JOURNAL OF THE PARLIAMENTARY AND SCIENTIFIC COMMITTEE
ALL-PARTY PARLIAMENTARY GROUP

SCIENCE IN PARLIAMENT
sip
SPRING 2025


# Artificial Intelligence

## Transforming science and law



UNIVERSITY OF LIVERPOOL

# The Nature of Scientific Innovation

## Volume I: Processes, Means and Impact

## Volume II: Those Who Deliver

Dr David R. Dent FRSB

**"A heavy burden is placed on our ability to innovate; invoked like some universal all-pervasive deity..."**

**What if perspective becomes limited?**
**What if options and approaches are constrained?**
**What if we are blinded by adequacy?**
**What then for innovation?**

**"An excellent and exhaustive exploration of the vital theme of innovation, which is the main event of the modern world."**

**Matt Ridley**
Author of *'The Rational Optimist'* and *'How Innovation Works'*

**"The level of research and detail in this work is extremely impressive with a focus on how inventors and innovators can be encouraged by changes in culture, education and investment policy. Thoroughly recommended."**

**Professor Sir John Beddington CMG FRS,**
Former UK Government Chief Scientific Adviser.


### The Nature of Scientific Innovation

Links to View/Buy Copies Here

**Volume I: Processes, Means and Impact**
https://shorturl.at/PXmEZ

**Volume II: Those Who Deliver**
https://shorturl.at/heWXH

Find out more about the Author @ Dent Associates Ltd: **www.dentassociates.co.uk**
**linkedin.com/in/david-dent-4b70251**

Visit Dr David R Dents YouTube Channel
**@DrDavidRoyDent**

Published by
palgrave macmillan

Rt Hon George Freeman FRSA MP
Chair, Parliamentary & Scientific Committee

As I write, we are approaching the end of the new Government's first nine months since winning office in July last year.

As the Chancellor prepares to give her Spring Statement (or Emergency Budget after stubbornly low growth rates with economic contraction in January) the UK Science Research Technology & Innovation sectors are hoping that the continuation of the last Government's major commitment to science spending & R+D led growth will see a continued commitment to R+D in the forthcoming Industrial Strategy.

With public finances under increasing pressure and tax revenues falling, the Chancellor is warning of tough choices on public spending. Until 2010, that historically meant cuts to R+D but I'm proud to say that hopefully those days are now gone.

The key questions which Ministers are being asked will soon be answered: how much **will R+D be at the heart of this Industrial Strategy**? Will all the funding go to The Golden Triangle or will the Freeman/Gove crusade for R+D levelling up via regional clusters be continued? Will it all be AI and 'tech' or will the Government continue support for the BioEconomy, AgriTech, Space, Fusion and Cleantech? Will Ministers intervene to free up visas for researchers? We will see.

Meanwhile I'm pleased to report that science continues to attract growing interest from policymakers across Parliament: in the **Science, Technology & Innovation Select Committee** we are looking into Regional R+D as well as AI and science diplomacy. The **Lords Science & Technology Committee** is as busy as ever on Industrial Strategy, the BioEconomy and Life Science.

Our programme of meetings continue to attract full houses with some fascinating recent events:

- **How to tackle Contaminants or Emerging Concern (CECs) in water** in partnership with the Royal Society of Chemistry
- **How can Precision Prevention reduce the demand on the NHS?** in partnership with The Physiological Society
- **Communicating risk – what, who, why does it matter?** in partnership with the Hazards Forum
- **Building a healthcare science workforce equipped to face the grand challenges** in partnership with the Institute of Physics & Engineering in Medicine
- **Accelerating the UK bioeconomy: the scientific and economic case for investment** in partnership with the University of York

But perhaps the highlight of this quarter has been **#BritishScienceWeek** and the **#STEMforBRITAIN** event bringing inspiring young scientists & posters into Parliament. Our Annual Science Awards for Early-Career Researchers saw Portcullis House full of inspired young scientists. It was a huge honour to award their Gold, Silver and Bronze Awards with the Learned Societies and supporter organisations. The Summer SiP will carry a special photo feature of the day. On 17 March, we also judged the Gold winners for the **Westminster Medal** – designed to promote the importance of communicating science to a lay audience.

We also had **The Royal Society Partnership Anniversary** celebration in Parliament with the wonderful Dame Maggie Pocock inspiring a new generation of young scientists to be passionate about the power of science to change lives. As the recent paper from the Guy Foundation highlights – space travel has been shown to be a series accelerator of ageing and cell decline. Watch this space for some fascinating downstream research. In the words of the great Carl Sagan: "*from the DNA in our bones to the calcium in our teeth we are but resembled stardust.*"

Have a great Easter,
George

SCIENCE IN PARLIAMENT
sip
Journal of the Parliamentary and Scientific Committee (All-Party Parliamentary Group)

# CONTENTS



Science in Parliament has two main objectives:

Inform the scientific and industrial communities of activities within Parliament of a scientific nature and of the progress of relevant legislation

Keep Members of Parliament abreast of scientific affairs

# How the UK can lead the materials sector with AI and robotics

**Professor Andrew Cooper FRS**
Royal Society Research Professor, Academic Director of the Materials Innovation Factory, University of Liverpool

Artificial intelligence (AI) is a global, disruptive force. Research-active nations around the world are busily investing in AI with the hope of transforming scientific R&D. UK industry can take a lead by applying AI and robotics to key R&D areas, but this requires a differentiated national strategy.

Here, I outline research at the University of Liverpool that has led the way in physically embodied AI by using 'robot scientists' to discover new materials. This approach could revolutionise materials R&D, paving our path to net zero targets, as demonstrated with industry partners in the Materials Innovation Factory.

## AI: the brain in a jar

AI is great at interpreting data but less good, so far, at coming up with entirely new concepts by itself. In some scientific research areas, we can apply AI to large, pre-existing datasets. In the physical and life sciences, the most influential example to date of AI-led research is AlphaFold, an AI system developed by Google DeepMind that accurately predicts the 3D structures of proteins from their amino acid sequences, which has applications within medicine.

This work was recognised by the 2024 Nobel Prize in Chemistry[1] [2] but AlphaFold did not result from AI alone. AlphaFold was built on earlier advances in computation and structure prediction[3], and relied on a huge experimental dataset of measured and predicted protein structures, built at great cost, to train the AI mode – it did not learn protein structure for free. Also, these protein data were open and publicly available: without this, AlphaFold would have been impossible to create[4].

However, not all experimental data are open. Industry tends not to share its data in commercially competitive sectors. While greater data sharing could be facilitated by privacy enhancing technologies[5], there are some inherent limitations. For example, you cannot learn how the properties of a molecule or material correlate with its structure if you anonymise its structure because of commercial sensitivity. Additionally, even the biggest multinational companies might not possess datasets that are large enough to draw general conclusions using AI. Again, AlphaFold was based on a global effort involving 200 million openly available datasets, focussing on a narrow, albeit highly important, problem[4].

For the R&D needed to tackle other key societal challenges, the training data required to build AI models do not yet exist. Society needs new materials, for example to combat climate change, with new properties that do not exist today[6]. There are no training data available for these hypothetical materials – they must first be made in a laboratory. By itself, AI is not a panacea, especially in commercial areas, where datasets are not open, and in emerging areas of science, where few, if any, datasets exist.

Policy makers should recognise that science is not conducted 'in the cloud' – it is carried out in laboratories – and without strong and effective ways of coupling AI with our laboratories, we risk building a 'brain in a jar'.

## Integrating AI with laboratory science

The rapid rise of open-source AI software, including software produced by large organisations such as Google and Amazon, has created a global uplift in AI capability[7]. This 'democratisation' of AI raises an important question: if everyone has it, how does the UK create a competitive advantage using AI for R&D? How do we capture the resulting value?

In the development of new scientific technologies, hard experimental data has always been the driving power. The advent of widespread AI will escalate, rather than lessen, the importance of hard data. For example, AI can make it possible to leapfrog rapidly from a new scientific discovery toward a commercially viable product, even if that initial discovery was not made using AI.

For now, at least, AI is geared more toward pattern spotting and fast optimisation, rather than genuine creativity. Therefore, these precious breakthrough discoveries become even more valuable – and potentially transient – in an era where technology development is accelerated worldwide. This creates both an opportunity and a threat for the UK.

Scientific breakthroughs can be amplified by AI and developed much faster than before, presenting a UK opportunity. Conversely, AI will make it easier for other nations to capitalise rapidly on UK-led innovation, exacerbating a challenge that predates AI. Scientific R&D is not like social media: in many areas, the commercial and societal value lies in physical products of that R&D, not the data produced along the way.

**Figure 1: Competitive progress in scientific R&D cannot be solved by AI alone**

The UK needs to tightly integrate cutting-edge scientific ideas (bottom left quadrant, clockwise) with AI and robotics, underpinned by teamwork and capability sharing across sectors, as in the Materials Innovation Factory at the University of Liverpool.

**Figure 2: The mobile robotic chemist developed at the University of Liverpool – a physically-embodied AI agent for laboratory R&D problems**

Image credit: Filip T. Szczypinski.

For these reasons, it would be a mistake for the UK to focus solely on AI capability – this could create the 'brain in a jar' scenario where the training data do not exist. However, there is huge competitive advantage in investing in the capability to produce experimental data more rapidly and integrating this tightly with emerging AI technologies (Figure 1), as we have done in the Materials Innovation Factory in Liverpool.

The most competitive long-term strategy will be to achieve this integration at the grass roots level in custom-designed facilities, rather than seeing AI as a sticking plaster that can be post-applied to existing laboratories, though there are some initial quick wins there, too. Governments, universities and industry should build this into their long-term R&D plans.

Indeed, almost all R&D-intensive industries already have their own 'lab of the future' programmes, although some are mostly conceptual so far. Having spoken to the leads of many such programmes, I see huge commonalities between different industry sectors, both in terms of the drivers and the perceived barriers to implementation. For one thing, the breakneck pace of AI and robotics development means that all 'lab of the future' programmes are shooting at a rapidly moving target.

## Unleash the data-bots!

In the Materials Innovation Factory at the University of Liverpool, we addressed the challenge of fast experimental data creation by building the world's first 'mobile robotic chemist'[8 9]. Inspired by global net zero targets, this robot was built to search for clean energy catalysts, carrying out autonomous experiments over the course of days or weeks (see videos in reference 8).

The robot performed experiments at a rate that was at least 200 times faster than a human researcher[8] – effectively, doing a PhD in a week – while using an AI algorithm to decide which experiments to do next, without any human intervention. In an eight-day, 24/7 continuous search, the autonomous robot discovered a catalyst that was six times better than the composition that we started with. This is the tightest possible coupling of AI with experimental R&D, and the embodiment of the scheme in Figure 1: that is, the AI updates its beliefs around the clock, folding in new experimental data as soon as they are obtained, before telling the robot what to do next, based on initial ideas and targets set by a human research team.

From a scalability perspective, this approach leverages the rapidly declining cost of industrial robotics[10]. Moreover, essentially all scientific R&D equipment is designed to be used by human researchers, and this represents an enormous installed capital base worldwide. Likewise, all laboratories are built to a human scale. The use of an anthropomorphic, roughly human-sized robot scientist (Figure 2) means that we have a drop-in solution that can be used in existing facilities, sharing key equipment with human researchers if needed[11].

This robotic approach is applicable to multiple R&D sectors, just as industrial robots have already found applications in multiple manufacturing sectors. For example, we already have examples in pharmaceutical research[11] and consumer products. As well as greatly accelerating existing R&D, this technology will also allow companies to tackle high-risk, high-reward goals where current methodologies are just too slow to justify the time and resource commitment.

Researchers at the University of Liverpool are also working to make these robots smarter with more advanced AI. For example, we are researching agent-based methods where AI can make more nuanced interpretations of laboratory measurements[11], reason about chemical composition[12], and fold human scientific hypotheses into the optimization loop[13], with the long-term aim of building a

**The Materials Innovation Factory at the University of Liverpool – a unique space that is shared by industry and university researchers with a common interest in using AI and robotics to find better materials**

hybrid intelligence that combines the best aspects of AI and human reasoning.

Our aim is not to replace human teams with AI – indeed, the premium on human scientific creativity has never been higher than today. Rather, we see AI as a tool that will allow the UK to develop new scientific discoveries on a timescale that is competitive with global challenges such as climate change and net zero.

## The Materials Innovation Factory

Our vision of directly coupling AI to robotic R&D laboratories (Figure 1) is applicable both to university and industrial research programmes. A live example of this is the Materials Innovation Factory (MIF) that we established at the University of Liverpool in 2017. The MIF is a globally unique facility that is shared by both academic and industry researchers. Our key partner Unilever filed 200 patents between 2020 and 2022 based on data generated at MIF, and they invested more than €100 million in this innovation hub in the three-year period 2020–2023[14]. What's more, the MIF was highlighted in a recent paper by the Tony Blair Institute for Global Change as a national strength for the UK[15]. The MIF is also one of the co-leads in the EPSRC-funded £12 million AI for Chemistry Hub, AIchemy, which aims to catalyse the use of AI in chemistry in the UK[16].

### References


[1] Nobel Prize in Chemistry 2024. www.nobelprize.org/prizes/chemistry/2024/summary

[2] J Jumper et al. (2021) Highly accurate protein structure prediction with AlphaFold. *Nature* 596: 583–589.

[3] B Kuhlman, et al. (2003) Design of a novel globular protein fold with atomic-level accuracy. *Science* 302: 1364–1368.

[4] EMBL (2023) *Case study: AlphaFold uses open data and AI to discover the 3D protein universe*. www.embl.org/news/science/alphafold-using-open-data-and-ai-to-discover-the-3d-protein-universe

[5] The Royal Society (2024) *Science in the Age of AI: How artificial intelligence is changing the nature and method of scientific research*. https://royalsociety.org/-/media/policy/projects/science-in-the-age-of-ai/science-in-the-age-of-ai-report.pdf

[6] Q Gibson et al. (2021) Low thermal conductivity in a modular inorganic material with bonding anisotropy and mismatch. *Science* 373: 1017 www.science.org/doi/10.1126/science.abh1619

[7] Sahota N (2024) *AI Democratization: Turning the Tables on Tech Exclusivity*. www.neilsahota.com/ai-democratization-turning-the-tables-on-tech-exclusivity

[8] B Burger et al. (2020) A mobile robotic chemist. *Nature* 583: 237–241. www.nature.com/articles/s41586-020-2442-2

[9] BBC News feature (2020). www.youtube.com/watch?v=WBwZp5Bg2L8

[10] Inbolt (2024) *Industrial Robot Cost Decline*. www.inbolt.com/resources/industrial-robot-cost-decline

[11] T Dai et al. (2024) Autonomous mobile robots for exploratory synthetic chemistry *Nature* 635: 890–897. www.nature.com/articles/s41586-024-08173-7

[12] J Clymo et al. (2025) Exploration of Chemical Space Through Automated Reasoning. *Angewante Chemie International Edition* 64, e202417657. https://onlinelibrary.wiley.com/doi/epdf/10.1002/anie.202417657

[13] Cissé A et al. (2025) HypBO: accelerating black-box scientific experiments using experts hypotheses. *Proceedings of the 33rd International Joint Conference on Artificial Intelligence. (IJCAI-24)*, 3881 www.ijcai.org/proceedings/2024/0429.pdf

[14] Unilever (2023) *How Robots Help Design our Beauty Products*. www.unilever.com/news/news-search/2023/how-robots-help-design-our-beauty-products

[15] Boakye B et al. (2025) *A New National Purpose: Accelerating UK Science in the Age of AI*. London: Tony Blair Institute for Global Change. https://institute.global/insights/tech-and-digitalisation/a-new-national-purpose-accelerating-uk-science-in-the-age-of-ai

[16] AIchemy website. https://aichemy.ac.uk

# AI and law
## The changing nature of legal work

**Professor Katie Atkinson**
Professor of Computer Science, Associate Pro-Vice-Chancellor, Director of the Interdisciplinary Centre for Sustainability Research, University of Liverpool

The artificial intelligence (AI) revolution is now in full swing. It is difficult to think of many professions or subject areas that are not in some way being affected by AI in 2025.

While the topic of AI itself has been the subject of research and teaching within universities for many decades, there are also some well-established interdisciplinary crossover topics within AI – one of which is the field of AI and law. In fact, the International Conference on AI and Law, where experts present new research on the topic, has been taking place biennially since 1987[1] – the longest running regular conference in this area.

A key feature of the AI and law community's research is that it is undertaken to develop AI techniques and applications that specifically capture legal knowledge and reasoning; this is very different from taking AI methods developed without a specific domain application in mind and applying these to legal problems. Researchers within the AI and law community work in an interdisciplinary manner with a focus on developing computational models of legal knowledge, reasoning, and decision making, drawing on the fields of logic, machine learning, cognitive psychology, linguistics and philosophy.

