Research and Technology (IRT) sector. The IRT sector has a combined turnover of £6.9Bn, employs over 57,000 people and contributes £34Bn to UK GVA. AIRTO's members work at the interface between academia and industry, for both private and public sector clients. Members include independent Research and Technology Organisations, Catapult Centres, Public Sector Research Establishments, National Laboratories, some university Technology Transfer Offices and some privately held innovation companies.

Contact:
Tony Harding
07895 162 896 for all queries whether for membership or assistance.
Branch Office Address:
Merchant Quay,
Salford Quays, Salford
M50 3SG.

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.

Contact:
Colin Danson
Distinguished Scientist & Head of Profession for Physics and Mathematics
AWE
Aldermaston, Reading RG7 4PR
Email: Colin.Danson@awe.co.uk
www.awe.co.uk
Tel: 0118 98 56901

AWE plays a crucial role in our nation's defence by providing and maintaining warheads for the UK's nuclear deterrent and delivers advice and guidance on a 24/7 basis to UK government in the area of national security.

We are a centre of scientific, engineering and technological excellence, with some of the most advanced research, design and production facilities in the world. AWE is contracted to the Ministry of Defence (MOD) through a Government-owned-contractor-operated (GOCO) arrangement. While our sites and facilities remain in government ownership, their management, day-to-day operations and maintenance of Britain's nuclear stockpile is contracted to a private company: AWE Management Limited (AWE ML). AWE ML is a consortium comprising three partners: Jacobs Engineering Group, the Lockheed Martin Corporation and Serco Group plc.

Contact: Hannah Russell
Director of Society Programmes
Biochemical Society
Charles Darwin House,
12, Roger Street,
London WC1N 2JU
Tel: +44 (0)20 7685 2439
Email: Hannah.russell@biochemistry.org
Website: www.biochemistry.org

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 bioscientists;
- supporting the next generation of biochemists;
- promoting and sharing knowledge and
- promoting the importance of our discipline.

Contact: Linda Capper, MBE, MCIPR
Head of Communications
British Antarctic Survey
High Cross
Madingley Road
Cambridge CB3 0ET
Email LMCA@bas.ac.uk
Tel: +44 (0)1223 221448
Mobile: 07714 233744

British Antarctic Survey (BAS), an institute of NERC, 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

Contact:
Ben Connor, Policy Manager
British Ecological Society
12 Roger Street,
London WC1N 2JU
Email: ben@britishecologicalsociety.org
Tel: 020 7685 2510
Website: www.BritishEcologicalSociety.org
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.

British In Vitro Diagnostics Association (BIVDA)

Contact: Doris-Ann Williams MBE
Chief Executive
British In Vitro Diagnostics Association
299 Oxford Street, London W1C 2DZ
Tel: 0845 6188224
Email: doris-ann@bivda.co.uk
www.bivda.org.uk

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.

Contact: Jonathan Brüün
Chief Executive
British Pharmacological Society
The Schild Plot, 16 Angel Gate,
City Road, London EC1V 2PT
Tel: : 020 7239 0171
Fax: 020 7417 0114
Email: jonathan.bruun@bps.ac.uk
Website: www.bps.ac.uk

The British Pharmacological Society is a charity with a mission to promote and advance the whole spectrum of pharmacology. It is the primary UK learned society concerned with drugs and the way they work, and leads the way in the research and application of pharmacology around the world.

Founded in 1931, the Society champions pharmacology in all its forms, across academia, industry, regulatory agencies and the health service. With over 3,500 members from over 60 countries worldwide, the Society is a friendly and collaborative community. Enquiries about the discovery, development and application of drugs are welcome.

SCIENCE DIRECTORY

Tracey Guise, Chief Executive Officer
British Society for Antimicrobial Chemotherapy (BSAC)
53 Regent Place, Birmingham B1 3NJ
+44 (0)121 236 1988
tguise@bsac.org.uk
www.bsac.org.uk

BSAC is a learned society whose members are among the world's leading infectious disease physicians, pharmacists, microbiologists, and nurses.

With more than 45 years of leadership in antibiotic research and education, BSAC is dedicated to saving lives by fighting infection. It does this by supporting a global network of experts via workshops, conferences, evidence-based guidelines, e-learning courses, and its own high-impact international journal.

BSAC also provides national surveillance and susceptibility testing programmes, an outpatient parenteral antimicrobial therapy (OPAT) initiative, research and development grants, and the secretariat for the All-Party Parliamentary Group on Antibiotics.

BSAC has members in 40 nations and active learners in more than 135 countries.

Contact Dr Doug Brown, CEO
British Society for Immunology
34 Red Lion Square
Holborn
London WC1R 4SG
Tel: 020 3019 5901
E-mail: bis@immunology.org
Website: www.immunology.org

The British Society for Immunology's mission is to promote excellence in immunological research, scholarship and clinical practice in order to improve human and animal health. We are the leading UK membership organisation working with scientists and clinicians from academia and industry to forward immunology research and application around the world. Our friendly, accessible community of over 3,500 immunologists gives us a powerful voice to advocate for immunological science and health for the benefit of society.