### Research developments

The University of Liverpool has had a prominent and sustained role in advancing fundamental research on AI and law since the 1980s. A key thread running through much of our research is developing AI techniques that can capture the knowledge and process of how legal arguments are identified, attacked and defended with legal debates – for example, when a judge evaluates the claims put forward in a legal case[2]. These techniques to represent arguments in computational terms enable software programmes to be developed that can advise on the strength of arguments present in legal cases, determining this through reference to the relevant legislation and the existing case law within a scoped legal domain.

Much attention has been given to known problems with AI concerning the use of 'black box' methods whereby AI tools make recommendations, but how the outcome was determined cannot be explained in legal terms. This is a particular drawback of machine learning approaches that are trained on vast quantities of data where statistical correlation between data points serves as the thrust of the learning mechanism[3]. One way to embed better explainability is to make use of 'symbolic AI' approaches, whereby knowledge is captured in methods that mimic human reasoning, such as through rules to be applied in a problem-solving scenario. Using these symbolic techniques in a legal setting means that legal argumentation can be conducted by the AI tool so that it can justify, in legal terms, whatever conclusion it reaches as to which arguments are the strongest in coming to its decision, and why some alternative conclusion has not been reached[4].

However, such symbolic approaches often rely on close consultation with legal experts during the design and evaluation of legal AI methods, and thus yield the drawback that symbolic approaches do not scale easily. Accounting for the known and well documented benefits and drawbacks of different AI techniques used in modelling legal reasoning, new 'hybrid' approaches are starting to emerge that aim to combine different approaches and this is a live topic of research at the University of Liverpool[5].

Similarly, generative AI chatbots such as ChatGPT, powered by large language models, are not a panacea for undertaking complex legal tasks, so another live area of research is developing the next wave of AI techniques that can work with generative AI to address the known capability gaps[6].

The fundamental research developments that are being produced in academia on AI and law are now being translated into deployed products within legal practice. Recent years have seen a significant increase in collaborators being undertaken between academics and law firms to start getting AI applications used in the real world. At the University of Liverpool, we collaborate with a variety of partners from across the legal sector. Working with law firm Weightmans, for example, we successfully applied our AI models in pilots on several of their specialist domains to identify and reason about arguments relevant for decisions on settling cases[7].

In a further three-year project supported by funding from Innovate UK, Liverpool academics worked with Fletchers Solicitors to produce an AI-based 'digital legal assistant' that provides a level of automation in assessing new medical negligence claims that the firm receives. Long hours used to be spent by lawyers and paralegals weighing up the chances of success for clients pursuing claims for serious or life-changing injuries. But with the new AI tool acting as a decision aid, staff at Fletchers can assess in seconds whether a client has a strong case. The tool is used daily, and it has transformed working practices at Fletchers, increasing efficiency and reducing costs for the company, and importantly, improving turnaround times for clients[8].

While research and translation developments in the academic AI and law community have been accelerating over the past decade, these have been complemented by the development of industrial applications of AI and digital technologies for law, in what has become known as 'lawtech'.

## Establishment of the lawtech field

Legal work covers a vast array of different tasks. The first wave of lawtech products that were developed were mostly aimed at transactional, admin-based activities, such as legal document search and process automation. Attention then turned to developing products that can take on more cognitively challenging tasks, such as analysing contracts and assessing the strength of legal cases. Recognising the potential for new tools to assist with legal work, an array of start-up companies appeared in the 2010s, establishing a visible presence of lawtech within the UK.

To provide support to this growing community, LawtechUK was established in 2019[9]. LawtechUK is a Ministry of Justice-backed initiative that commenced with a suite of activities, delivered by a growth platform for tech companies, to provide resources, programmes and courses to promote new ways of delivering and accessing legal services. The success of the initial programme of work led to continued government support, enabling a targeted range of expanded activities to be run to support growth and investment in lawtech.

A set of free, focused education programmes[10] are available to support lawtech founders from ideation to scale-up, as well as to aid organisations seeking to harness the benefits of innovation for their legal operations. To foster connections between the different stakeholders in the lawtech community, a vibrant programme of events is run at locations around the UK, showcasing start-up activity and enabling discussion on current topics, such as generative AI and access to justice. LawtechUK also produces reports to gather and make available intelligence on topics relevant to the community, such as regulatory navigation, smart contracts, and adoption of machine learning. A key resource of value to the community is their Ecosystem Tracker report[11], which captures hundreds of lawtech ventures across the UK, providing a breakdown of information by various filters, such as area of work, region, funding raised and funding stage.

Through its rich suite of activities, LawtechUK provides important strategic oversight of the UK's lawtech activities and supports growth of an ecosystem that is a key contributor to the UK's industrial base and economy. Having a national convening body that can support new entrants to the sector, provide network connections and demonstrate thought leadership for future development of the sector, is a vital asset to enable the advancement of the lawtech ecosystem across the UK.

## What next for AI and law?

Looking to the future, the thriving lawtech ecosystem that is firmly established in the UK will be well placed to respond to the prospects and challenges that are set out with the AI Opportunities Action Plan[12] announced by the Government in January 2025. The plan urges swifter deployment of AI technologies, in both the public and private sectors, and without doubt there are many use cases present within legal work where current products and technologies can be deployed and evaluated. Given the support already provided by LawtechUK to start-ups in navigating the regulatory landscape, this important consideration is already part of the wider conversations taking place around deployment of lawtech.

The academic AI and law community is also looking at the next set of research challenges. Much of this effort is focused on deepening the explainability of AI models needed for trustworthy deployment. It is recognised that generative AI cannot be a broad-brush solution applied to all legal tasks, so researchers in AI and law are working on methods to combine different AI techniques into systems that can deploy the most appropriate techniques on different legal tasks. There is much talk about the rise of 'agentic AI', whereby AI agents, which have been under development in the field of AI for decades[13], will start to complete tasks autonomously on behalf of a user outside of a dialogue interaction with an AI chatbot. But developing and deploying the next wave of AI will require attention to be paid to several key issues including:

- Alignment of AI with human values
- Privacy-preservation of personal data between AI agents
- Open evaluation exercises to enable reflection on advantages and drawbacks of early pilots of new AI tools
- Consultation on, and alignment with, regulatory requirements about data use for training AI models
- Upskilling opportunities for those who will start to use AI in their daily work

Thanks to the strong communities established in academia and industry, which already work and collaborate at the intersection of AI and law, the UK is very well placed to respond to the next phase of innovation challenges.

### References


[1] www.iaail.org

[2] Al-Abdulkarim L et al.(2016) A methodology for designing systems to reason with legal cases using Abstract Dialectical Frameworks. *Artificial Intelligence and Law* 24(1): 1–49.

[3] Bex F and Prakken H (2021) On the relevance of algorithmic decision predictors for judicial decision making. *Proceedings of ICAIL*: 175–179.

[4] Collenette J et al. (2023) Explainable AI tools for legal reasoning about cases: a study on the European Court of Human Rights. *Artificial Intelligence* 317: 103861.

[5] J Mumford J et al. (2023) Combining a legal knowledge model with machine learning for reasoning with legal cases. *Proceedings of ICAIL*: 167–176.

[6] https://link.springer.com/collections/cdbhcfcgae

[7] Al-Abdulkarim L et al. (2019) Noise induced hearing loss: Building an application using the ANGELIC methodology. *Argument and Computation* 10(1): 5–22.

[8] www.liverpool.ac.uk/collaborate/our-successes/developing-ai-for-the-legal-sector

[9] https://lawtechuk.io

[10] https://lawtechuk.io/our-programmes

[11] https://lawtechuk.io/ecosystem

[12] www.gov.uk/government/publications/ai-opportunities-action-plan/ai-opportunities-action-plan

[13] www.ifaamas.org

# Economic growth and innovation

**David Dent**
Chief Executive of Dent Associates Ltd
Author of The Nature of Scientific Innovation, Palgrave Macmillan.
www.dentassociates.co.uk
david.dent@dentassociates.co.uk

In 2019 I was privileged to become a Royal Society Entrepreneur in Residence at the University of East Anglia. In addition to supporting commercialisation activities of the academics within the School of Biological Sciences, part of my role was to research and write a book on "The Nature of Scientific Innovation". Five years later, the latter task has been completed and the research and analyses I undertook has been published as a Monograph by Palgrave Macmillan in two volumes, the first dealing with 'processes, means and impact' while the second addresses issues relevant to 'those' [individuals and institutions] who deliver' innovation.

The two volumes challenge conventional views and approaches to scientific innovation, how we conduct our scientific research and deliver outputs and impact, and our failure to educate and train cadre's of innovators, particularly disruptive scientific entrepreneurs. I make the case that we are too 'blinded by adequacy' and that fundamental change is required in order to actually deliver significant economic growth, societal impact and environmental sustainability; change that the tax-paying public deserve and the nation needs from its publicly funded scientific research.

Two parallel approaches by economists have been used to describe and explain the role and need for innovation for economic growth for over a century; firstly in terms of the requirement for 'technological change' (particularly neo-classical economics) and secondly in terms of the role of entrepreneurs as 'disruptors of markets' (Schumpterian economics), with the former rather than the latter dominating economic thought, models and subsequently, government policy.

This is not to say there is no acknowledgement of the role and importance of entrepreneurs to a nation's economy. However, ask of yourself but one question – if entrepreneurs are so essential for our economy, growth, employment and wealth, why then is not our education system geared-up to primarily deliver to this purpose? Why instead do we prioritise intellectual attainment, of a prescribed type of intelligence over that of creativity, emotional intelligence and the training of business skills at all levels of learning and education.

Instead we follow an habitual line of thinking and logic that considers that economic growth arises from technological change, technologies arise from scientific discovery, which in turn arises from scientific research, that is best undertaken by scientists trained as elite specialists, given freedom to follow their own curiosity – therefore our education system at all levels prioritises these types of individual and grants them access to the funding, resources and institutions they need to generate discoveries. Such thinking and logic is no longer fit for purpose (if it ever was) and I simply ask the question – why and what needs to be done differently so that public research does deliver to current needs and priorities for innovation?

There are many questions we should be asking ourselves about our scientific research capability. For example, should our measures of scientific achievement be based on publication of research papers that are read on average by around 20 other scholars or focus more on impact and publication of highly cited patents.

Only around 15% of our academics account for their research in terms of impact, while a single patent can generate impact for inventors, investment in start-ups, employment (and hence livelihoods and taxes), the benefits of sales of products, services and processes, and exports as well as value attained at company sale or IPO. The evidence demonstrates that businesses filing a single patent benefit more in each of these areas than companies without a patent(s). From a UK perspective, the independent inventors (the general public) file as many patents as our academic community, ca. 10% each of our total national portfolio, but of course the former at no cost to the public purse.

> Should our measures of scientific achievement be based on publication of research papers … or focus more on impact and publication of highly cited patents?

If we wish for economic growth, social impact and environmental sustainability we need to achieve more than just highly cited scientific publications from our public research base, we have to increase the efficiency of papers needed per highly cited patent, to around values of other economically advanced nations.

There are also questions about how we view innovation. Without doubt by seeing innovation in aggregate rather than its individual components of scientific discovery, invention, entrepreneurship and markets – then innovation loses all meaning, which maintains the status quo and hinders the ability to focus on where to target change. It is important to recognise that scientists make discoveries but these are different skills from those of inventors who can recognise an opportunity and

turn a discovery into a novel artefact having utility, and then it is an innovator (intrapreneurs, entrepreneurs and disruptive entrepreneurs) who will take all the real risks (less so for intrapreneurs working within established companies) and marshal the people, the resources and the knowhow to take an invention and turn it into a product, service or process – the embodiments of innovation, and deliver into the market. Innovators may be inventors and/or scientists and while some scientists are inventors the vast majority are certainly not innovators – with around only 0.1% of UK academics per annum establishing a spin-off company. We need trained and resourced innovators not more researchers.

> We need trained and resourced innovators not more researchers.

In an article for SiP in 2010, I emphasised the need for a better balance between science supply-led research and market-led research, and have extended this thinking to a better and more nuanced understanding of technology and market related risks and opportunity. Risks are central to innovation and a key attribute of being entrepreneurial, particularly with regard to disruptive innovations.

We need to identify those entrepreneurs who aspire to be scientists rather than the press-ganging of academic researchers into becoming entrepreneurs – a bit like asking performing seals to become trapeze artists – those individuals who have a different set of skills, attitudes to risk, self-efficacy and resilience who are comfortable challenging accepted orthodoxy. But this would require a different approach to education and addressing the point made at the start of this article – education needs to be built around the needs of those who are our drivers of the economy – our entrepreneurs.

Given that entrepreneurs are often school-leavers, or university drop-outs or are graduates who start-up a business post university, the initial emphasis must be on education within schools and as undergraduates – creating a learning environment and education relevant to these different but talented students. It is our most conformist students who 'fit' the system, who pass exams and who stay on into higher education to undertake an MSc or PhD and become researchers – these individuals are not the challengers of orthodoxy or the disrupters of markets. There may be the odd one, (see above) but they are trained in all the wrong things by academics who are rarely risk takers themselves or exude a passion for changing the world. Even our MBAs, as wonderful as they are as a qualification, emphasise the 'what' of entrepreneurship rather than the 'how'. A rethink is required.

A report from the APPG on Entrepreneurship back in 2014 argued the case for less bolt-on activities relating to enterprise and entrepreneurship, and a more strategic approach to promoting both. We need every University science faculty to be able to integrate entrepreneurially relevant content, and appropriate business skills training, and communication skills, knowledge of self, into science undergraduate courses. We need entrepreneurs who do science and can treat research as a sophisticated tool rather than a vocation.

As argued and evidenced in my books, faced with a general decline in creativity, reduced novelty derived from large collaborative research programmes, a reductionist knowledge burden that hinders interdisciplinarity, paradigm-limiting research and a systematic decline in innovative output at all of scales of operation (aggregate, industry sector or individual business), as well as a decline in research productivity across the board, simply granting more money to research is not the solution to boosting innovation. The need is not for more scientific research or researchers but rather those who know how to exploit opportunities offered by discovery – entrepreneurs who know science.

The conventional models of financing innovation involving a series of barriers erected and manned by risk-averse individuals with little genuine experience of innovation and entrepreneurship or an inability to recognise opportunity (albeit a bit risky) does not deliver novelty or creative solutions for new products, services and processes. Rather what will deliver, is to place greater trust in non-conformist unconventional individuals who fail to meet all the conventional qualifications and lack institutional track records, but who have self-efficacy, the resilience to challenge orthodoxy, tenacity, risk taking and hence, the psychological make-up that makes them elite entrepreneurs, good decision makers regarding opportunity and the skills and know how to deliver products, services and processes to the market.

> We need to think differently about how we value entrepreneurs – if we want economic growth then let's be innovative about how we achieve it!

In the same way we develop the means to select elite professionals in other roles, for example airforce fighter pilots whose training costs exceed £5 million per pilot which allows them to fly under extreme risk an aircraft valued at over £100 million – then by analogy, how much are we prepared to identify those most likely to be great entrepreneurs, pay to train them and how much finance should be released in order generate significant economic growth. How would we make that happen? We need to think differently about how we value entrepreneurs – if we want economic growth then let's be innovative about how we achieve it!

My books pose the question about how many successful entrepreneurs we need, how many intrapreneurs, how many innovative disruptors and what impact can they each have on an economy, and then set about delivering on creating this vital resource for the nation. More of the same just does not 'cut it'!

#### References


APPG (2014) *An Education System Fit for an Entrepreneur*. APPG for Micro-businesses, February 2014, pp.1–139.

Dent D (2010) A Gap in the Innovation Market. *Science in Parliament*, 67 (3), 18–20.

Dent D (2024a) *The Nature of Scientific Innovation, Vol. I: Processes, Means and Impact*. Palgrave Macmillan. Springer Nature, Switzerland. p. 1–313. https://shorturl.at/PXmEZ

Dent D (2024b) *The Nature of Scientific Innovation, Vol. II: Those Who Deliver*. Palgrave Macmillan. Springer Nature, Switzerland. p. 1–309. https://shorturl.at/heWXH

# Responsible leadership:

## Saving our ailing National Health Service

**Professor Mike Saks** BA, MA, PhD, FIKE, FIoD, FIRL, FRBC, FRCCM, FRSA
Chair of the Institute for Responsible Leadership
Emeritus Professor, University of Suffolk
Visiting Professor, Universities of Westminster, York and Toronto

**Julie Search-Whittaker** BEd, MA, FIRL
Chief Executive of the Institute for Responsible Leadership

Responsible leadership is vital in a particularly turbulent world with a high incidence of wars, public scandals and financial collapse with a huge impact on citizens. The leaders of organisations and countries, also have a broader moral responsibility to address matters such as ecological issues, human rights and poverty in innovative and ethical ways.[1] The dilemmas of responsible leadership continue to be present worldwide – not least in our ailing health service which this article uses as an illustration.