Contact: Ian Brown
Building 42a
Cranfield University
Cranfield
Bedfordshire
United Kingdom

The British Society of Soil Science (BSSS) or "BS cubed" as it is fondly known was founded in 1947 by a number of eminent British soil scientists. It was formed with the aims: to advance the study of soil; to be open to membership from all those with an interest in the study and uses of soil; and to issue an annual publication.

Nowadays BSSS is an established international membership organisation and charity committed to the study of soil in its widest aspects. The Society acts as a forum for the exchange of ideas and provides a framework for representing the views of soil scientists to other organisations and decision making bodies. It promotes research by organising several conferences each year and by the publication of its two scientific journals, the European Journal of Soil Science, and Soil Use and Management.

Contact: Geoff Rodgers
Brunel University London
Kingston Lane
Uxbridge UB8 3PH
Tel: 01895 265609
Fax: 01895 269740
E-mail: g.j.rodgers@brunel.ac.uk
Website: www.brunel.ac.uk

Brunel University London is an international research active university with 3 leading research institutes:

Institute of Energy Futures: Led by Professor Savvas Tassou, the main themes of the Institute are *Advanced Engines and Biofuels, Energy Efficient and Sustainable Technologies, Smart Power Networks*, and *Resource Efficient Future Cities*.

Institute of Materials and Manufacturing: The main themes of research are *Design for Sustainable Manufacturing, Liquid Metal Engineering, Materials Characterisation and Processing, Micro-Nano Manufacturing*, and *Structural Integrity*. The Institute is led by Professor Luiz Wrobel.

Institute of Environment, Health and Societies: Professor Susan Jobling leads this pioneering research institute whose themes are *Health and Environment, Healthy Ageing, Health Economics Synthetic Biology, Biomedical Engineering and Healthcare Technologies*, and *Social Sciences and Health*.

Brunel University London offers a wide range of expertise and knowledge, and prides itself on having academic excellence at the core of its offer, and was ranked in the recent REF as 33rd in the UK for Research Power (average quality rating by number of submissions) and described by The Times Higher Education as one of the real winners of the REF 2014.

Cavendish Laboratory

Contact: Departmental Administrator,
The Cavendish Laboratory,
J J Thomson Avenue, Cambridge CB3 0HE, UK.
E-mail: glw33@cam.ac.uk
http://www.phy.cam.ac.uk

The Cavendish Laboratory houses the Department of Physics of the University of Cambridge.

The research programme covers the breadth of contemporary physics

Extreme Universe: Astrophysics, cosmology and high energy physics

Quantum Universe: Cold atoms, condensed matter theory, scientific computing, quantum matter and semiconductor physics

Materials Universe: Optoelectronics, nanophotonics, detector physics, thin film magnetism, surface physics and the Winton programme for the physics of sustainability

Biological Universe: Physics of medicine, biological systems and soft matter

The Laboratory has world-wide collaborations with other universities and industry

Stephen Barraclough
Chief Executive
s.barraclough@ergonomics.org.uk
+44 7736 89 33 44
www.ergonomics.org.uk

Ergonomics, also called Human Factors, sometimes abbreviated 'E/HF' is a science-based discipline about 'designing for people'. E/HF takes into account the physical and mental capabilities, aptitudes and abilities of people acting individually (a pilot, a surgeon or nurse, train driver) or collectively, with or without equipment (a theatre team, air traffic control) in the design of workplaces, equipment and ways of working to deliver the least harmful, safest, most efficient, most elegant possible outcomes'. E/HF uses science to improve the places in which we work, live and relax and the ways in which we interact with people, equipment and systems.

Contact: Dr Christopher Flower
Josaron House
5-7 John Princes Street
London W1G 0JN
Tel: 020 7491 8891
E-mail: info@ctpa.org.uk
Website: www.ctpa.org.uk &
www.thefactsabout.co.uk

CTPA is the UK trade association representing manufacturers of cosmetic products and suppliers to the cosmetic products industry. 'Cosmetic products' are legally defined and subject to stringent EU safety laws. CTPA is the authoritative public voice of a vibrant and responsible UK industry trusted to act for the consumer; ensuring the science behind cosmetics is fully understood.

Contact: Dr Eric Albone MBE
Clifton Scientific Trust
49 Northumberland Road, Bristol BS6 7BA
Tel: 0117 924 7664 Fax: 0117 924 7664
E-mail: eric.albone@clifton-scientific.org
Website: www.clifton-scientific.org

Science for Real- Science for Life-Science for Citizenship and Employability

We build grass-roots partnerships between school and the wider world of professional science and engineering

- encountering science as a creative, questioning, collaborative human activity
- bringing school science added meaning and motivation, from primary to post-16
- locally, nationally, internationally (our UK-Japan Young Scientist Workshop Programme in since 2001)

Clifton Scientific Trust Ltd is registered charity 1086933

Contact: Lindsay Walsh
De Morgan House
57-58 Russell Square
London WC1B 4HS
Tel: 020 7637 3686
Fax: 020 7323 3655
Email: cms@lms.ac.uk
Website: www.cms.ac.uk

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

Daphne Jackson Trust

Contact: Dr Katie Perry
Chief Executive
The Daphne Jackson Trust
Department of Physics
University of Surrey, Guildford GU2 7XH
Tel: 01483 689166
Email: Katie.perry@surrey.ac.uk
Website: www.daphnejackson.org

Founded in 1992 in memory of the UK's first female Professor of Physics, the Trust is the UK's leading charity dedicated to realising the potential of scientists and engineers returning to research after career breaks for family, caring and health reasons. Our Fellowship programme, working in partnership with universities, research councils, charities, learned societies and industry, enables individuals to undertake part-time research in universities and research institutes. Fellowships comprise a research project alongside an individually tailored retraining programme, with additional mentoring and support, enabling recipients to re-establish scientific credentials, update skills and redevelop confidence, in a suitably supportive environment.

energy institute

Contact: Louise Kingham OBE FEI
Chief Executive
61 New Cavendish Street
London W1G 7AR
Tel: 020 7467 7100
Email: info@energyinst.org
Website: www.energyinst.org

The Energy Institute (EI) is the chartered professional membership body bringing global energy expertise together. Our ambition is that energy, and its critical role in our world, is better understood, managed and valued. We're a unique network with insight spanning the world of energy, from conventional oil and gas to the most innovative renewable and energy efficient technologies. We gather and share essential knowledge about energy, the skills that are helping us all use it more wisely, and the good practice needed to keep it safe and secure. We articulate the voice of energy experts, taking the know-how of around 20,000 members and 250 companies from 120 countries to the heart of the public debate. And we're an independent, not-for-profit, safe space for evidence-based collaboration, an honest broker between industry, academia and policy makers.

EngineeringUK

Gemma Wood
Head of Public Affairs
EngineeringUK
5th Floor, Woolgate Exchange
Basinghall Street
London EC2V 5HA
Tel: 0203 206 0441
Mob: 07734 768 242
www.EngineeringUK.com

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.

fera

Contact: Director of Science
Fera Science Ltd. (Fera)
Sand Hutton, York, YO41 1LZ
Tel: 01904 462000
E-mail: chiefscientistoffice@fera.co.uk
Website: www.fera.co.uk

Fera provides expert analytical and professional services to governments, agrichemical companies, food retailers, manufacturers and farmers to facilitate safety, productivity and quality across the agrifood supply chain in a sustainable and environmentally compatible way.

Fera uses its world leading scientific expertise to provide robust evidence, rigorous analysis and professional advice to governments, international bodies and companies worldwide. Our food integrity, plant health, agri-tech and agri-informatics services ensure that our customers have access to leading edge science, technology and expertise.

First Group

Contact: Mac Andrade
Director Infrastructure
First Group
4th Floor,
Capital House
25 Chapel Street
London
NW1 5DH
E-mail: mac.andrade@firstgroup.com
Website: www.firstgroup.com

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.

GAMBICA

Contact: Steven Brambley
Rotherwick House
3 Thomas More Street
London, E1W 1YZ
Tel: 020 7642 8080
E-mail: info@gambica.org.uk
Website : www.gambica.org.uk

GAMBICA is the voice of the laboratory technology, instrumentation, control and automation industries, providing influence, knowledge and community. We offer members a common platform for voicing their opinions and representing their common interests to a range of stakeholders. GAMBICA seeks to spread best-practice and be thought leaders in our sectors.

The Geological Society

serving science, profession & society

Contact: Florence Bullough
Head of Policy and Engagement
Burlington House
Piccadilly
London W1J 0BG
Tel: 020 7434 9944
Fax: 020 7439 8975
E-mail: florence.bullough@geolsoc.org.uk
Website: www.geolsoc.org.uk

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.

IBMS Institute of Biomedical Science

Contact: Lynda Rigby, Executive Head of Marketing and Membership
Institute of Biomedical Science,
12 Coldbath Square, London, EC1R 5HL
Tel: 020 7713 0214
Email: mc@ibms.org
Twitter: @IBMScience
Website: www.ibms.org

Advancing knowledge and setting standards in biomedical science

With over 20,000 members in over 30 countries, the Institute of Biomedical Science is the leading professional body for biomedical scientists, support staff and students.

For over 100 years we have been dedicated to the promotion, development and delivery of excellence in biomedical science within all aspects of healthcare, and providing the highest standards of service to patients and the public.By supporting our members in their practice of biomedical science we set quality standards for the profession through: training, education, assessments, examinations and continuous professional development.

Institute of Food Science + Technology ifst

Contact: Delia Mertoiu
5 Cambridge Court
210 Shepherds Bush Road
London W6 7NJ
Tel: 020 7603 6316
E-mail: info@ifst.org
Website: www.ifst.org

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.

IKE

Institute of Innovation & Knowledge Exchange

Contact: Michelle Medhat
Institute of Innovation & Knowledge Exchange
Rex House
4 – 12 Regent Street
London SW1Y 4PE
www. InnovationInstitute.org.uk

IKE is the UK's professional body for innovators. It accredits and certificates 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. IKE runs think-tanks, conducts research, develops new business models and tools and supports organisations to benchmark their innovation capabilities.

Institute of Marine Engineering, Science and Technology (IMarEST)

Contact: Bev Mackenzie
Institute of Marine Engineering, Science and Technology (IMarEST), Aldgate House, 33 Aldgate High Street, London, EC3N 1EN

Tel: +44(0) 20 7382 2600
Fax: +44(0) 20 7382 2667
E-mail: technical@imarest.org
Website: www.imarest.org

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.