### RESPONSIBLE LEADERSHIP: THE IMPORTANCE OF STAKEHOLDERS

In the business world much of the focus on responsible leadership has been on the needs of shareholders of companies rather than a wider range of stakeholders. While this has highlighted the financial benefits of liquidity and profitability related to good governance in terms of features such as accountability, risk management and succession planning,[2] it does not address broader agendas. Kempster, Maak and Parry argue that a framework with greater emphasis on social responsibility and a broader, long-term outcome orientation leading to 'good dividends' is necessary.[3]

While highly laudable, their framework has its own limitations as it is abstract and not that strongly grounded. At the Institute for Responsible Leadership (IRL), of which the authors are the Chair and Chief Executive respectively, it is argued that the currently most meaningful and operational touchstone for such responsible leadership is the Sustainable Development Goals (SDGs) of the UN for 2030.[4] These SDGs, adopted by all member states of the UN in 2015 and used as a key benchmark by many organisations in the UK, are shown in Figure 1.

**Figure 1: The 17 United Nations Sustainable Development Goals**


Goal 1: End poverty everywhere
Goal 2: Bring about zero hunger
Goal 3: Promote good health and wellbeing
Goal 4: Improve the quality of education
Goal 5: Facilitate gender equality
Goal 6: Provide clean water and sanitation
Goal 7: Generate affordable and clean energy
Goal 8: Encourage decent work and economic growth
Goal 9: Enhance infrastructure, industry and innovation
Goal 10: Reduce inequality in all its forms
Goal 11: Create sustainable cities and communities
Goal 12: Engage in responsible production and consumption
Goal 13: Take action on climate change
Goal 14: Conserve life below water
Goal 15: Protect life on land
Goal 16: Promote peace, justice and strong institutions
Goal 17: Engender global partnerships for sustainable development

The pursuit of these SDGs may not only improve the bottom line in the corporate sector, but also advance the interests of stakeholders in the public, private and third sector. As Saks highlights in his collaborative edited book with the IRL and the United Nations Institute for Training and Research (UNITAR) (Figure 2) while they are stretch targets, responsible leadership is essential to the ultimate achievement of the UN SDGs. The discursive chapters of the book span from areas such as cybercrime, good governance and responsible innovation to education, climate change and human trafficking.

Further details of the IRL's activities in these and other areas are available on the IRL website (www.responsible-leadership.org). Since health is one of the key SDGs which underlies a number of the other goals and is also discussed extensively in this book, it is proposed to highlight the importance of responsible leadership in relation to the presently ailing National Health Service (NHS) in Britain, the travails of which have become a major issue of public concern.

## OUR AILING NATIONAL HEALTH SERVICE

The pioneering NHS, implemented in 1948 in Britain and free at the point of access, has been the shining reference point for other NHSs formed at a later date throughout the Western world. However, in the last couple of decades the NHS has been in decline to the detriment of stakeholders who heavily depend on it for their health and wellbeing. It is therefore no surprise that the sustainability of the British NHS has been brought into question by the report by Lord Darzi in 2024 (Figure 3) that was commissioned for England on an eight-week timescale by the new Labour government of that year.

This review identified many key failings with the examples set out below:

- Crumbling Victorian hospital buildings in various states of disrepair and desperate need of modernisation.
- Extended waiting times with 7.6 million people still on the list for routine operations and some 14,000 avoidable deaths per annum from longer waits in A&E departments.
- Unproductive hospitals where no more operations were performed despite a 17% increase in the hospital workforce over the past five years.
- A need to more strongly prioritise prevention with an ageing population and rising rates of chronic illnesses.
- More resources required in primary care, where the number of community nurses fell by 5% compared to an increase of 35% hospital nurses in 2019 to 2023.
- The collapse of social care, which is means-tested and placing an increasing burden on families and the NHS – not least by hospital bed blocking.
- Technology deficits in the wake of AI and other developments which place the NHS well behind the private sector in many areas and increase waiting lists.

Central to resolving these issues sustainably is radical reform and investment. Pleasingly, the new government has taken some short range steps to progress the agenda. It also has a target by 2029 of carrying out 92% of routine operations and appointments within 18 weeks. Against this, it is self-confessedly felt that this target, unless matched by more fulsome actions on a wider front, could lead to the displacement of other aspects of the NHS such as cutting local health services, especially if shortening A&E waiting times is prioritised. Amongst many other things, innovative approaches to care will need to be adopted and a more supportive, rather than adversarial, approach to top-level managers may be required.

## NEED FOR AN INTERNATIONAL FRAME OF REFERENCE

One dimension of how to move things forward that has received too little attention is the power of learning from lessons internationally. This is underlined by the recent co-edited book by Giarelli and Saks which importantly focuses on the challenges, reforms and future prospects of the NHSs of Western Europe including in countries spanning from Sweden, Denmark and Norway in

**Figure 2: Responsible Leadership: Essential to the Achievement of the United Nations Sustainable Development Goals**


Saks M (ed) (2023) *Responsible Leadership: Essential to the Achievement of the United Nation's Sustainable Development Goals,* Abingdon: Routledge.

**Figure 3: The "Darzi Report"**


Professor Lord Darzi (2024) *Independent Investigation of the National Health Service in England,* London: Department of Health and Social Care.

Scandinavia to Spain, Portugal, Italy and Greece in the Mediterranean macro-region (Figure 4).

This is one of a number of helpful recent books in which Saks has been involved on comparative health policy covering countries as diverse as India, Japan and the United States.[5] In addition, he has taken a lead policy role on the Technical Expert Group of the World Health Organization in providing its first ever guidance on global health practitioner regulation (Figure 5). This is based on an extensive commissioned international review of 410 peer-reviewed articles and more than 400 items of grey literature.

There are many future pointers arising from this international experience for responsible leaders in government and the NHS in Britain, such as:

- Ensuring adequate regulation of professions and support workers to protect the public
- Encouraging collaborative working as opposed to a destructive silo-based approach
- Striking an appropriate balance between centralisation and decentralisation
- Addressing inequalities between groups and regions in different parts of the country
- Increasing the influence of the patient voice in healthcare decision making
- Making sure that our health services are sufficiently funded and regularly upgraded.

Although there are always going to be dilemmas over resource allocation with new and existing developments in healthcare, these are worthy ambitions for both our own and other health services to achieve sustainability for healthy and inclusive living for the benefit of users.

## CONCLUSION

It is no coincidence that the logo for the IRL (see Figure 6) includes an image of Nelson Mandela – a much revered responsible leader who very humbly and commendably brokered the end of apartheid with FW de Klerk in South Africa after twenty-seven years in jail for his subversive activities.

In dealing with the crisis in our NHS in particular and advancing the UN's SDG 3 in health and wellbeing – while acknowledging the political debate about the source of the problems – we need in Mandela's words, to let bygones be bygones at the appropriate point in time. We can then move on to systematically address the issues in an informed way in the public interest. This will take time, but identifying what the issues are is a critical staging post in providing for their resolution. In the broader frame of reference of the IRL, which aims to work in the interests of all relevant stakeholders, this will involve clear commitment and milestones to chart progress.

### References


[1] Saks M and Search-Whittaker J (2018) 'Responsible leadership in challenging times', *Innovation Review,* December.

[2] Grant Thornton (2019) *Corporate Governance and Company Performance*, London: Grant Thornton.

[3] Kempster S, Maak T and Parry K (eds) (2020) *Good Dividends: Responsible Leadership of Business Purpose*, Abingdon: Routledge.

[4] United Nations (2015) *Transforming Our World: The 2030 Agenda for Sustainable Development*, Geneva: United Nations

[5] See, for example:

Saks M (2015) *The Professions, State and the Market: Medicine in Britain, the United States and Russia*, Abingdon: Routledge;

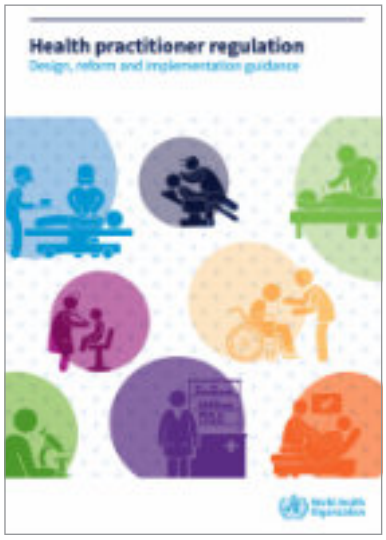
Chamberlain JM, Dent M and Saks M (eds) (2018) *Professional Health Regulation in the Public Interest: International Perspectives*, Bristol: Policy Press;

Saks M (ed) (2020) *Support Workers and the Health Professions in International Perspective: The Invisible Providers of Health Care*, Bristol: Policy Press.


**Figure 4: The National Health Services of Western Europe**


Giarelli G and Saks M (eds) (2024) *National Health Services of Western Europe: Challenges, Reforms and Future Perspectives*, Abingdon: Routledge.

**Figure 5: Health Practitioner Regulation**




World Health Organization (2024) *Health Practitioner Regulation: Design, Reform and Implementation Guidance,* Geneva: WHO.

**Figure 6: IRL logo**

# Beyond genomics:

## Unlocking the full potential of Our Future Health

**Laura Mitchell** BA Hons
Senior NHS Consultation Manager, Our Future Health

**Dr Ali Connell** MA MBBS PhD MRCP
Director of Digital Health, Our Future Health

**Dr Ros Blackwood** MA MBBS MPH FFPH PhD
Director of Population Health Insights, Our Future Health

Over 2 million people in the UK have signed up to take part in Our Future Health, making it the world's largest source of longitudinal health data, enabling disease prevention, drug discovery and supporting economic growth.

### Tackling growing challenges in healthcare: a prevention approach

The UK, like many countries globally, faces an increasing burden from treating late-stage chronic disease and growing numbers of cases of multimorbidity in the population, with two-thirds of adults aged over 65 years expected to be living with multimorbidity by 2035[1]. Alongside increasing multimorbidity and slowing gains in life expectancy, increasing disparities in health create new challenges to healthcare infrastructure. Non-communicable diseases such as cardiovascular disease (CVD), cancers and diabetes continue to cause the highest burden of mortality and morbidity globally[2]. However, many of these diseases are preventable through reducing major risk factors like tobacco use, physical inactivity, unhealthy diet and the harmful use of alcohol.

Focusing on prevention provides a clear pathway to breaking this cycle. However, preventative health care programmes struggle to attract funding, as their long-term macroeconomic impacts bear limited weight in the allocation of expenditure. Estimates suggest that a 20% reduction in the six main causes of long-term illness keeping people out of work – cancer, cardiovascular disease, chronic respiratory illness , diabetes, mental health and musculoskeletal disorders – could raise gross domestic product (GDP) by an estimated 0.74% within five years, or £19.8 billion per year[3]. Increased tax revenues and reduced benefits payment from people returning to work could amount to a further £10.2 billion by 2030[3].

Our Future Health, a longitudinal research study that opened for recruitment in October 2022, has been established to help everyone live longer and healthier lives through the discovery and testing of more effective approaches to prevention, earlier detection and treatment of diseases. The programme supports the government's commitment to improving the health of the nation through a more predictive, preventative and personalised system, and builds on the strong legacy of research infrastructure in the UK[4].

Recruiting faster than any study at this scale before, the study aims to recruit 5 million participants. 2.3 million participants have already consented to join the study, and 1.7 million participants have completed the short lifestyle and health questionnaire, with 1.3 million providing blood samples and physical measurements. This detailed health and lifestyle information is further enhanced through direct linkage to hospital records, cancer registries, death registration and consent to link to primary care records, making Our Future Health a powerful tool for conducting novel research to facilitate new healthcare discoveries and inform health and social care policy. The programme will also support the enrolment of participants into future studies, speeding up recruitment to clinical trials, and due to its scale, enabling research on rare diseases where other datasets fall short. Evaluations of the effectiveness of returning personalised disease risk estimates based on genetic and lifestyle information will enable Our Future Health to generate an evidence base that will support improvements in the health and wellbeing of the UK population.

## Prevention: a key for economic growth

Lord Darzi's Independent investigation of the NHS in England highlighted a growing challenge to the UK government and the NHS: 2.8 million people were economically inactive due to long-term sickness as of the start of 2024, an 800,000 person increase on pre-pandemic levels[5]. Trends show that those who leave the workforce due to long-term ill-health are unlikely to return to work, reducing the population participating in the labour market and increasing those seeking universal credit. In addition to this, the rising State Pension Age risks pushing more unemployed people into poverty and exacerbating ill-health[6].

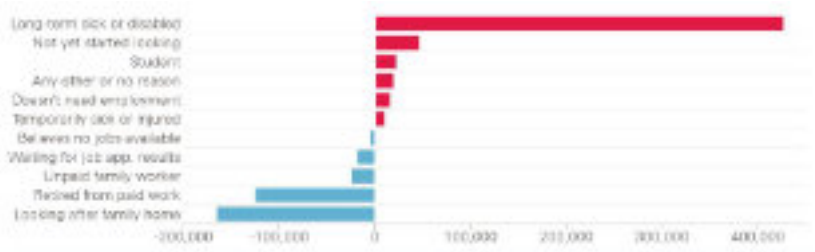
The relationship between incomes, health, and life-expectancy is not linear. As income rises, life expectancy increases; however, the relationship weakens as income rises, suggesting that those on lowest incomes have most to gain in returns on life expectancy from health investment (see Figure 2)[7,8,9]

Analyses undertaken on behalf of NHS Confederation investigating the direct relationship between NHS spend and economic output found that "growth in healthcare investment has a clear relationship with economic growth" concluding that every £1 invested in the NHS translates into an overall economic return of £4 in the local area[10].

With the largest cohort of young people aged 18–40 years (over 200,000) and working age populations (over 750,000) of any study to date, Our Future Health can facilitate research into diseases disproportionately affecting younger people and their ability to work, including their long-term follow-up. We have the largest ever number of participants from under-represented groups in a health research programme, with 12% of participants joining from the most deprived quintile of the population. 14% of participants are from ethnic minorities, making Our Future Health the largest multi-ethnic cohort in the UK.

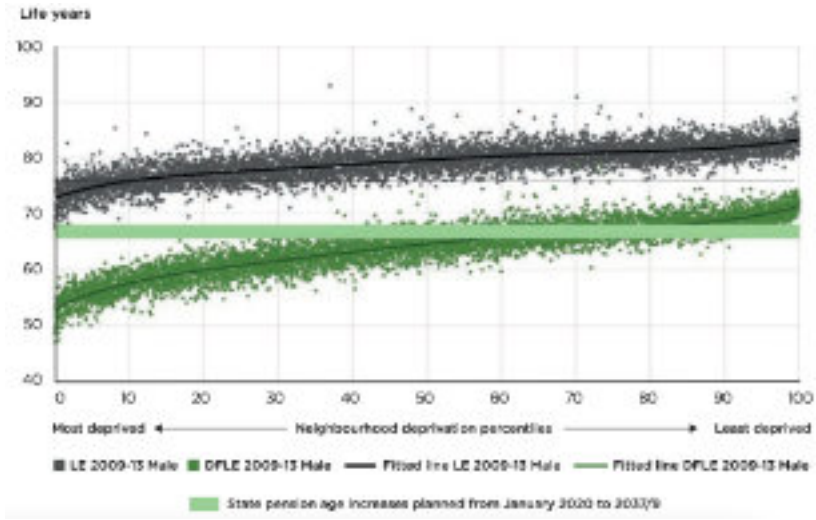
We can provide the insights and evidence for service improvements and distribution, enabling the identification of high-risk populations. For example, data from volunteers of working age (18 to 66 years inclusive) reveals that 14.6% of people who have had a diagnosis of heart attack or stroke are unable to work because of sickness or disability, compared with rates of 2.9% for the whole cohort. Data such as this could be used to improve or target services and programmes to those most in need.

**Figure 1: Change in number of people aged 16–65 who are economically inactive by reason: UK, Q1 2020–Q1 2023.**




Source: Health Foundation (2023)[6]

**Figure 2: Life expectancy at birth (in males) by neighbourhood deprivation percentiles, 2009–13, England**




Adapted from: Marmot M et al (2020)[9]

Note: Each dot represents life expectancy (LE) or disability-free life expectancy (DFLE) of a neighbourhood (middle level super output area).

## Enabling a personalised approach to healthcare

As demand on NHS services continues to increase alongside growing rates of non-communicable diseases, a preventative and personalised approach to care must be adopted. Motivating and equipping patients with the knowledge and tools to improve their long-term health outcomes is essential. Our Future Health has committed to providing personal disease risk information to participants who wish to receive it. Some risk prediction tools are already recommended in clinical guidelines, however there is more work to be done to support their routine integration and utilisation in clinical pathways as well as their widespread adoption by both the public and clinicians[11].