The Institute of Materials Finishing

Contact: Dr Trevor Crichton FIMF; MInstCorr; MRSC; CChem.
Email : exeterhouse@materialsfinishing.org
Tel : 0121 622 7387

The Institute of Materials Finishing is the premier technical organisation representing industry, academia and individual professionals in both the UK's and global surface engineering and materials finishing sector.
We actively promote continual education and knowledge dissemination by providing both distance learning and tutored training courses, as well as a technical support service. We also provide bespoke courses that are tailored to an employer's specific needs. The Institute also publishes *Transactions of the Institute of Materials Finishing* and a bimonthly newsletter (*IMFormation*), as well as holding regular regional and international technical meetings, symposia and conferences.

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

Contact: Alex Connor
76 Portland Place, London W1B 1NT
Tel: 020 7470 4819
E-mail: alex.connor@iop.org
Website: www.iop.org

The Institute of Physics is the professional body for physics in the UK and Ireland, inspiring people to develop their understanding and enjoyment of physics. We are a world-leading science publisher and proud to be a trusted voice for the physics community.

Our work includes supporting the teaching of physics, encouraging innovation in business and providing evidence-based advice to Government. Our members are from across the physics community – in academia, the classroom, and industry – and our reach extends to all who have an interest in physics and its contribution our culture, society and economy.

IPEM Institute of Physics and Engineering in Medicine

Contact: Rosemary Cook CBE (CEO)
Fairmount House, 230 Tadcaster Road,
York, YO24 1ES
Tel: 01904 610821 Fax: 01904 612279
E-mail: rosemary.cook@ipem.ac.uk
Website: www.ipem.ac.uk

IPEM is a registered, incorporated charity for the advancement, in the public interest, of physics and engineering applied to medicine and biology. Its members are medical physicists, clinical and bio-engineers, and clinical technologists. It organises training and CPD for them, and provides opportunities for the dissemination of knowledge through publications and scientific meetings. IPEM is licensed by the Science Council to award CSci, RSci and RSciTech, and by the Engineering Council to award CEng, IEng and EngTech.

IChemE ADVANCING CHEMICAL ENGINEERING WORLDWIDE

The Institution 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.

Alana Collis, Technical policy manager
+44 (0) 1788 534459
acollis@icheme.org
www.icheme.org

Kuala Lumpur | London | Melbourne | Rugby | Singapore | Wellington

Institution of Civil Engineers

Contact: Alex Green-Wilkes,
Public Affairs Manager,
One Great George Street, Westminster,
London SW1P 3AA, UK
Tel: 020 7665 2109
E-mail: alex.green-wilkes@ice.org.uk
Website: www.ice.org.uk

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.

IET The Institution of Engineering and Technology

Contact: Joanna Cox
IET
Michael Faraday House
Six Hills Way
Stevenage
SG1 2AY
Tel: +44(0)1438 765690
Email: policy@theiet.org
Web: www.theiet.org

The IET is a world leading professional organisation, sharing and advancing knowledge to promote science, engineering and technology across the world. Dating back to 1871, the IET has over 163,000 members in 127 countries with offices in Europe, North America, and Asia-Pacific.

Contact: Dr Julian Braybrook
Queens Road, Teddington
Middlesex, TW11 0LY
Tel: +44 (0)20 8943 7000
Fax: +44 (0)20 8943 2767
E-mail: info@lgcgroup.com
Website: www.lgcgroup.com

LGC is an international leader in the extended life sciences sector, providing reference materials, genomics reagents and instrumentation, as well as research and measurement services, to customers in the public and private sectors.

Under the Government Chemist function, LGC fulfils specific statutory duties as the referee analyst and provides advice for Government and the wider analytical community on the implications of analytical measurement for matters of policy, standards and regulation. LGC is also the UK's National Measurement Laboratory for chemical and bio-measurement.

With headquarters in Teddington, South West London, LGC has 46 laboratories and centres across Europe and at sites in China, Brazil, India, South Africa and the US.

Contact: Steve Shiel
Director of Scientific, Regulatory and Corporate Affairs,
L'Oréal UK & Ireland
255 Hammersmith Road, London W6 8AZ
Tel: +44(0)20-8762-4489
E-mail: Steve.SHIEL@loreal.com
Website: www.loreal.co.uk

L'Oréal employs more than 3,800 researchers world-wide and dedicates over €877 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.

Contact: Dr Elizabeth Rollinson,
Executive Secretary
The Linnean Society of London
Burlington House, Piccadilly,
London W1J 0BF
Tel: 020 7434 4479 ext 212
E-mail: elizabeth@linnean.org
Website: www.linnean.org

As the world's oldest active biological society, the Linnean Society is an essential forum and meeting point for those interested in the natural world. The Society holds regular public lectures and events, publishes three peer-reviewed journals, and promotes the study of the natural world with several educational initiatives. The Society is home to a world famous library and collection of natural history specimens. The Society's Fellows have a considerable range of biological expertise that can be harnessed to inform and advise on scientific and public policy issues.