By enabling all participants (but especially younger working adults) to understand their risk of future disease and how to reduce such risk, it may be possible to generate evidence for policies and


interventions that could reduce the incidence of early-onset long-term illness leading to premature departures from the workforce. There is evidence to suggest that providing the public with early personal risk information is cost effective. The NHS Health Check (which includes the calculation of CVD risk) has already demonstrated a return on investment (ROI) of £2.93 per £1 spent[12]. Our Future Health is already positioned to take the pulse of the health of the UK population, as well as provide insights and an evidence base into effective interventions that will improve the health of the UK population, and as a result, the economy. We can help the government better understand barriers to good health, the intersection between health and the economy, and geographical areas in which actions can have real benefits.

## Conclusions

Our Future Health is already open to researchers. Harnessing the power of our large-scale data could revolutionise the UK's approach to the health and wellbeing of its citizens. In 2024, the government delivered a request to the nation to help build a health service fit for the future[13]. We plan to support this effort by providing tailored products to support the work of Public Health and Government. Our Future Health offers a unique opportunity to build an evidence base supporting the prevention, early detection and improved treatment of disease at a national scale.

### References

[1] NIHR (2018) *Multi-morbidity predicted to increase in the UK over the next 20 years*. https://evidence.nihr.ac.uk/alert/multi-morbidity-predicted-to-increase-in-the-uk-over-the-next-20-years

[2] World Health Organisation (2025) *Noncommunicable Diseases.* www.who.int/health-topics/noncommunicable-diseases#tab=tab_1

[3] Bell J et al. (2024) *Prosperity Through Health: The macroeconomic case for investing in preventative health care in the UK*. Tony Blair Institute for Global Change. https://institute.global/insights/economic-prosperity/the-macroeconomic-case-for-investing-in-preventative-health-care-UK.

[4] Department of Health and Social Care (2022) *Genome UK: 2022 to 2025 implementation plan for England*. www.gov.uk/government/publications/genome-uk-2022-to-2025-implementation-plan-for-england/genome-uk-2022-to-2025-implementation-plan-for-england

[5] Department of Health & Social Care (2024) *Summary letter from Lord Darzi to the Secretary of State for Health and Social Care*. www.gov.uk/government/publications/independent-investigation-of-the-nhs-in-england/summary-letter-from-lord-darzi-to-the-secretary-of-state-for-health-and-social-care

[6] The Health Foundation (2023) *A rising State Pension age will leave people who are out of work due to ill health at greater risk of poverty and worsening health.* www.health.org.uk/reports-and-analysis/analysis/a-rising-state-pension-age-will-leave-people-who-are-out-of-work-due

[7] Fumugalli E, Pinna Pintor M, Suhrcke M, (2024). The impact of health on economic growth: a narrative literature review. *Health Policy*, 143. www.sciencedirect.com/science/article/pii/S0168851024000496#cebibl1

[8] Preston S, 1975. The changing relation between mortality and level of economic development. *Population Study (Camb),* 29 (2):231–248.

[9] Marmot M, Allen J, Boyce T, Goldblatt P, Morrison J (2020). *Health Equity in England: The Marmot Review 10 Years On.* Institute of Health Equity. http://health.org.uk/publications/reports/the-marmot-review-10-years-on

[10] Richardson B et al. (2022) *The link between investing in health and economic growth*. www.nhsconfed.org/system/files/2022-10/Health-investing-and-economic-growth-analysis.pdf. .

[11] NICE guideline [NG238] (2023) *Cardiovascular disease: risk assessment and reduction, including lipid modification*. www.nice.org.uk/guidance/ng238/chapter/Recommendations

[12] Office for Health Improvement and Disparities (2021) *Review of the NHS Health Check Annex E: health economic modelling.* https://assets.publishing.service.gov.uk/media/61af4e0fe90e07043e8ff4e9/annex-e-health-economic-modelling.pdf

[13] Department of Health and Social Care (2024) *Change NHS: help build a health service fit for the future*. www.gov.uk/government/publications/change-nhs-help-build-a-health-service-fit-for-the-future

# The future of UK healthcare:

## How personalised prevention can revolutionise the NHS

**Heidi de Wet**
Associate Professor of Physiology, Department of Physiology, Anatomy & Genetics, University of Oxford and Trustee, The Physiological Society

The UK healthcare system has been under mounting pressure for years, even prior to the COVID-19 pandemic. Elective admissions rose from 7.3 million in 2009/10 to 8.8 million in 2019/20, and while they dipped during the pandemic, they nearly returned to pre-pandemic levels in 2022/23 at 8.6 million[1].

This surge in demand is largely driven by an ageing population and the rise in noncommunicable diseases (NCDs), which now account for an estimated 89% of deaths in the UK[2]. Health inequalities further exacerbate the issue, disproportionately affecting certain communities.

As the Secretary of State for Health and Social Care, Wes Streeting MP, said when launching Change NHS: help build a health service fit for the future,

> "Our NHS is under rising pressure; we are diagnosing ill health too late and not doing enough to prevent it in the first place…and costs are escalating"[3].

This consultation sought public and professional input on transforming the NHS to better address current challenges, with a significant focus on preventative measures and early intervention strategies.

Beyond the strain on healthcare services, poor health carries a significant economic burden. Long-term sickness costs the UK economy an estimated £43 billion annually, with individuals losing up to £2,200 per year in earnings[4]. Poor employee health also leads to an estimated loss of £138 billion per year due to absence and reduced productivity. These figures highlight the urgent need for better preventative healthcare measures to improve public health and economic stability.

### Transforming healthcare through a physiology-led approach to personalised prevention

A proactive approach to healthcare – one that prioritises prevention – could transform the way we address health and wellness. By detecting and addressing early signs of disease, preventative care has the potential to enhance quality of life while reducing long-term costs. Physiological research is a vital part of a personalised approach to prevention since it integrates molecular, cellular, systems, and whole-body function. Within healthcare, this supports a holistic view of a patient and their condition(s) and the development of more accurate monitoring tools and diagnostic tests that use a range of biomarkers and combine diverse health data for analysis. By enabling real-time condition tracking and leveraging advanced data-driven insights, personalised prevention is a core component of the future of healthcare.

The 'Physiology Passport', proposed by The Physiological Society in its recent policy report, is a digital health initiative aimed to support the adoption of personalised prevention[5]. The Passport will collect, manage, and present an individual's physiological health data within their existing electronic health records (EHRs). By establishing personalised health parameters, the Physiology Passport will provide a baseline for what defines "good health" for each individual.

As a first step, the Physiology Passport would optimise the use of existing clinical parameters such as blood pressure, weight, cholesterol, and blood sugar levels, ensuring their consistent collection across various healthcare settings. In the future, it could incorporate a broader range of physiological biomarkers, offering a comprehensive, longitudinal view of an individual's physiological health and well-being.

### Tackling obesity through early intervention – a case study in personalised prevention

Obesity management is an excellent example of how the Physiology Passport could revolutionise preventative healthcare. Currently, 2 in 3 middle-aged adults in the UK are overweight or obese, increasing their risk of numerous NCDs, including Type 2 diabetes and cancer[6]. Alarmingly, childhood obesity rates are also on the rise 9.6% of reception-age children (4–5 years old) were obese in 2023/24, with a further 12.4% overweight, and these numbers were even higher in year 6 children (age 10-11), with 22.1% being obese and 13.8% overweight[7]. This indicates that 35.9% of 11-year-olds in the UK are already at an unhealthy body weight. These data have long-term consequences, 77% of obese children go on to become obese adults.

This issue is not limited to the UK. Recent global research projects that within the next 25 years, a third of all children and adolescents will be overweight (385 million) or obese (360 million), highlighting the urgent need for stronger early intervention strategies[8]. Through a combination of a single-payer national

health system and the diversity of the population, the UK is well-positioned to be a world-leader in this transition towards a more preventative system.

The Physiology Passport could support efforts to prevent obesity by providing early, yearly monitoring of body weight, blood pressure, and glucose tolerance, allowing individuals to track gradual weight gain and other health markers before they develop into serious conditions. Understanding when people are most susceptible to weight gain – whether during student years, early parenthood, or shift work – can inform tailored lifestyle and dietary recommendations. Importantly, those with a family history of obesity would particularly benefit from early interventions, as losing weight and maintaining a healthy weight is notoriously difficult once obesity sets in.

The success of past initiatives, such as the Sure Start programme, demonstrates that early-life interventions can yield long-term health benefits[9]. Addressing unhealthy body weight and promoting active lifestyles must become an urgent national priority to prevent future health crises and reduce economic costs.

## Policy recommendations for a healthier future

To harness the benefits of the Physiology Passport, five key recommendations we made five key recommendations for governments, researchers, and funders across the UK:

1. **Integrate physiological data for personalised prevention**

   Integrating physiological data into existing health records and digital tools will better enable personalised prevention and real-time health monitoring, supporting early intervention and chronic disease management.

2. **Promote health equity**

   Addressing healthcare disparities by prioritising underrepresented and marginalised populations in prevention initiatives, research efforts, and funding allocations will be crucial in ensuring that advancements in health technologies close, rather than exacerbate, existing health inequalities.

3. **Empower individuals and foster community care**

   The proliferation of data from a variety of sources will only be effective if individuals are encouraged to actively manage their health through education, community-focused prevention programmes, and co-created, patient-centric technologies tailored to their needs and preferences.

4. **Advance research andinnovation**

   The Government should support interdisciplinary research in biomarkers, physiology, genomics, and behavioural science to develop predictive models and innovative interventions, and establish comprehensive longitudinal data sets for dynamic prevention strategies.

5. **Invest in pilot studies and sustainable interventions**

   The Government should fund feasibility studies and long-term research to evaluate the effectiveness and scalability of physiology-led tools like the Physiology Passport, ensuring they are cost-effective and sustainable across diverse populations.

## The road ahead: a collaborative approach

Implementing the Physiology Passport will require collaboration between policymakers, healthcare professionals, researchers, and digital health innovators. By working together, we can make personalised prevention a cornerstone of UK healthcare, alleviating pressure on the NHS and improving population health.

Additionally, in a world where climate change creates and exacerbates health risks – through extreme heat, air pollution, and shifting disease patterns – and reduces our capacity to respond to them, it is crucial to integrate climate resilience into healthcare strategies. To further understand how the Physiology Passport can become an important tool for personalising prevention and resilience in a changing environment, The Physiological Society is hosting the Global Climate and Health Summit in July 2025. Bringing together policymakers, researchers, climate scientists, and individuals with lived experiences, the Summit will explore innovative solutions to enhance health resilience, especially for vulnerable populations. If you wish to attend, please visit our website at: www.globalclimateandhealthsummit.com

By embracing personalised prevention, we can build a healthier future – one where early intervention saves lives, reduces economic burdens, and ensures a stronger NHS for future generations.

### References


[1] The Kings Fund (2024) *NHS: Key Facts and Figures*. www.kingsfund.org.uk/insight-and-analysis/data-and-charts/key-facts-figures-nhs

[2] Robbins AJ, Fowler AJ, et al. (2021) Emergency hospital admissions associated with non-communicable diseases 1998–2018 in England, Wales and Scotland: an ecological study. *Clinical Medicine (London)*. 21(2):e179–e185. doi: 10.7861/clinmed.2020-0830

[3] UK Parliament (2021) *10 Year Health Plan: Building a health service fit for the future*. https://questions-statements.parliament.uk/written-statements/detail/2024-10-21/hcws147

[4] Bloomberg (2023) *Long-term sickness is costing the UK economy £43 Billion a year*. www.bloomberg.com/news/articles/2023-04-26/long-term-sickness-is-costing-the-uk-economy-43-billion-a-year

[5] The Physiological Society (2025) *Physiology Passport: Putting personalised prevention at the heart of resilient health systems*. www.physoc.org/policy/precision-medicine/physiology-passport

[6] House of Commons Library, UK Parliament (2025) *Obesity Statistics*. https://commonslibrary.parliament.uk/research-briefings/sn03336/

[7] Future NHS (webpage). *Healthy Weight and Physical Activity*. https://future.nhs.uk/PHIOnline/view?objectId=1159187

[8] GBD 2021 Adolescent BMI Collaborators (2025) Global, regional, and national prevalence of child and adolescent overweight and obesity, 1990–2021, with forecasts to 2050: a forecasting study for the Global Burden of Disease Study 2021.*The Lancet*. 405(10481): 785–812.

[9] Carneiro P, Cattan S, Ridpath N (2024) *Sure Start greatly improved disadvantaged children's GCSE results*. Institute for Fiscal Studies. https://ifs.org.uk/news/sure-start-greatly-improved-disadvantaged-childrens-gcse-results

# Transforming healthcare:

## The potential of personalised prevention

**Professor Dame Melanie Welham**
**DBE, FRSB**
Former Executive Chair, Biotechnology and Biological Sciences Research Council
Independent Trustee, Royal Society of Biology

### Introduction

Healthcare systems across the four nations of the UK have been experiencing increased demand for their services for many years. The main contributing factors are an increasingly ageing population (18.9% of the UK population was aged over 65 in 2024 according to the Office for National Statistics projections[1]) and a rise in non-communicable diseases, estimated in 2019 to account for 89% of deaths in the England[2]. As the population continues to age, and the costs of healthcare increase, it has been predicted that to maintain current levels of service, Government spending on healthcare would need to increase from an estimated 7.2% of GDP in 2018-19 to 13.8% of GDP in 2067[3].

Other factors also impact health and wellbeing. Significant health inequalities exist in the UK, driven by socioeconomics, ethnicity, and geography, highlighted very starkly during the early stages of the Covid-19 pandemic[4]. Climate change is likely to have an increasing impact on human health, with air quality and extremes of temperature, especially heatwaves, adversely affecting those with chronic respiratory and cardiovascular diseases[5].

These trends paint a worrying picture of ever increasing and unsustainable pressure on healthcare systems across the UK. This issue is not limited to the high demand for healthcare services; it also includes the broader economic impact of chronic ill-health within the workforce, which adversely affects national productivity.

Recognising the need for change, the current UK Government is consulting broadly on building an NHS fit for the future. Now, more than ever, long-term thinking and bold actions are required to transform our healthcare systems. A shift to focus healthcare towards the prevention of disease and promotion of health, embracing the latest advances in research, innovation and technology, surely has a central role to play.

### Precision medicine

Precision, or personalised, medicine is widely considered to have the potential to transform how diseases are diagnosed, treated and prevented, by considering an individual's unique genetic, lifestyle and environmental factors. Key to precision medicine is the use of genomic data to understand an individual's susceptibility to disease or their response to different treatments. We know from multiple studies that early diagnosis and intervention improve health outcomes. And in the UK, Our Future Health[6] is a large health research programme which is building a cohort of 5 million adult volunteers with the aim of discovering and testing new effective approaches to prevention, early detection and treatment of diseases.

### Personalised prevention in healthcare

Personalised prevention is a key element of precision medicine and focuses on preventing the onset, progression or re-occurrence of disease. Interventions are tailored by considering an individual's biological information, alongside lifestyle, environmental, socioeconomic and cultural factors. The development and widespread adoption of personalised prevention strategies has the potential to transform healthcare provision. Key to success will be the ability to develop a comprehensive and holistic understanding of an individual's health through their life-course.

In the latter part of 2024, I chaired the expert Steering Group that supported the joint Physiological Society / PHG Foundation project which considered how physiology, recognised for its integrative approach across molecular, cellular, systems and whole-body functions, could support the development and use of personalised prevention in healthcare. I recalled that when I was a senior leader at The Biotechnology and Biological Sciences Research Council, an horizon-scanning workshop a decade earlier had identified 'Personalised health / prevention' as an important emerging area[7]. During the intervening time scientific knowledge and understanding (much of which has been generated by the physiological research community), alongside technology development, have progressed to such an extent that there are now clear opportunities to apply personalised prevention approaches as part of strategies to improve individual's health and reduce the burden on healthcare systems.

The Steering Group had many in-depth discussions about personalised prevention, appreciating it is a complex and multifaceted challenge. The group saw real opportunities for physiology-led research and innovation in the development of more accurate monitoring tools, diagnostic tests, and identification and validation of novel biomarkers to track health. But it also recognised that many physiological health measurements are already captured in routine clinical practice – height, weight, blood pressure, pulse, blood glucose and cholesterol for example – and what is currently lacking is the curation of these data, over time, in a format that is readily accessible to both individuals and healthcare professionals.

Through consideration of how physiological health data could be collected and curated during an individual's lifetime the concept of the Physiology Passport emerged. The project report[8] was launched in Parliament in January 2025 at a discussion event jointly hosted by the Parliamentary and Scientific Committee and The Physiological Society.

## The Physiology Passport: a dynamic, long-term and integrated personal physiology profile


Conceptually, the Physiology Passport provides a means to collect, manage and present a person's physiological health information in a useful manner, potentially over decades. Much of this information already exists, but it is patchy and hard to find, so ideally it would become part of the existing, or a re-designed version of, the NHS App (in England, for example). By integrating physiological health data into existing electronic health records the parameters defining good health for each individual could be more readily established. And the Physiology Passport could then be used by individuals themselves and healthcare teams in an integrated and holistic way to monitor health and proactively intervene early if parameters change.

Like any new health-related innovation, the Physiology Passport raises a series of ethical, practical and research questions that require more detailed consideration. The challenges associated with data collection and curation, encompassing security, sharing and ownership, are of utmost importance. The need to narrow health inequalities, rather than widen them, was an area of particular concern, as reflected in the report's recommendations. The opportunity to leverage new and emerging technologies, especially Artificial Intelligence, to analyse large amounts of health-related data were recognised. The ever-expanding repertoire of wearable devices now available to monitor an individual's health were seen as an opportunity for future data collection, notwithstanding the challenge of clinically validating new data sources. The need to ensure a future workforce that is supported to develop the skills needed as healthcare shifts to being more data-intensive and digital was also recognised. The Steering Group, and participants at the launch event in Parliament, debated these and many other questions – deliberations that should continue into the future.

## Making personalised prevention a priority

It is hoped that the Physiology Passport report[9] will achieve a number of things; from highlighting the opportunity and multiple benefits that can be realised by

# Launching the Physiology Passport

## Putting personalised prevention at the heart of resilient health systems

Parliamentary & Scientific Committee Discussion Meeting held on 14 January in partnership with The Physiological Society


Left to right: **Professor Catherine Ross**, Chief Scientific Adviser, Scottish Government; **Dame Melanie Welham DBE**; **Professor Heidi de Wet**, Associate Professor of Physiology, University of Oxford; **George Freeman MP**, Chair, Parliamentary & Scientific Committee; **Viscount Stansgate**, President, Parliamentary & Scientific Committee; **Dr Alistair Connell**, Director of Digital Health, Our Future Health.

focusing more on prevention, including the role physiology can play, through to sparking a national debate about personalised prevention and an individual's responsibility for their own health.

To turn the Physiology Passport into reality, however, personalised prevention will need to become a key priority for multiple stakeholders. And this is where the recommendations in the report for Governments, Researchers and Funders seek to inform and shape future approaches.

It is clear that new strategically-aligned physiological and multi-disciplinary collaborative research and innovation, adopting integrative and holistic approaches, is needed to accelerate progress. Proof of principle, pilot and longitudinal studies to test feasibility and cost effectiveness will be critical, along with identification of new biomakers. Inclusion of under-represented groups in such studies will be vital to address health inequalities. Prevention has been highlighted as one of the current UK Government's priority areas in Health. But policy stability, along with long-term support, will be critical to incentivise the private sector investment needed to accelerate innovation, translation and implementation.

Innovative approaches to personalised prevention have the potential to shift the health of the UK's population in the medium to longer-term, reducing chronic ill-health, lowering demand on healthcare provision, and simultaneously boosting economic productivity through a healthier workforce. With the potential for such widespread benefits implementation seems to be a 'win-win'. However, there are likely to be few 'quick fixes' so a long-term view and patience will be vital. Health economists will need to consider the financial implications of change, but one thing is clear, the status quo cannot continue indefinitely and the longer it takes to implement change, the bigger the changes needed to ensure sustainability of our healthcare systems into the future. The time to embrace personalised prevention is now.

**References**


[1] www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/datasets/tablea21principalprojectionukpopulationinagegroups

[2] www.gov.uk/government/publications/nhs-health-check-programme-review/annex-c-data-on-the-distribution-determinants-and-burden-of-non-communicable-diseases-in-england#the-burden-of-non-communicable-disease

[3] https://ifs.org.uk/articles/economic-consequences-uks-ageing-population

[4] www.thenhsa.co.uk/app/uploads/2021/09/A-Year-of-COVID-in-the-North-report-2021.pdf

[5] www.who.int/news-room/fact-sheets/detail/climate-change-and-health

[6] https://ourfuturehealth.org.uk

[7] https://medium.com/@BBSRC/q-a-with-professor-melanie-welham-me-bbsrc-and-the-future-of-uk-bioscience-8694862fe74d

[8] www.physoc.org/policy/precision-medicine/physiology-passport

[9] www.physoc.org/policy/precision-medicine/physiology-passport


# Building a healthcare science workforce equipped to face the grand challenges

**Parliamentary & Scientific Committee Discussion Meeting held on 11th February 2025, in partnership with the Institute of Physics and Engineering in Medicine (IPEM)**

Left to right:

**Dr Anna Barnes**, President of the Institute of Physics and Engineering in Medicine (IPEM) and Director, King's College London Technology and Evaluation Centre

**Dr Victoria Kidgell**, Lead Clinical Scientist, Sheffield Teaching Hospitals NHS Foundation Trust

**Professor Lord Mair CBE**, Chair, House of Lords Science and Technology Select Committee

**Katherine Bunting**, Director of Education and Strategic Development, IPEM; **Chris Watt**, Head of Communications and Public Affairs, IPEM

**Viscount Stansgate**, President, Parliamentary & Scientific Committee APPG

**Dr Jemimah Eve**, Director of Policy and Impact, IPEM

# Revealing the big picture

When I was little, I discovered that I was good at jigsaw puzzles. I recall the satisfaction of seeing the image gradually emerge as the pieces were assembled. It's not a talent I mention on my CV. But it has turned out to be very helpful in my career

**Chris Rapley CBE MAE**
Professor of Climate Science, University College London; Chair of the European Science Foundation's European Space Sciences Committee; Chair of the UCL Climate Action Unit; member of the Advisory Board of the UK Clean Growth Fund

A problem with science today is that its domain is so vast that no-one can be expert in all fields. A common quip is that the career path of a researcher is "to learn more and more about less and less until they know everything about nothing." Joking aside, the silo-ing of knowledge and expertise, and the tendency not to link the parts, is a widespread problem in the modern world, and not just in science.

The US space agency NASA addressed the matter many years ago by introducing the concept of the T-shaped professional – someone with deep expertise in a particular field, but with the breadth to engage across disciplines. Their 'Helicopter View' allows them to apply their talents to greatest effect, and to create meaningful knowledge rather than isolated facts. This broad perspective is critical for understanding complex systems, such as the Earth's climate system, which operate as an interconnected whole, and in which individual components interact in ways that produce emergent behaviours not evident when examined in isolation.

I first encountered the power of interdisciplinary thinking in the 1970s as a PhD student at UCL's Mullard Space Science Laboratory. My task was to determine the origin of the celestial soft X-ray glow that had been discovered using sounding rockets to loft instruments above the atmosphere. Familiarity with features of the optical sky learned at the Oxford University Observatory during my undergraduate physics studies, and of the radio sky acquired from an MSc course at Jodrell Bank, allowed me to devise a novel sounding rocket experiment. Following a successful flight (British National Skylark SL1203 launched from Woomera, Australia, in 1974, see Figure 1), the combination of the X-ray, radio, and optical data revealed the emissions to be Galactic in origin[1].

Some years later, as Executive Director of the International Geosphere-Biosphere Programme (IGBP), I led an initiative uniting thousands of scientists from 75 nations to study Earth's bio-geochemical cycles. To make progress, we had to overcome academic disciplinary boundaries as well as language, institutional, national and cultural barriers. The objective was to establish a framework guiding the investigation of multiple individual research 'jigsaw pieces', and then to assemble the fragments so that the 'big picture' of climate system behaviour emerged.

The IGBP was itself nested within a high-level arrangement of the World Climate Research Programme (focusing on the physical climate system) and International Human Dimensions Programme (examining societal roles and responses). See Figure 2.

The success of the programme generated new and important knowledge about the workings of the planet[2]. By integrating

**Figure 1: The Skylark SL1203**

**(a) X-ray astronomy payload ready for launch**

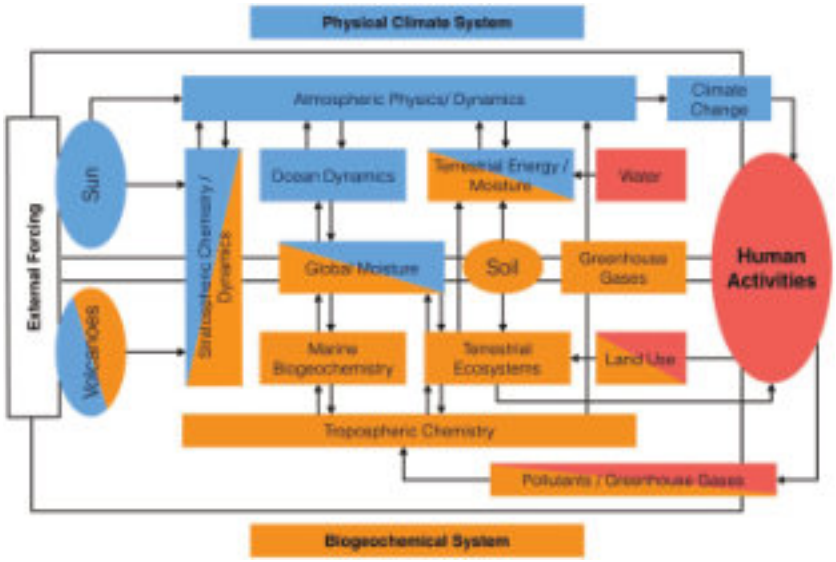
**(b) The launch in February 1974**

An earlier version of this article appeared in the King Edward's School Bath *OELink Magazine* 2024

these efforts – now combined as the programme Future Earth (https://futureearth.org) – we generated new insights about how the Earth's systems function – insights that would have been impossible by means of independent research projects.

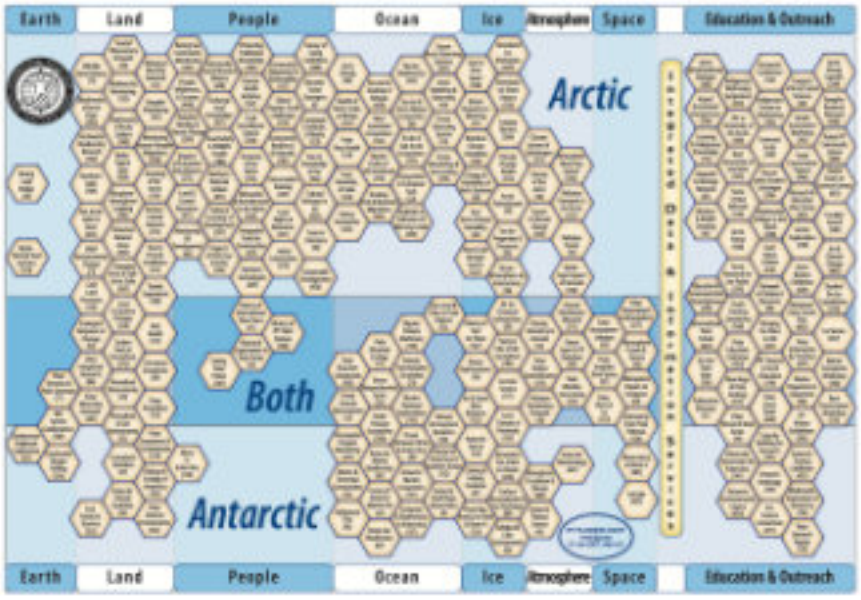
A similar approach proved successful when I chaired the Planning Committee for the International Polar Year 2007–2008. This ambitious campaign, sponsored by the International Council for Science and the World Meteorological Organisation, built on the heritage of the International Geophysical year 1957–1958 to bring together 50,000 researchers from over 60 nations in an integrated research effort to explore and characterise the Polar Regions[3].

**Figure 2: A schematic of the Earth system showing the domains of the International Geosphere-Biosphere Programme (orange), the World Climate Research Programme (blue) and the International Human Dimensions Programme (pink) before they merged in to 'Future Earth'**




Source: Mauelshagen F (2014) Redefining historical climatology in the Anthropocene. *The Anthropocene Review*, 1. Adapted from the 'Bretherton Diagram' produced for NASA by Francis Bretherton (Earth System Science Committee, NASA Advisory Council (1986) *Earth System Science. Overview. A Program for Global Change*, p. 19).

**Figure 3: International Polar Year 2007–2008 projects showing their distribution in terms of topic of study and polar focus**




Credit: Dave Carlson

Its objectives were to explore new frontiers, to deepen our understanding of polar processes and their global linkages, to increase our ability to detect changes, to attract and develop the next generation of polar scientists, engineers and leaders, and to capture the interest of the public and decision-makers. It comprised 228 international projects – 171 scientific and the rest focused on education and outreach (Figure 3).

The scale and depth of the initiative yielded a snapshot of the state of the polar regions for future reference, and new understanding of these critical Earth system environments[4].

Following International Polar Year scientific conferences in St Petersburg in 2008 and Oslo in 2010, the final conference "*From Knowledge to Action*" took place in Montreal in 2012. The event attracted participants from academia, industry, non-governmental organisations, education, Arctic communities, and circumpolar indigenous peoples. Together those groups shared and applied the new scientific findings to address policies and decisions in reaction to accelerating polar change. A strong emphasis was placed on the participation of the indigenous peoples, whose welfare and livelihoods are especially at risk.

Since then, interdisciplinary synthesis has been a hallmark of the research programme that I led at British Antarctic Survey, and of the galleries (especially the 'atmosphere' climate science gallery) that were installed when I was Director of the Science Museum.

More recently, I have been collaborating with neuroscientists, psycho-sociologists and communications specialists to investigate why the global response to climate and environmental crises falls short of what the science deems is necessary. As an experimental scientist with a physical sciences background, I was initially taken aback by how little I had previously understood about the limitations of my primary observational instrument – my own brain. I had

**Figure 4: The process by which the UCL Climate Action Unit assembles the pieces of knowledge to create the 'Agency to Act' on climate change**


Credit: Kris De Meyer and Lucy Hubble-Rose

assumed that presenting overwhelming evidence would lead society to reasoned action. My colleagues in behavioural sciences, however, found this expectation amusingly naive.

At University College London, I Chair the Climate Action Unit (www.ucl.ac.uk/climate-action-unit)[5] which applies key insights from the mind sciences to help organisations, decision makers and the general public who wish to act on climate change but are confronted by psychological or institutional barriers that block or hinder progress. Our mission is to transform how society responds to climate change, intervening at a scale where 'The planet will ultimately notice'. Grounded in a systems-based understanding of why governments, businesses, institutions, civil society, and individuals struggle to act at the necessary scale and pace, we focus on unlocking this inertia. Rather than conducting research, we deliver tangible outcomes and impacts to accelerate progress towards Net Zero and enhanced adaptation.

Our approach is rooted in behavioural science. We design and facilitate targeted interventions that bridge disciplines and expertise, solve communication and collaboration challenges, and remove barriers to action. A key insight is that the conventional 'linear' model of communication – assuming facts alone drive behaviour – is flawed. Instead, recognizing that 'Actions drive Beliefs' enables a virtuous cycle of engagement and commitment. Through carefully structured workshops and events, we empower key actors to discover their 'Agency to Act' (Figure 4).

Daniel Kahneman, the Nobel laureate in economics, describes the human mind as "a machine for jumping to conclusions", noting that "Thinking to humans is as swimming to cats – We can do it, but prefer not to". In practice, people filter information based on preconceptions and often act against their own best interests. Social influence is particularly powerful, meaning that storytelling and demonstrable examples are far more effective than raw data in motivating action. Self-persuasion, generated from experience of action, can lead to a virtuous spiral of strengthening resolve. These insights should be integral to policymaking, just as they are now shaping research communication and the delivery of 'actionable information'.

The climate crisis, like my childhood jigsaw puzzles, requires assembling diverse pieces into a coherent picture. Interdisciplinary collaboration and the co-production of actions – between scientists, economists, behavioural experts, business leaders, and policymakers – are the key to unlocking progress. By breaking down silos and fostering synthesis, we can generate the knowledge and agency necessary to navigate the defining challenges of our time. These are insights and skills not commonly taught to natural scientists, who have much to learn from the world of social and behavioural research. As a parliamentarian, you face the same challenge: making sense of complex, interlinked issues and translating insights into meaningful policy and legislation.

The upshot is that I find myself still discovering and assembling new and unexpected jigsaw pieces – and being astonished and inspired by the pictures that emerge!

## References


[1] Rapley CG, Bell Burnell J, Culhane JC (1976) Observations of the soft X-ray diffuse background, *Advances in Space Research* XVI:839–846.

[2] Rosswall et al. (2015) Reflections on Earth System Science, *Global Change* 84.

[3] Rapley CG and Bell (2004) *A Framework for the International Polar Year 2007–2008,* Paris, International Council for Science.