A Forum for Natural History

London School of Hygiene & Tropical Medicine
Contact: Professor Peter Piot, Director
Keppel Street, London, WC1E 7HT
Tel: 020 7636 8636
Email: director@lshtm.ac.uk
www.lshtm.ac.uk

The London School of Hygiene & Tropical Medicine (LSHTM) is a world-leading centre for research and postgraduate education in public and global health with over 4,000 students and more than 1,300 staff working in over 100 countries across the world – including at two MRC Units in The Gambia and Uganda which joined LSHTM in 2018. Our depth and breadth of expertise encompasses many disciplines, and we are one of the highest-rated research institutions in the UK.

Marine Biological Association

Contact: Dr Matthew Frost
Marine Biological Association,
The Laboratory, Citadel Hill, Plymouth, PL1 2PB
Tel: 07848028388
Fax: 01752 633102
E-mail: matfr@mba.ac.uk
Website: mba.ac.uk

Since 1884 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.

Contact: Paul Haines
Head of Content & Communications
1 Birdcage Walk
London SW1H 9JJ
Tel: +44 (0)20 7304 6833
E-mail: P_haines@imeche.org
Website: www.imeche.org

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.

Contact: Kirsty McBeath
Met Office,
Fitzroy Road,
Exeter,
EX1 3PB
Email: kirsty.mcbeath@metoffice.gov.uk
Website: www.metoffice.gov.uk

The Met Office doesn't just forecast the weather on television. Our forecasts and warnings protect UK communities and infrastructure from severe weather and environmental hazards every day – they save lives and money. Our Climate Programme delivers evidence to underpin Government policy through the Met Office Hadley Centre. Our Mobile Meteorological Unit supports the Armed Forces around the world. We build capacity overseas in support of international development. All of this built on world-class environmental science.

Contact: Policy Officer
Microbiology Society
Charles Darwin House
12 Roger Street
London WC1N 2JU
Tel: 020 7685 2400
E-mail: policy@microbiologysociety.org
Website: www.microbiologysociety.org

The Microbiology Society is a membership charity for scientists interested in microbes, their effects and their practical uses. It is one of the largest microbiology societies in Europe with a worldwide membership based in universities, industry, hospitals, research institutes and schools.

Our principal goal is to develop, expand and strengthen the networks available to our members so that they can generate new knowledge about microbes and ensure that it is shared with other communities. The impacts from this will drive us towards a world in which the science of microbiology provides maximum benefit to society.

Contact: Fiona Auty
National Physical Laboratory
Hampton Road, Teddington
Middlesex TW11 0LW
Tel: 020 8977 3222
Website: www.npl.co.uk/contact-us

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.

SCIENCE DIRECTORY

Contact: John Jackson
Head of Science Policy and Communication
Natural History Museum
Cromwell Road, London SW7 5BD
Tel: +44 (0)20 7942 5257
E-mail: j.jackson@nhm.ac.uk
Website: www.nhm.ac.uk

We challenge the way people think about the natural world – its past, present and future

We use our unique collection and unrivalled expertise to tackle the biggest challenges facing the world today.

We are leaders in the scientific understanding of the origin of our planet, life on it and can predict the impact of future change.

We study the diversity of life and the delicate balance of ecosystems to ensure the survival of our planet.

We help enable food security, eradicate disease and manage resource scarcity.

We inspire people to engage with science to solve major societal challenges.

Contact: Nick Allen
Executive Officer
Boughton Green Road,
Northampton, NN2 7AL
Tel: 01604 735500
Fax: 01604 716502
E-mail: nick.allen@northampton.ac.uk
Website: www.northampton.ac.uk

The University of Northampton is an institution committed to science education through initial teacher training, a STEM Ambassador network which works within the community and teaching and research to doctoral level. We are an Ashoka U 'Changemaker Campus' status university recognising our commitment to social innovation and entrepreneurship.

Contact: Alex Miles
Deputy Director, External Relations
(Public Affairs)
University Park, Nottingham, NG7 2RD
E-mail: alex.miles@nottingham.ac.uk
Mobile: 07917115197
Twitter: @AlextoMiles
www.nottingham.ac.uk

With 43,000 students and campuses in Nottingham, China and Malaysia, The University of Nottingham is 'the nearest Britain has to a truly global university'. With more than 97 per cent of research at the University recognised internationally according to the Research Excellence Framework 2014, the University is ranked in the top 1% of the world's universities by the QS World University Rankings.

Contact: Mark Hollingsworth
Chief Executive Officer
The Nutrition Society
10 Cambridge Court, 210 Shepherds Bush
Road, London, W6 7NJ, UK
Email: office@nutritionsociety.org
Tel: +44 (0)20 7602 0228
www.nutritionsociety.org

The Nutrition Society is a not for profit, membership organisation which is dedicated to delivering its mission of advancing the scientific study of nutrition and its application to the maintenance of human and animal health. Highly regarded by the scientific community, the Society is one of the largest learned societies for nutrition in the world and anyone with a genuine interest in the science of human or animal nutrition can become a member.

Contact: Henry Lovett
Policy & Public Affairs Officer
Hodgkin Huxley House
30 Farringdon Lane
London EC1R 3AW
Tel: +44 (0) 20 7269 5722
E-mail: hlovett@physoc.org
Website: www.physoc.org

Physiology is the science of how molecules, cells and organs work in the body. Representing over 3500 life scientists, The Physiological Society supports scientific research through its grants schemes, conferences and its three open access journals.