[4] National Research Council (2012) *Lessons and Legacies of International Polar Year 2007–2008*, The National Academies Press.

See also Krupnik I et al. (eds) (2011) *Understanding Earth's Polar Challenges: International Polar Year 2007–2008.* University of the Arctic and ICSU/WMO Joint Committee for International Polar Year 2007–2008.

[5] See also Roberts F, De Meyer K, Hubble-Rose L, Rapley C (2021) Climate change is the elephant in every room, *Science in Parliament* 77(3):28–30.

# New Approach Methodologies

## New wine in old bottles or old wine in new bottles?

**Dr Isabelle Guelinckx**
Executive & Science Director, ILSI Europe

**Dr Bryan Hanley**
ACTA, Amsterdam, Vice-President, ILSI Europe

### Introduction – what are NAMs

New Approach Methodologies (NAMs) have attracted considerable attention. In essence NAMs are new and advanced ways of assessing the environmental and health risks posed by chemicals including pharmaceuticals, environmental contaminants and substances found or created in foods. The drivers for the development of NAMs includes economic, ethical and scientific issues. These include the cost, ethical challenge and scientific relevance to humans of traditional animal testing and the availability of advanced techniques including AI-supported techniques, more relevant *in vitro* technologies, high throughput screening and omics technologies.

### NAMs and the pharmaceutical industry

The concepts of using NAMs is part of the move to reduce, refine and replace animal models (3Rs), which was first introduced as a unified concept in 1959[1]. Chemistry and toxicology are reductionist disciplines[2] which seek to examine the properties of individual compounds in their interaction with complex, living systems. For the pharmaceutical industry, this has led to attempts to identify the most biologically salient aspects of living systems (for example, particular receptors) and to develop rapid screening techniques. Structure/activity relationships (SARs) have been at the forefront of the industry, however over 90% of drugs fail to reach the market and it has been suggested this is a consequence of the use of SARs rather than also including considerations of uptake and metabolism[3]. The development of more complex in vitro systems such as organoid culture and 'lab on a chip' methodology is designed to strike a balance between complexity and coherence. The effect/no effect dichotomy of pharmaceutical research allows for very targeted systems with few confounders to be developed. This does not apply to food systems with multiplicities of components causing multiple effects.

### NAMs – global initiatives

In addition to the long-standing initiatives promoted by organisations such as the European Centre for the Validation of Alternative Methods (ECVAM), which was founded in 1993 under the directorship of Professor Michael Balls[4], the more recent interest in NAMs has led to (and produced) a number of initiatives including initiatives by the EC ("to valorise emerging technologies, tools, standards and infrastructure for use in food systems")[5], UK Research and Innovation [6], the FDA[7] and industry[8]. Further investment in the application and use of NAMs is likely in the near future – once regulatory standards are adopted and approval of methodologies is achieved.

### NAMs in food systems

The opportunities for the use of NAMs in food systems are considerable. The Food Standards Agency in the UK has developed a NAMs roadmap and the European Food Safety Authority (EFSA) have developed a similar initiative[9]. These are precursors to the development of a regulatory framework for the production of an approval process for NAMs in the food sector. The problems associated with the assessment of benefits, risks and hazards derived from food systems are well known. The first of these is the size of the effect which, on an individual component or system at a specific timepoint, is often small and difficult to separate from confounders. The second is that foods are generally consumed over an extended period of time so any effect must be measured over a significant time period[10] and be representative of exposure at different ages and for different periods.

### NAMs in food systems – main stakeholders

The stakeholders in the development and use of NAMs are regulatory authorities, industry and consumers (who must have confidence in the safety and wholesomeness of food). In addition, those tasked with enforcement must be able to call upon scientifically rigorous and valid methods for NAMs which have gained the acceptance and approval of all stakeholders.

### ILSI Europe – role and function

The Europe branch of International Life Sciences Institute, (ILSI Europe') was created almost 40 years ago. Its role is to support the creation of a safe and nutritious food supply through decisions informed by science and collaboration across sectors. ILSI Europe develops, communicates & disseminates science-based guidance to tackle food, public health and sustainability challenges by facilitating collaboration and consensus building between academic, industry and public service experts. All the work carried out by ILSI adheres to rigorous

principles of scientific integrity including objectivity, clarity, transparency and reproducibility[11]; All of it is published in open access journals, mostly Q1 journals after the normal process of peer review. As a non-profit organization, ILSI Europe operates through in-kind contributions of experts, meaning that scientific investigators are not offered remuneration geared to the outcome of the research project. ILSI Europe receives funding from member companies, the European Union-funded projects they partner with and from projects initiated by Member States' national authorities.

## ILSI Europe and stakeholders – communication

ILSI Europe works through a number of Task Forces commissioning Expert groups. These operate under three core pillars – Food Nutrition and Health, Food Safety and Quality and Sustainability. In addition, ILSI Europe is an active participant in a number of EU (Horizon) projects and in COST coordination actions. The publicly funded projects are reported and disseminated using accepted methodologies. Task Forces report to the independent Scientific Advisory Committee and results are disseminated through peer-reviewed publications, workshops and conferences.

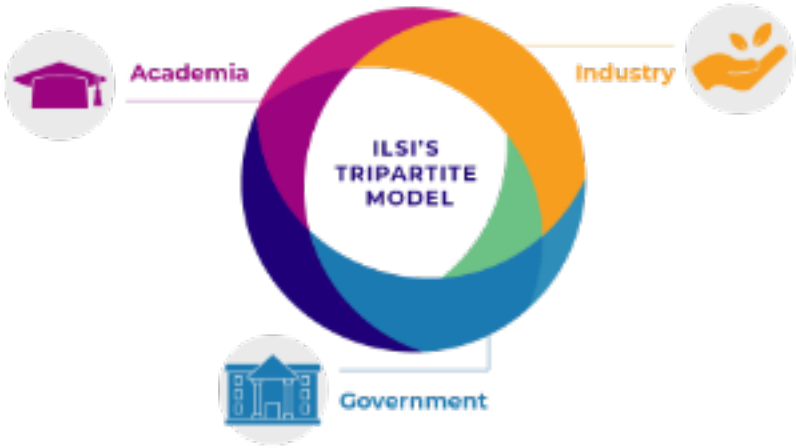
## An unbiased and transparent Food NAMs system

ILSI Europe seeks to create a 'consortium of the willing' to develop an unbiased and transparent Food NAMs system. Coordination of the three groups of the ILSI Europe tripartite model (academia, policymakers and industry) will ensure that any resultant system is effective, benefits from the active engagement of all three groups and is fit for purpose. Crucially, it must also gain the trust of consumers. ILSI Europe can support Europe to take the lead in the development and implementation of NAMs.

**Figure 1: ILSI Scientific integrity principles to develop sound science that benefits society**


Source: Rowe S et al. (2009)[11]

**Figure 2: ILSI Europe facilitates collaboration and consensus building between academic, industry and public service experts**




### References


[1] Russell WMS. and Burch RL (1959) *The Principles of Humane Experimental Technique*, London: Methuen.

[2] Hanley B (2025) Natural Product Chemistry. Reductionism and Biosynthesis. *In: Natural and Unnatural Product Chemistry*. Cham: Springer. doi.org/10.1007/978-3-031-81698-7_1

[3] D Sun, W Gao, H Hu, S Zhou (2022) Why 90% of clinical drug development fails and how to improve it? *Acta Pharmaceutica Sinica B* 12(7): 3049–3062

[4] Balls M (2022) The establishment of ECVAM and its progress since 1993. *Alternatives to Laboratory Animals* 30(suppl 2):5–11. https://journals.sagepub.com/doi/10.1177/026119290203002S02

[5] European Commission: Directorate-General for Research and Innovation (2020) *Food 2030 Pathways for Action – Food Systems and Data*, Publications Office of the European Union, https://data.europa.eu/doi/10.2777/406637

[6] Innovate UK et al. (2015) *A non-animal | Technologies Roadmap for the UK. Advancing Predictive Biology*. www.ukri.org/wp-content/uploads/2015/11/IUK-071221-RoadmapNonAnimalTech.pdf

[7] Nelson CP et al. (2024) Advancing alternative methods to reduce animal testing.*Science* 386 (6723): 724–726. www.science.org/doi/10.1126/science.adg6228

[8] Sewell F et al. (2024) New approach methodologies (NAMs): identifying and overcoming hurdles to accelerated adoption. *Toxicology Research (Cambridge)*.13(2): tfae044. https://academic.oup.com/toxres/article/13/2/tfae044/7634804.

[9] Escher SE et al. (2022) Development of a roadmap for action on new approach methodologies in risk assessment. *EFSA Supporting Publications* 19(6) https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/sp.efsa.2022.EN-7341

[10] European Food Safety Authority (2013) Considerations on the applicability of OECD TG 453 to whole food/feed testing. *EFSA Journal* 11(7):3347 https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/j.efsa.2013.3347

[11] Rowe S, et al. (2009) Funding food science and nutrition research: finiancial conflicts and scientific integrity. *American Journal of Clinical Nutrition* 89(5):1285–91 https://ajcn.nutrition.org/article/S0002-9165(23)23785-5/fulltext

# The role of engineers in achieving a sustainable future

**Nick Starkey**
Director, Policy & International,
Royal Academy of Engineering

## Introduction

The challenge to engineers in achieving a sustainable future is clear yet daunting: we must accelerate both adaptation to and mitigation of climate change, while embedding nature-positive practices across engineering. This means not only decarbonising existing systems but also expanding low-carbon solutions in a climate-resilient manner whilst minimising environmental impact. These are not just engineering challenges, but broader societal challenges with engineering, technology, and systems thinking at their core. Let's look at some examples of what that means in practice.

## Decarbonising the electricity system

The Government entered office pledging to accelerate decarbonisation of the electricity system.

A stable, resilient, decarbonised, and flexible electricity system, growing over time to twice, perhaps even three times its current size, is essential for the UK's industrial strategy and sustainability goals. The National Engineering Policy Centre (NEPC), a partnership of engineering organisations led by the Royal Academy of Engineering, looked at how this might be achieved. The report, co-chaired by Sir Patrick (now Lord) Vallance HonFREng and Simon Harrison FREng, sets out the designing architecture of what needs to be done, involving governance, planning, procurement, regulation, and digitisation. This transformation involves all forms of engineering, from electrical, civil, mechanical, chemical and systems engineering, and will require many things to be done in an integrated way.

### Strong central leadership and governance

Transforming the power system is a major infrastructure programme requiring empowered leadership accountable to the Prime Minister. Creating 'Clean Power Mission Control' was a good first step, and including engineers within the 'Clean Power Commission' which is advising the officials in Mission Control was wise. The challenge goes well beyond conventional policy planning, to include engagement with industry and, crucially, systems integration to ensure the many elements of the new system work together effectively and efficiently.

### A flexible, digitally enabled system

The new system must be digital-first and cyber-secure to manage a complex, renewables-based system efficiently. This can deliver consumer benefits and lower costs and make best use of the infrastructure we already have. But experience of other engineering mega-projects attests that digitisation cannot be a bolt on, an afterthought once the physical requirements of the system have been looked after; the system must be designed around it. Countries that are further along with system digitalisation, such as France, are reaping the benefits of doing so.

### Proactive procurement and regulation

The transition to a decarbonised grid is a challenge to the way in which the UK has hitherto done procurement and investment. Before now, a strategy of delaying infrastructure investment until really needed has often been a sensible wish to protect the exchequer and consumers from unnecessary cost. But the situation is markedly different now. The UK simply won't have the infrastructure it needs unless it is happier to make investments ahead of demand, in the knowledge that so called 'stranded assets' aren't likely given the scale of the expansion required. Similarly, a less cautious approach to procurement which gives industry sight of the pipeline ahead is more likely to enable the UK to get to the front of the queue in tight global supply chains, as multiple countries race to redesign their electricity systems. Controlling costs is important, and markets have their place, but it is the lesson of many infrastructure projects that delay quickly leads to escalating expense.

### Planning and consenting

Two major sources of delay are the long lead times for building new transmission infrastructure, and the time it takes to secure a grid connection. Streamlining planning and consenting in a sensitive and intelligent way is an absolute requirement for progress. Communities have a right to be engaged respectfully about a transformation which will impact on the landscape and will require their support. The Electricity Networks Commissioner's Report of August 2023 set out a comprehensive set of recommendations for how these may be addressed together, not seen as opposites, and it is good to see recent developments in that direction from the Strategic Spatial Energy Planning led by NESO to concrete proposals for community benefits.

### Long-term vision

While the 2030 pledge is a significant milestone, full decarbonisation of the economy is the greater prize, and the needs of that more sustainable economy must always be kept in view, to ensure actions taken now in pursuit of accelerated progress do not compromise future objectives.

## Sustainability of AI

AI has a positive role to play in environmental sustainability: supporting better planning to help optimise energy

use, improving resource efficiency, and accelerating innovations in sectors like renewable energy, transportation, and agriculture. Smarter, AI-enabled systems and automation can reduce waste, enhance climate resilience, and support efforts to achieve net-zero carbon emissions.

But AI has environmental impacts of its own, and these will increase as AI is more widely used. Large AI models require vast computational power, consuming as much energy as several hundred homes annually, increasing carbon footprints. The data centres AI relies upon account for around 1% of global electricity use, and AI's environmental impact could grow unsustainably without more energy-efficient, renewable-based data centres.

The National Engineering Policy Centre report Foundations for Sustainable AI looks right across the AI lifecycle to see how we can avoid locking ourselves into an unsustainable model of AI.

The report recommends **improving environmental reporting**, requiring engineers and organisations to disclose AI systems' environmental impacts, including energy and water consumption and carbon emissions. It suggests **enhancing lifecycle transparency**, collaborating closely across the AI value chain to improve transparency about environmental impacts throughout the AI lifecycle, from development to deployment.

Establishing **clear standards for data centres** could improve their efficiency and encourage a transition to renewable energy sources, transitions governments can incentivise through supportive policies.

**Adopting data reduction practices** is crucial. Changes such as using smaller datasets or creating shared libraries for existing data can help to reduce the need for massive computational resources for data storage, lowering energy consumption.

Finally, whilst the fiscal environment is tight, government investment can favour green AI technologies to create sustainability frameworks, and thoughtful regulation can enable innovation while limiting AI's negative environmental impacts.

In conclusion, the report underscores the shared responsibility of engineers and government in advancing AI in a way that is both innovative and environmentally responsible.

## Critical materials

In making these large-scale shifts, it is vital that we are mindful of the potential environmental and economic implications of how we go about it. The UK's dependency on materials mined elsewhere poses significant risks to its resilience and economic prosperity. Significantly the global transformation of infrastructure to achieve net zero, alongside others needs, will only increase global demand raising the need to limit the environmental and social damage caused by extraction, processing and supply of materials.

As an illustration, a recent report from the National Engineering Policy Centre estimates that the UK is on course to need 268,000 tonnes of lithium metal by 2040 for battery electric vehicles (BEVs), the mining of which would displace 438 million tonnes of earth. Lithium extraction, primarily from South American brines, has severe environmental and social impacts, including ecosystem degradation and harm to indigenous communities.

This is not an argument for avoiding climate change mitigation, the importance of which should not be in doubt. We do, however, need to apply strategic forethought and do what we can to limit the negative impacts of our transition – the NEPC report sets out how (see Box).

Without intervention, the UK risks not achieving Net Zero and being overly exposed to future economic uncertainty. But this is not something we have to accept as inevitable. To return to electric cars, reducing battery sizes by 30% by 2040 could mitigate lithium requirements by 17%, equivalent to 75 million tonnes of rock, while designing lithium out of battery manufacture could help further. The report provides 25 recommendations for policymakers on how to take this approach further, including developing

**Box: National Engineering Policy Centre report recommendations**

Infrastructure and technology planning

It is crucial to integrate both material requirements and end-of-life considerations into infrastructure planning across energy, transport, and digital systems. This includes considering the material demands of wind turbines, solar panels, batteries, and nuclear power – and planning for the economic recovery and/or safe disposal of those materials when they have served their purpose. There are too many examples of the problems caused by failing to look far enough ahead, from nuclear to plastics (not to mention the opportunities for domestic sources of critical materials provided we design for their recovery now); there is a closing window of opportunity to do differently this time.

Design and design skills

Smart design changes can minimise or eliminate the need for critical materials, through material substitution, reduction, and can also ensure we design for extended product life, reuse, and recovery. We need to accelerate and pull through exciting research and best design practices and make this a widespread reality.

Circular economy

Ensuring that materials used can be recovered, reused, or recycled can reduce our 'linear' economy's impact and promote a more sustainable use of resources. For examples, a 6MW offshore wind turbine uses 5,800kg of neodymium magnets, and the UK's existing stock represents a trove of high value materials. Better inventories can help policy makers to know when, where and how much of this neodymium will come available, enabling better re-use. Increasing more decommissioning capacity can improve our ability to recover materials, whilst design changes can make them easier to recover and recycle, as the material's high value is slashed if it is encased in epoxy resin and costly to extract.

an integrated materials strategy, establishing a National Materials Data Hub, and targeting a 15% whole-system energy demand reduction.