The Society also supports the teaching of physiology in schools and universities, and works to promote an understanding of physiology amongst policy-makers and the general public.

Contact: Sue Ferns,
Director of Communications and Research,
New Prospect House
8 Leake St, London SE1 7NN
Tel: 020 7902 6639 Fax: 020 7902 6637
E-mail: sue.ferns@prospect.org.uk
www.prospect.org.uk

Prospect is an independent, thriving and forward-looking trade union with 117,000 members across the private and public sectors and a diverse range of occupations. We represent scientists, technologists and other professions in the civil service, research councils and private sector.

Prospect's collective voice champions the interests of the engineering and scientific community to key opinion-formers and policy makers. With negotiating rights with over 300 employers, we seek to secure a better life at work by putting members' pay, conditions and careers first.

QUADRUM INSTITUTE

Contact: Laura Knight
Head of Corporate Affairs
Quadram Institute Bioscience, Norwich
Research Park, NR4 7UA
Tel: 01603 255000/5310
Email: laura.knight@quadram.ac.uk
Website: www.quadram.ac.uk

Opening fully in mid-2018, the Quadram Institute will be an interdisciplinary research centre capitalising on the academic excellence and clinical expertise of the Norwich Research Park. Its mission is to understand how food and the gut microbiota link to the promotion of health and preventing diet and age related diseases. The Quadram Institute brings together fundamental and translational science with a clinical research facility for human trials and one of Europe's largest gastrointestinal endoscopy units. This will synergise interactions between basic and clinical research, delivering a step change in the understanding of the role of food in health.

Contact: Juniour Blake
External Relations Manager
Royal Academy of Engineering
3 Carlton House Terrace
London SW1Y 5DG
Tel: 020 7766 0600
E-mail: juniour.blake@raeng.org.uk
Website: www.raeng.org.uk

As the UK's national academy for engineering, we bring together the most successful and talented engineers for a shared purpose: to advance and promote excellence in engineering. We have four strategic challenges: drive faster and more balanced economic growth; foster better education and skills; lead the profession; and promote engineering at the heart of society.

Contact: Office of the Science Directorate
Royal Botanic Gardens, Kew
Richmond, Surrey, TW9 3AB
Tel: 020 8332 5050/5248
Email: scienceadmin@kew.org
Website: www.kew.org

RBG Kew is a centre of global scientific expertise in plant and fungal diversity, conservation, and sustainable use, housed in two world-class gardens. Our scientific vision is to document and understand global plant and fungal diversity and its uses, bringing authoritative expertise to bear on the critical challenges facing humanity today.

Kew's strategic priorities for science are:

1. To document and conduct research into global plant and fungal diversity and its uses for humanity.
2. To curate and provide data-rich evidence from Kew's unrivalled collections as a global asset for scientific research.
3. To disseminate our scientific knowledge of plants and fungi, maximising its impact in science, education, conservation policy and management.

These priorities enable us to curate, use, enhance, explore and share Kew's global resource, providing robust data and a strong evidence base for our UK and global stakeholders. Kew is a non-departmental government body with exempt charitable status, partially funded by Defra.

The Royal Institution
Science Lives Here

Contact: Dr Gail Cardew
Director of Science and Education
The Royal Institution
21 Albemarle Street, London W1S 4BS
Tel: 020 7409 2992 Fax: 020 7670 2920
E-mail: gcardew@ri.ac.uk
Websites: www.rigb.org,
www.richannel.org
Twitter: ri_science

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

Contact: Becky Purvis
Head of Public Affairs
The Royal Society, 6-9 Carlton House Terrace
London SW1Y 5AG.
Tel: 020 7451 2261
Email: becky.purvis@royalsociety.org
Website: www.royalsociety.org

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.

Royal Society of Biology

Contact: Dr Stephen Benn
Director of Parliamentary Affairs
Royal Society of Biology
Charles Darwin House
12 Roger Street
London WC1N 2JU
Tel: 020 7685 2400
E-mail: stephen.benn@rsb.org.uk
Website: www.rsb.org.uk

The Royal Society of Biology is a single unified voice, representing a diverse membership of individuals, learned societies and other organisations. We are committed to ensuring that we provide Government and other policy makers – including funders of biological education and research – with a distinct point of access to authoritative, independent, and evidence-based opinion, representative of the widest range of bioscience disciplines. Our vision is of a world that understands the true value of biology and how it can contribute to improving life for all.