## A wider perspective

We tend to tackle large problems by breaking them down into more manageable pieces, and this approach can be very successful, but the transition to a more sustainable UK must go beyond a series of single point solutions in several ways.

**A whole lifecycle perspective.** The cuts to material consumption and the more sustainable AI discussed above both require us to think across the whole lifecycle, and to build consideration of sustainability into every stage.

**A whole system perspective.** Designing more sustainable AI, expanding the grid, and addressing materials demand are issues which overlap in many ways, with many dependencies stretching in multiple directions. A complex engineering project will typically have a chief engineer charged with ensuring with systems integration across the many sub-systems and processes it involves. There is many a government project which could use a chief engineer!

**A whole planet perspective.** The UK has much to do, often in collaboration with other countries, sometimes in competition. Either way, a global perspective is essential.

The Royal Academy of Engineering's partnership with the Lloyd's Register Foundation through its programme Engineering X has regularly highlighted the need for genuinely inclusive global systems. High-income countries' technology and consumer demands often create vulnerabilities in lower and middle-income countries. For example, the demand for goods has driven shipping expansion without addressing end-of-life solutions for ships, leading to significant safety and ecological impacts in Southeast Asia where many ships are decommissioned.

Similarly, the end-of-life phase of offshore wind infrastructure poses complex challenges: by 2035, over 3.5 gigawatts of offshore wind turbines will reach the end of their operational life, equating to roughly 600 turbines by 2030. Without proper planning, these structures could face unsafe and environmentally damaging decommissioning processes, similar to the issues seen in the shipping industry.

Often these impacts surface many miles from where the systems were designed, tucked conveniently out of sight. Policy makers are under huge pressure to move the dial on sustainability, and it can sometimes feel that thinking about end-of-life can wait for another day. It can't. Acting now to develop safe and sustainable end-of-life practices is crucial to avoid unnecessary future harm.

## Engineering the future

Engineers are essential in addressing these challenges. They are systems thinkers who can integrate technology, finance, policy, and logistics. We need more engineers, and a more diverse supply of them, engineers with the technical skills we need, but also the ability and confidence to lead beyond their specific field. The NEPC's Engineers 2030 project has developed a vision and principles for the future engineer and is now exploring how the UK's education and skills systems must change to deliver the engineers we need; the findings will be published later this year. With sufficient engineering expertise we can make significant contributions to local and global sustainability both in this Parliament and beyond.

# Tick and flea treatments

## A hidden chemical threat in our waterways


**Dr Leon Barron**
Reader in Analytical and Environmental Sciences, Imperial College London

**Professor Guy Woodward**
Professor of Ecology, Imperial College London

**Dr Tilly Collins**
Senior Fellow & Deputy Director, Centre for Environmental Policy, Imperial College London

**Dr Rosemary Perkins**
Veterinary Surgeon and University of Sussex

**Dr Andrew Prentis**
Veterinary Surgeon and Visiting Fellow, Grantham Institute, Imperial College London

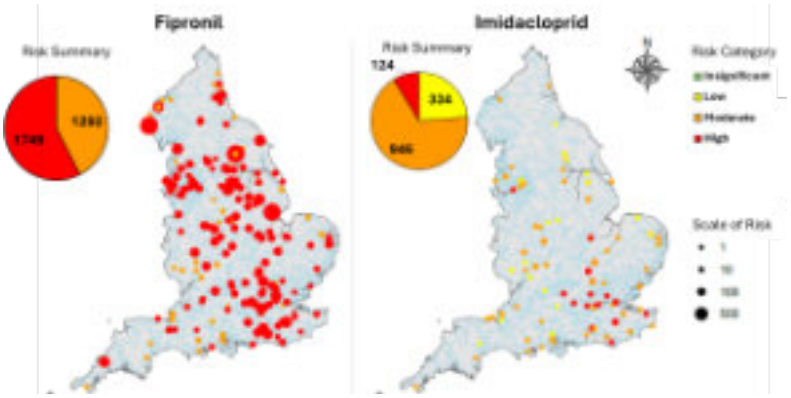
**Dr Wendy Hein**
Senior Lecturer in Marketing, Birkbeck University of London


The poor state of waterways is a source of public anger. In England, only 14 % of rivers have 'good' ecological status. More worryingly, no English river now has good chemical status. Chemicals enter our environment in many ways, with the dominant routes including agricultural and surface runoff as well as wastewater. Approximately 350,000 chemicals are used commercially worldwide[1] and while many are beneficial, safe to use and not harmful in the environment, we understand very little about the wider impacts of the vast majority, especially when present in mixtures.

Of all the organic chemicals monitored in UK waters by the Environment Agency, a common pet parasiticide (fipronil) was ranked highest in terms of environmental risk[2] (Figure 1). We found that another pet parasiticide (imidacloprid, a neonicotinoid) also presented risks to aquatic invertebrates in urban water bodies impacted by wastewater[3]. These are the same chemicals that were banned by 2018 for use in outdoor agriculture in the EU and UK because of their devastating effects on pollinators. For context, one typical monthly dose of imidacloprid for a large dog is enough to kill 25 million bees[4]. There are over 21.4 million pet dogs and cats in the UK, with many receiving preventative routine treatments for ticks and fleas, even in the absence of any evidence of infestation.

In this article, we explore this issue and outline how and why these pet parasiticides are entering our surface waters to a degree that makes them a major cause for concern. We also propose practical recommendations to help manage their risks.

**Figure 1: Locations and environmental risk of two tick and flea treatments to aquatic life (Environment Agency samples, June 2018–June 2024)**




Risks calculated using measured environmental concentrations and lowest predicted no-effect concentrations (PNEC) to aquatic wildlife published by the Norman Network Ecotoxicology Database (accessed 17/3/2025) Risk Categories: Insignificant risks <0.1, low risk =0.1–1.0; moderate risk =1.0–10; and high risks >10.

Pie charts show number of samples that tested positive and how many fell into each risk category.

### Why the major source of tick and flea treatments in our environment is wastewater

Before chemical products are marketed, an environmental risk assessment is required. For this, the hazard (its potential to cause harm) and exposure (the degree to which organisms come into contact with it) need to be characterised. Hazard and exposure combine to give us the scale of risk. Despite being persistent on pet fur and broadly toxic to invertebrates, an assumption still exists that there is little chance of pet parasiticides reaching the environment, negating an in-depth risk assessment under current policy[5]. This assumption is inaccurate, and multiple routes have been shown to exist (Figure 2). For example, Perkins et al. measured three "down the drain" routes for fipronil and imidacloprid following use in spot-on flea products[6]. Bathing, pet bed laundering and hand washing all contributed to wastewater contamination. Other unquantified sources exist including washing of upholstery, clothing and fabrics, surface contamination (e.g., floor mopping, etc.), and disposal of pet excreta, dust and hair via toilets, among others. After a single treatment, pesticide residues were still washing off for at least 28 days, including from the owner's hands. Importantly, current wastewater treatment is ineffective at removing some of these chemicals, especially fipronil and imidacloprid.

Aside from wastewater, pet swimming has been suggested as a major source of water contamination. Datasheets for spot-on tick and flea treatments provide guidance on how long to wait before swimming should be allowed, to minimise loss of treatment efficacy, but also to mitigate environmental contamination. However, these vary (e.g., from two to four days) and are rarely based on product-specific data. In park ponds designated for dog swimming, parasiticide concentrations are often high, but dilution reduced downstream transmission[7]. This was also found to be the case in rivers regularly used by dogs as this direct contamination was dwarfed by that of wastewater influx[3 8]. It is currently unclear whether this route really dominates over wastewater sources.

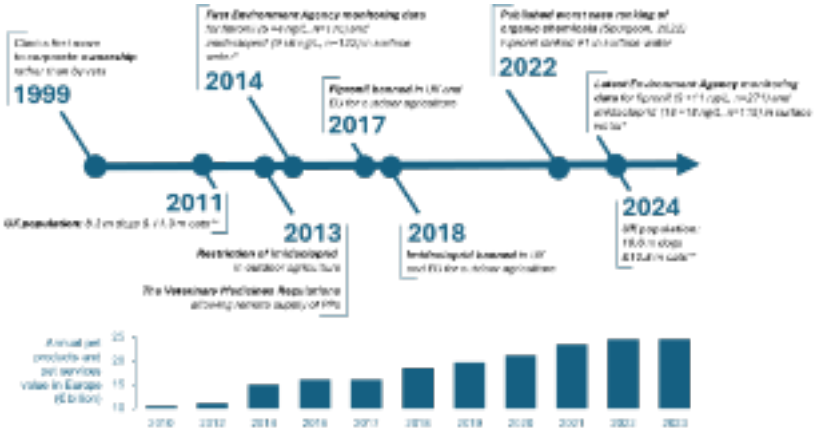
## Negative impacts of pet parasiticides

Tick and flea treatments are not designed to harm humans and are currently considered low risk, with The Veterinary Medicines Directorate suggesting ≤1 adverse event in humans for every 10,000 doses in collars, spray or spot-on treatments[9]. Imidacloprid is among the most intensively studied of these pesticides, and is known to be harmful to a wide range of non-target wildlife and natural ecosystems, which led to its ban for outdoor agricultural use in 2018. Together with other neonicotinoids, it has been implicated in negative impacts on terrestrial ecosystems, including the recent continental-scale declines in European farmland birds. Its impacts also spill over into other ecosystems, with fresh waters being particularly vulnerable, and many invertebrates such as mayflies, shrimps and dragonflies are highly sensitive to it. Impacts can range from sublethal effects (e.g., impaired feeding, growth and reproduction) to direct mortality via toxic poisoning. In addition to direct impacts, these chemicals can trigger a range of indirect effects as they ripple through food webs, for instance by removing important prey species. As a result, predators, such as fishes, may be left without food, and other stressors can also interact to amplify (or mask) chemical impacts. Recent large-scale field experiments have shown that imidacloprid simplifies entire freshwater food webs, especially when combined with warming[10].

**Figure 2: Major activities leading to environmental contamination with pet tick and flea treatments**


The major route to the environment is given in parenthesis.

**Figure 3: Key events in surface water contamination with pet parasiticides (1990–2024) and annual value of pet products and services (2010–2023)**




* Environment Agency Water GC-MS and LC-MS semi-quantitative screen dataset.
** Pet Animal Wellbeing (PAW) reports 2011 and 2024 published by the People's Dispensary for Sick Animals.

## The changing market in the UK

Major changes have occurred in the pet tick-and-flea treatment market over the past 25 years (Figure 3). Most importantly, there has been a shift away from reactive treatment (i.e., treatment in response to a parasite being identified) towards blanket preventive treatment of large populations of pets, many of whom will not have fleas or been examined or risk assessed. This is now widespread practice and reinforced by product advertising to both vets and pet owners. Subscription schemes are part of business models of most clinics (over 60% of which belong to one of six major corporate veterinary groups). These schemes routinely include parasite treatment, despite the relatively low incidence of most parasites being treated. The ongoing Competition and Markets Authority investigation recently reported that 37% of pet owners now subscribe to at least one of these schemes. Pet ownership, particularly in urban areas, has changed over the past two decades, with a dramatic 150% rise in related commercial activity (Figure 3). This includes increased demand for premium pet foods, an explosion of pet shops selling luxury items and pet insurance, all reflecting a perceptual shift away from consumers as pet 'owners' to pet 'parents'. In addition to substantial e-commerce and over-the-counter pesticide sales, many insurance schemes exist, which do not always cover preventative application with tick and flea treatments[11].

## The mechanisms for change

Behavioural science has been frequently implemented in policy interventions, for example aimed at creating safer communities, the 'good society', or healthy and prosperous lives (e.g.,

MINDSPACE[12]). Changing pet owners' consumption of pet parasiticides requires careful consideration. It is likely that many consumers follow veterinary advice on preventative treatment, and a change in how advice is given and followed is warranted. It is important that veterinary expertise is not undermined, but that scientific evidence is fed into the process of adjusting consumer behaviour regarding parasiticides. If change rests on individual choice (to consume or not to consume), the change may be slower than the environmental risk demands. Change by choice may be adjusted through other measures, for example price changes, which have a more punitive and reinforced effect. Of course, this punishes consumers who are reliant on these medications indiscriminately. Measures may be required to target communities as groups rather than as individuals, and more broadly consumer norms, beliefs, emotions (such as fear of flea infestation) and, importantly, habits. Regular, preventative application of pet parasiticides has arguably now become ingrained in the care habits of many owners and belief in the effectiveness of this practice will likely make it more difficult to change current levels of consumption. It is important that nuanced interventions, which do not hold pet owners responsible for 'environmental pollution', are put in place and align with evidence.

As wastewater is a major source of water pollution, new technologies to improve treatment effectiveness and capacity are urgently needed, particularly for high-risk chemicals including pet parasiticides. Along with technology upgrades, we recently proposed several measures that could lead to reduced risks[13]. Importantly, we do not recommend an immediate ban on their use to minimise 'regrettable substitution' with potentially more dangerous compounds and to continue effective treatment of pets suffering from parasite infestations. That said, we propose a review of their risk assessment and impact policies including for existing products where their active ingredients have been banned in other sectors. Where these continue to fail to meet risk assessment standards, the specific chemicals should be controlled through reclassification to prescription-only status or phased out. In addition, a regulatory threshold to ensure the risks for products that sell above a certain volume in a given timeframe should be introduced. Importantly, we should move away from preventative use to risk-based use to reduce water and household contamination but also pesticide resistance. This includes better guidance on disposal of used products.

The Royal College of Veterinary Surgeons, the British Veterinary Association and the British Small Animal Veterinary Association now advise against blanket treatment and recommend a risk-based approach to parasite control in pets, targeting preventative use to higher-risk animals. Effectively applying this would enable more judicious use of parasiticides, minimising the likelihood of resistance, unnecessary treatments and environmental harm. The risk of human disease from pet parasites (zoonoses) such as Bartonella (Cat Scratch disease) or Toxocariasis has been used to justify routine, preventative parasite treatment. Such diseases are rare in the UK[14 15]. In the absence of evidence, we argue that blanket parasite treatment cannot be justified based on zoonotic disease prevention, and a risk-based approach is surely more responsible.

In conclusion, pet parasiticides represent a 'hidden' threat to our environment and widely contaminate our waterways. There is a need for balanced, interdisciplinary guidance on their responsible use and control, which considers animal, human and environmental factors. Pet owners should be aware of the risks and benefits of treatments, and further interventions in consumption of pet parasiticides require careful consideration.

## References


[1] Wang Z et al. (2020) Toward a global understanding of chemical pollution: a first comprehensive analysis of national and regional chemical inventories. *Environmental Science & Technology* 54, 2575–2584. https://doi.org/10.1021/acs.est.9b06379

[2] Spurgeon D et al. (2022) Worst-case ranking of organic chemicals detected in groundwaters and surface waters in England. *Science of The Total Environment* 835, 155101. https://doi.org/10.1016/j.scitotenv.2022.155101

[3] Egli M at al. (2023) A One-Health environmental risk assessment of contaminants of emerging concern in London's waterways throughout the SARS-CoV-2 pandemic. *Environment International* 180, 108210. https://doi.org/10.1016/j.envint.2023.108210

[4] Little CJ, Boxall AB (2020) Environmental pollution from pet parasiticides. *Veterinary Record* 186, 97–97. https://doi.org/10.1136/vr.m110

[5] *The Veterinary Medicines Regulations 2013*, www.legislation.gov.uk/uksi/2013/2033/contents

[6] Perkins R et al. (2024) Down-the-drain pathways for fipronil and imidacloprid applied as spot-on parasiticides to dogs: estimating aquatic pollution. *Science of The Total Environment* 917, 170175. https://doi.org/10.1016/j.scitotenv.2024.170175

[7] Yoder LE et al. (2024) Dog swimming and ectoparasiticide water contamination in urban conservation areas: A case study on Hampstead Heath, London. *Science of The Total Environment* 955, 176686. https://doi.org/10.1016/j.scitotenv.2024.176686

[8] Richardson AK et al. (2022) A miniaturized passive sampling-based workflow for monitoring chemicals of emerging concern in water. *Science of The Total Environment* 839, 156260. https://doi.org/10.1016/j.scitotenv.2022.156260

[9] *Ectoparasiticide Veterinary Medicinal Products Containing Fipronil, Imidacloprid, and Permethrin* (2023). www.gov.uk/government/news/ectoparasiticide-veterinary-medicinal-products-containing-fipronil-imidacloprid-and-permethrin

[10] Zhang P et al. (2025) Multiple stressors simplify freshwater food webs. *Global Change Biology* 31, e70114. https://doi.org/10.1111/gcb.70114

[11] Noble Futures (2023) *Pet Industry in the UK in 2023: Trends and Opportunities*, https://noble-futures.com/pet-industry-in-the-uk-in-2023-trends-and-opportunities

[12] Dolan P et al. (2010) *MINDSPACE: influencing behaviour for public policy*, https://www.instituteforgovernment.org.uk/sites/default/files/publications/MINDSPACE.pdf

[13] Preston-Allen RGG et al. (2023) *Are Urban Areas Hotspots for Pollution from Pet Parasiticides?* Grantham Institute Briefing Note No 15, https://doi.org/10.25561/102699

[14] Patterson J (2023) Toxocarosis in humans: how much of a problem is it in the UK? *DTB* 61, 7–11. https://doi.org/10.1136/dtb.2022.000052

[15] Chaloner GL et al. (2011) Multi-locus sequence analysis reveals profound genetic diversity among isolates of the human pathogen Bartonella bacilliformis. *PLOS Neglected Tropical Diseases* 5, e1248. https://doi.org/10.1371/journal.pntd.0001248



## Acknowledgments

Thanks are extended to the Producing Rational Evidence for Parasiticide Prescription (PREPP) group at Imperial College London as well as William Francis, Alexandra Richardson and Shreya Jei for their assistance with illustrations.