ROYAL SOCIETY OF CHEMISTRY

Contact: Matt Davies
Parliamentary Affairs Manager
Policy and Campaigns
Royal Society of Chemistry, Thomas Graham House (290), Science Park, Milton Road, Cambridge, CB4 0WF
Tel 020 7440 2267
Email vineyc@rsc.org
Website: www.rsc.org

The Royal Society of Chemistry is the world's leading chemistry community, advancing excellence in the chemical sciences. With over 50,000 members and a knowledge business that spans the globe, we are the UK's professional body for chemical scientists; a not-for-profit organisation with 170 years of history and an international vision of the future. We promote, support and celebrate chemistry. We work to shape the future of the chemical sciences – for the benefit of science and humanity.

society for applied sfam microbiology

Contact: Dr Christopher Brown,
Policy Officer
LABS, 90 High Holborn,
London, WC1 6LJ.
Christopher@sfam.org.uk
+44 (0)207 685 2596

*Sf*AM is a UK organization, serving microbiologists internationally. It works to advance, for the benefit of the public, the science of microbiology in its application to the environment, human and animal health, agriculture, and industry. With Wiley-Blackwell, *Sf*AM publishes five internationally acclaimed journals. Value for money and a modern, innovative and progressive outlook are its core principles. A friendly society, *Sf*AM values integrity, honesty, and respect, and seeks to promote excellence and professionalism and to inspire young microbiologists.

Society for Underwater Technology

SUT Society for Underwater Technology

Society for Underwater Technology
Contact: David Liddle, Business Development Executive
1 Fetter Lane, London EC4A 1 BR
Tel: 020 3440 5535
Fax: 020 3440 5980
E-mail: info@sut.org
Website: www.sut.org

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

SCI: where science meets business

Contact: Sharon Todd
SCI
14-15 Belgrave Square
London SW1X 8PS
Tel: 020 7598 1500
E-mail: sharon.todd@soci.org
Website www.soci.org

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

Society of Cosmetic Scientists

SCS SOCIETY OF COSMETIC SCIENTISTS

Contact: Gem Bektas,
Secretary General
Society of Cosmetic Scientists
Suite 109 Christchurch House
40 Upper George Street
Luton Bedfordshire LU1 2RS
Tel: 01582 726661
Fax: 01582 405217
E-mail: secretariat@scs.org.uk
Website: www.scs.org.uk

Advancing the science of cosmetics is the primary objective of the SCS. Cosmetic science covers a wide range of disciplines from organic and physical chemistry to biology and photo-biology, dermatology, microbiology, physical sciences and psychology.

Members are scientists and the SCS helps them progress their careers and the science of cosmetics ethically and responsibly. Services include publications, educational courses and scientific meetings.

Society of Maritime Industries

Contact: John Murray
Society of Maritime Industries
28-29 Threadneedle Street,
London EC2R 8AY
Tel: 020 7628 2555 Fax: 020 7638 4376
E-mail: info@maritimeindustries.org
Website: www.maritimeindustries.org

The Society of Maritime Industries (SMI) is the voice of the UK's maritime engineering and business sector promoting and supporting companies which design, build, refit and modernise ships, and supply equipment and services for all types of commercial and naval ships, ports and terminals infrastructure, offshore oil and gas, maritime security and safety, marine science and technology, maritime autonomous systems and marine renewable energy.

UK INNOVATION & SCIENCE SEED FUND

Contact: Dr Andrew Muir
c/o STFC Innovations Ltd
Harwell Campus Oxford OX11 0QX
Tel: 0121 710 1990
E-mail: Andrew.muir@midven.co.uk
Website: https://ukinnovationscience seedfund.co.uk/

The **UK Innovation & Science Seed Fund** is a leading patient capital investor with more than £330 million private investment leveraged to date. The Fund works to build technology companies from the earliest stage by working closely with its partners led by STFC, BBSRC, NERC and Dstl, with the National Research and Innovation Campuses they support, and with entrepreneurial science-led teams. UK Innovation & Science Seed Fund is also closely aligned with the Catapults and InnovateUK, helping to commercialise key technological advances in industrial biotech, agricultural technology, healthcare, medicine, clean energy, materials, artificial intelligence, software and space.

Understanding ANIMAL RESEARCH

Contact: Chris Magee
Head of Policy and Media
Understanding Animal Research
Hodgkin Huxley House
30 Farringdon Lane, London EC1R 3AW
direct tel: 020 3675 1234
email: cmagee@UAR.ORG.UK
http://www.understandinganimalresearch.org.uk/

Understanding Animal Research is a not-for-profit organisation that explains why animals are used in medical, veterinary, environmental and other scientific research. We aim to achieve a broad understanding of the humane use of animals in medical, veterinary, scientific and environmental research in the UK. We work closely with policymakers to ensure regulation is effective and are a trusted source of information for the national and international media. We are funded by our members who include universities, professional societies, trade unions, industry and charities.

University of Essex

Contact: Dr Rob Singh
Deputy Director, Enterprise
Wivenhoe Park
Colchester CO4 3SQ
T 01206 874278
E rjsingh@essex.ac.uk
W www.essex.ac.uk/business

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

UFAW Established 1926

Contact: Dr Robert Hubrecht OBE
Chief Executive and Scientific Director
The Old School, Brewhouse Hill
Wheathampstead, Herts. AL4 8AN.
Tel: 01582 831818. Fax: 01582 831414.
Email: ufaw@ufaw.org.uk
Website: www.ufaw.org.uk
Registered in England Charity No: 207996

UFAW, 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

Contact: Chris Eady
The Welding Institute, Granta Park, Great Abington, Cambridge, CB21 6AL

Tel: 01223 899614
Fax:01223 894219
E-mail: chris.eady@twi.co.uk
Website: www.twi-global.com

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, knowhow and safety assurance through engineering, materials and joining technologies.

SCIENCE DIARY

PARLIAMENTARY AND SCIENTIFIC COMMITTEE

Tel: 020 7222 7085
Email: office@scienceinparliament.org.uk
www.scienceinparliament.org.uk
follow us on Twitter @ParlSciCom

Evening Discussion

Meetings at 5.30pm followed by dinner

- Monday 9 September: AI and Health
- Monday 14 October: Climate Change – is there a Plan B?
- Monday 11 November: Extinctions
- Monday 2 December: Noise

Tuesday 19 November at 12.30pm
Annual Lunch
with Dame Jocelyn Bell Burnell DBE FRS FRSE FRAS FInstP

ROYAL SOCIETY OF BIOLOGY

Biology Week events include:

Monday 7 October 7:00-10:00pm
Insect declines in the headlights
https://my.rsb.org.uk/item.php?eventid=2693
Royal College of Physicians,
11 Saint Andrews Place Regent's Park,
London NW1 4LE
A free Policy Lates on insect decline exploring the evidence behind the headlines.

Tuesday 8 October 7:00-8:30pm
Marine Plastics: Is it too late to save our oceans?
https://my.rsb.org.uk/item.php?eventid=2695
The Royal Institution of Great Britain,
21 Albemarle Street, London W1S 4BS
Find out about the impact of plastic in our oceans and what can be done to save our seas.

Wednesday 9 October 7:00-10:00pm
Parliamentary Reception
https://my.rsb.org.uk/item.php?eventid=2731
Churchill Room, House of Commons,
London SW1A 0AA
A celebration of biology in the House of Commons in partnership with the BBSRC.

Thursday 10 October 6:00-9:30pm
Annual Awards Ceremony
https://my.rsb.org.uk/item.php?eventid=2730
The Francis Crick Institute, 1 Midland Road,
London NW1 1AT
Celebrates the achievement of our members and winners of our photography, drawing and outreach competitions via a members' ballot.

Friday 11 October – All day, Online
#iamabiologist
https://www.rsb.org.uk/get-involved/biologyweek/iamabiologist
Take part in this social media campaign where biologists take over twitter by sharing photographs of themselves in action.
Details of all events can be found on www.rsb.org.uk/events

ROYAL SOCIETY OF CHEMISTRY

Monday 14 October
Science and Stormont
Parliament Buildings, Stormont, Belfast.
The eighth annual event, organised on behalf, of and in cooperation with, the Northern Ireland STEM community, is designed to foster close relations between scientists and policymakers. Keynote Speaker: Dame Jocelyn Bell-Burnell, DBE FRS. This year's theme is 'STEM Education and Skills' For more information contact events@rsc.org or Leigh Jeffes at jeffesl@rsc.org

Wednesday 20 November
Science and the Parliament
Dynamic Earth, Edinburgh.
The nineteenth annual event brings together policymakers and the scientific community will this year focus on 'Science and Sustainability'.
For more information contact
Niall Sommerville via sommervillen@rsc.org

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.

THE PHYSIOLOGICAL SOCIETY

Tuesday 15 October 7:00-10:00pm
Parliamentary launch of Growing Older, Better
https://www.physoc.org/policy/lifelong-health/
Churchill Room, House of Commons,
London SW1A 0AA
Panel event and launch of our report into healthy ageing hosted by
Stephen Metcalfe MP.

SCIENCE IN PARLIAMENT sip
3 Birdcage Walk
London SW1H 9JJ
T: 020 7222 7085
office@scienceinparliament.org.uk
www.scienceinparliament.org.uk

Editor: Dr William Duncan and Leigh Jeffes
Editorial Assistant: Mrs Karen Smith

Published by Parliamentary and Scientific Committee, 3 Birdcage Walk, London SW1H 9JJ. Published four times a year. The 2019 subscripton rate is £80. Single numbers £20. ISSN 0263-6271

Parliamentary and Scientific Committee
An Associate Parliamentary Group

The Big Bang @ Parliament

EngineeringUK

Stephen Metcalfe MP

on behalf of

The Parliamentary and Scientific Committee with EngineeringUK

invites you to attend

The Big Bang @ Parliament

in celebration of

Tomorrow's Engineers Week

Tomorrow's Engineers Week

4th November 2019
Terrace Pavilion
House of Commons
1pm - 2.30pm
RSVP to bigbangparliament@engineeringuk.com

The Big Bang@Parliament

In celebration of Tomorrow's Engineers Week, now in its seventh year, The Big Bang @ Parliament will bring a slice of The Big Bang UK Young Scientists & Engineers Fair, the UK's largest science, technology, engineering and maths event for young people, to Parliament on **Monday 4 November**.

The Big Bang @ Parliament once again gives politicians, policy-makers and the business community the chance to meet award-winning young scientists and engineers and experience the careers inspiration behind The Big Bang Fair on their home turf.

The UK needs more engineers and, to achieve this vital aim, we must excite young people about the incredible range of great

careers that science, technology, engineering and maths subjects can lead to. That's what the Big Bang programme and Tomorrow's Engineers are all about, and why Tomorrow's Engineers Week is such a valuable initiative.

www.tomorrowsengineers.org.uk/teweek

www.thebigbangfair.co.uk