# "So, how do you decide what to write about in POST?"

**Jenny Chapman**
Biology and Medicine Advisor in POST

As an advisor working for the Parliamentary Office of Science and Technology (POST) I get asked this question a lot. People I meet at conferences, parliamentary colleagues and even my friends are keen to find out how we choose the topics for our research.

POST, a bicameral team, produces impartial, evidence-backed and peer-reviewed briefings on topics as diverse as online extremism, quantum technology, food waste and palliative care.

With such a broad remit and the ever-rapid pace of progress in science and technology, there is a thorough process for deciding what to write about, which ensures our publications best suit the needs of parliamentarians.

To give readers an insight into what goes on behind the scenes at POST, I'll explain how one of our recent publications – a briefing about using psychedelic-assisted therapy to treat mental health conditions – was selected, researched and written.

Psychedelic-assisted therapy is the use of psychedelic drugs, such as LSD and MDMA, in combination with therapy. After careful screening, patients undergo therapy before taking the drug and attend additional sessions afterwards to talk about their experiences.

Small clinical trials in hospitals and universities in the UK have shown that psychedelic-assisted therapy can be a safe and effective way to treat certain mental health conditions, such as depression. However, conducting such research is challenging and expensive due to the legal status of psychedelic drugs.

So, how did we choose to write about this topic?

## We focus on what interests parliamentarians…

The POST team keeps a finger on the parliamentary pulse. We get insights directly from members who tell us what issues they would value research on. We also work closely with select committees and Library staff from both Houses to understand what is coming up in Parliament.

We were aware that members from both Houses were concerned about the burden of mental health conditions. As there have been no new antidepressants developed in the last few decades, and existing medications can have limited success, we knew members were interested in novel ways to treat patients.

Psychedelic-assisted therapy was debated in the Commons Chamber in 2023, with the discussion focused on the legal and logistical challenges of using controlled drugs in clinical research.

Also in 2023, the Home Affairs Committee published a report that recommended "urgent" changes to the legal status of some psychedelic drugs to facilitate larger clinical trials.

## … and sometimes on topics that aren't coming up in Parliament!

Sometimes we research topics because they're not being discussed in Parliament.

Through attending events, keeping up with science news and maintaining close contact with stakeholders in research and policy, we get a feel for what's being talked about and what might develop as an issue.

We also conduct regular horizon scans, where we seek input from experts across the UK. The insights they provide give us an overview of emerging themes likely to be of interest to parliamentarians in the next five years. Our recent horizon scan identified over one hundred trends!

## Usually, we conduct research after hearing about a subject inside and outside of Parliament

This was the case for psychedelic-assisted therapy. In addition to the interest from members, several UK universities were involved in clinical trials, and the UK was hosting a major international conference focused on psychedelic drug research. Several high-profile books, films and newspaper articles had also increased public interest in psychedelic drugs and their use in therapy.

## We research complex subjects

Explaining complicated topics in accessible, jargon-free language is what POST does best.

A challenge I faced when writing about psychedelic-assisted therapy was explaining the 'Catch-22' situation that UK researchers find themselves in, due to how controlled drugs are grouped into five 'schedules' (which are categories independent from the 'class' a drug is in).

Schedule 1 drugs are those with no medicinal use, whereas drugs in schedules 2 to 5 are used in medicine with safeguards in place. For example, doctors use heroin as a painkiller, so it is placed in schedule 2, meaning it is stored and administered in hospitals, but its use is tightly regulated.

LSD, MDMA and psilocybin (the chemical found in 'magic mushrooms') are not considered to have any medical use, so are in schedule 1.

Herein lies the problem: UK researchers find it very difficult to conduct clinical trials using schedule 1 drugs due to the costs and paperwork involved. As a

result, large studies with thousands of participants have not taken place, meaning that it is not yet possible to fully understand the efficacy and safety of psychedelic-assisted therapy. Without the results of these trials, policymakers can't decide if psychedelic drugs should stay in schedule 1 or move to a schedule for drugs with a proven medicinal use.

## We cover areas where the evidence base is difficult to understand

In some cases, a topic is complex but the body of evidence behind it is relatively straightforward. In other cases, a topic may appear simple but the evidence behind it is complicated!

To ensure debate, scrutiny and policy decisions are informed by the best available evidence, POST unpicks research findings. We explain what studies can say, and what they cannot, and we highlight evidence gaps. We look at the quality of research, for example, outlining where there's a correlation but not necessarily a causation, or if a survey has a large and representative sample or not. We communicate uncertainty and the reasons behind it.

Due to the challenges of conducting research, clinical trials investigating psychedelic-assisted therapy are relatively small, often involving only 30 to 60 patients. Some trials are even smaller, and sometimes research is based on individual case studies. This means their results are less likely to be generalisable. However, there are pooled analyses, which combine evidence from multiple studies. These analyses suggest that psychedelic-assisted therapy can be more effective, and have fewer side effects, than some commonly prescribed medications.

The potential for confusion when interpreting the evidence base led to POST writing five 'Rapid Response' articles to explain how psychedelic-assisted therapy might treat different mental health conditions. A further briefing outlining policy considerations for psychedelic-assisted therapy research was published in early 2025.

## We write about challenging issues where there are a range of perspectives

Our briefings can cover subjects that some consider controversial. We review published literature, interview experts to capture perspectives and ensure our work is thoroughly peer-reviewed to bring an impartial approach to subjects that evoke a range of opinions.

Psychedelic-assisted therapy attracts commentary from groups including psychedelic 'evangelists', biotechnology entrepreneurs, patient advocacy groups and drug reform campaigners.

Calls to action from these groups often get confused. Some want all drugs to be decriminalised or legalised for recreational use, others want to see psychedelic-assisted therapy available in NHS hospitals, some think patients should be able to take psychedelic drugs home with a prescription, and others are concerned that legitimate use of psychedelic drugs in controlled clinical trials could lead to a rise in illegal use.

By focusing the recent briefing on one specific area (the use of psychedelic drugs in clinical trials to treat patients with mental health conditions), it was possible to tease apart these different views and bring nuance to the debate.

As we were writing about a sensitive issue, it was important to acknowledge the stigma associated with mental health conditions and the use of drugs with illegal classifications.

We write about areas where there have been developments in related policy

Parliamentarians are often keen to understand if there is evidence that a policy has (or hasn't!) worked in the way it was intended, and what should be considered when developing future policy.

In December 2023, the Advisory Council on the Misuse of Drugs, a non-departmental body that advises the government on drug harms, published a report considering the 'barriers to research' for schedule 1 drugs. The report outlined the challenges academics face when conducting clinical trials with schedule 1 drugs, such as costly licences and time-consuming paperwork. It highlighted to us the level of interest in potential updates to policy regarding research using schedule 1 drugs.

## We seek feedback from the POST board

POST has an advisory board comprised of a diverse mix of MPs, peers, representatives from learned societies and senior parliamentary staff. The board provides feedback on proposals for new briefings to ensure our work reflects parliamentarians' interests.

To receive updates from POST, including information on how to get involved in our future research, subscribe at post.parliament.uk/subscribe

**Figure 1: The CIPPRes Clinic - Centre for Psychedelic Research**

An NHS-Imperial collaborative research initiative set up to conduct pioneering psychopharmacology & psychedelic research at St Charles' Hospital.

The CNWL-Imperial Psychopharmacology & Psychedelic Research (CIPPRes) Clinic, launched in early 2021is a collaborative, multidisciplinary research initiative between Imperial College London and CNWL (Central & North West London Mental Health NHS Foundation Trust).

The CIPPRes Clinic is set up to deliver exciting new experimental psychopharmacology research that could have a major positive impact in mental health and neuroscience.

The NHS-based CIPPRes Clinic will be run in close association with Imperial's Centre for Psychedelic Research and Division of Psychiatry where most of the research staff will be anchored.

UK Parliament
POST

The Parliamentary Office of Science and Technology (POST) is an impartial research and knowledge exchange service based in the UK Parliament. POST connects members of parliament with cutting-edge research and evidence. We publish evidence-based, peer-reviewed briefings on a wide range of subjects and have a UK-wide network of researchers and academics ready to share their expertise with parliamentarians. We also help researchers understand parliament and contribute to its work.

## NEW POST RESEARCH

POST research is available to all at **post.parliament.uk**. Recent briefings include:

### Water fluoridation and dental health: 2024 update

POSTbrief, published 10 December 2024

Building on a POST Rapid Response published in 2021, this briefing gives an updated summary of the evidence around water fluoridation and dental health, as well as inequalities in dental health across England. With the Health and Care Act 2022 granting new powers to the Secretary of State for Health and Social Care, there is a renewed focus on managing fluoridation schemes. This evidence can help you understand how expanding these schemes could help address dental health disparities.

### Psychedelic-assisted therapy for mental health: Policy considerations

POSTbrief, published 12 February 2025

This briefing discusses the benefits and risks of psychedelic-assisted therapy (PAT), highlighting its potential uses in mental health treatment. It examines the regulatory challenges and policy considerations for conducting clinical trials with psychedelic drugs, which are currently classified under schedule 1 of the Misuse of Drugs Regulations 2001. We also take a look at public perceptions and the implications of rescheduling these drugs to facilitate research.

### Children's wellbeing in schools

POSTnote, published 6 February 2025

Analyses evidence on the wellbeing of children aged 5 to 16 in mainstream schools in England, in particular the impact of low wellbeing on relationships, behaviour, and academic achievement. This briefing also examines the various psychological, social and cultural practices aimed at improving wellbeing. With the introduction of the Children's Wellbeing and Schools Bill in December 2024, find crucial insights into the role of school culture and the importance of positive wellbeing for learning.

### AI and Mental Healthcare – ethical and regulatory considerations

POSTnote, published 31 January 2025

Examines the ethical and regulatory considerations of using artificial intelligence (AI) in mental healthcare. This briefing summarises the benefits and risks associated with AI tools, including issues of data privacy, bias, and equity of access. Our analysis highlights the need for improved evidence and data quality to support effective deployment, and looks at recent policy activities and collaborative efforts to address these challenges. Read this briefing for insight into the implications of AI in mental healthcare and evidence on its potential to transform treatment and diagnosis.

### AI and mental healthcare – opportunities and delivery considerations

POSTnote, published 31 January 2025

The second briefing in our collection on AI and mental healthcare explores the opportunities and delivery considerations for deploying AI in this area of care. It highlights the potential of AI tools to support administrative tasks and provide direct support to service users, particularly within the context of rising demand and workforce capacity issues. The briefing also discusses innovations from AI in precision psychiatry, which aim to enhance diagnosis, monitoring, and risk prediction of mental health conditions, as well as the need for high-quality data, public trust, and appropriate regulation.

### Planning for net zero

POSTnote, published 6 January 2025

Find out more about the role of England's planning system in achieving the UK's 2050 net zero target. This briefing outlines challenges and opportunities in this area, including the electricity generation system, housing and development, and resourcing and skills. It also looks at calls by stakeholders such as the National Infrastructure Commission to translate national objectives into local plans to support transparency and delivery.

### Energy security and AI

POSTnote, published 10 December 2024

Explores the applications of AI and machine learning (ML) in the energy sector. This includes AI's potential to optimise energy planning, generation, storage, and use by leveraging data from smart meters and other technologies. This briefing also discusses barriers to wider implementation, such as data access, regulation, and infrastructure reliability, as well as concerns around privacy, cyber security, fairness, and ethical use.

### 6G mobile technology

POSTnote, published 2 December 2024

This briefing examines the potential of 6G mobile technology, the next generation of wireless communication after 5G. Expected to be more responsive, reliable, and faster than 5G, 6G aims to support increased data transfer rates and enhanced connectivity. It will likely integrate technologies such as sensing, artificial intelligence, the Internet of Things, and cloud computing. Our analysis also looks at the UK's 6G Strategy, which includes an initial £100 million investment in research, and suggestions from commentators on what is needed to maximise the UK's influence in the development of 6G.

## UPCOMING RESEARCH

Keep an eye out for exciting new POST research being published over the next few months, on topics including:

- Cultivated meat
- Regulation and remediation of 'forever' chemicals
- STEM skills pipeline
- Barriers to digital transformation projects in government
- Impacts of birthrate decline
- The role of public engagement in improving trust in parliamentary systems and scrutiny
- Regenerative agriculture

If you'd like to be notified when new POST research is published on topics you care about, sign up for POST email updates at **post.parliament.uk/subscribe**.

## NEW POST BOARD APPOINTED

Following the 2024 general election, POST appointed a new board consisting of parliamentarians, representatives from parliamentary teams and experts from the research community. The board meets quarterly to advise POST and help ensure that its research programme meets the needs of parliament.

Parliamentarians and external experts who are members of the POST board are:

Lauren Sullivan MP (Chair)
Lord Ravensdale (Vice-chair)
Chi Onwurah MP
Chris Curtis MP
Adam Thompson MP
George Freeman MP
Ian Sollom MP
Lord Mair FREng FRS
Lord Haskel
Professor the Lord Winston
Professor Elizabeth Fisher FMedSci
Paul Martynenko MBE FBCS
Professor Susan Owens OBE, FBA
Professor Sir Bernard Silverman FRS

Bookmark the POST website **post.parliament.uk** to keep up to date with our latest research.

House of Commons Library

The House of Commons Library is a research and information service based in the UK Parliament. Our impartial analysis, statistical research and resources help MPs and their staff scrutinise legislation, prepare for debates and support constituents.

The Commons Library publishes expert analysis of legislation, policy and constituency issues online at **commonslibrary.parliament.uk**. Our team of around 100 subject specialists also offer confidential services providing bespoke research and information to Members of Parliament and their staff on request.

You can receive the latest research updates from the Commons Library, on the topics you care about, with alerts sent straight to your email inbox. Sign up at **commonslibrary.parliament.uk/subscribe**.

## NEW COMMONS LIBRARY RESEARCH

We publish a range of topical and business-related research online each month. Read about our latest research on science, health, the environment and technology below – you can find more recent research, as well as the full briefings for everything in this article, on our website at **commonslibrary.parliament.uk/scienceinparliament**.

### Aviation and climate change

Research Briefing CBP 8826
published 4 March 2025

Provides a comprehensive analysis of the UK's aviation emissions and the challenges of decarbonising this sector. This briefing examines the UK government's policies including its Jet Zero strategy, its promotion of Sustainable Aviation Fuel (SAF) and its stance on airport expansion, as well as international frameworks for reducing emissions. It highlights the contribution aviation makes to climate change and offers insights into future trends and policy measures. Our research also looks at technological advancements, such as electric and hydrogen-powered aircraft.

### Gas and electricity prices during the 'energy crisis' and beyond

Research Briefing 9714
published 25 February 2025

This research briefing offers a detailed examination of the factors influencing gas and electricity prices during the 'energy crisis' and beyond, including the consequences of the Russian invasion of Ukraine. It describes how and why the energy price cap has changed over time, analyses the impact of government support during the energy crisis and looks at energy price forecasts. Additionally, it discusses the economic and policy implications of the crisis, providing valuable insights into the complexities of the current energy market.

### Energy efficiency of UK homes

Research Briefing 9889
published 24 February 2025

Provides analysis of the energy efficiency of UK homes, including progress made and the challenges that remain. Find out more about energy efficiency ratings across different regions and types of properties, and the impact of various government schemes aimed at improving insulation and reducing energy consumption. This briefing also explores the economic and environmental benefits of enhancing energy efficiency, helping you understand the current state and future prospects of energy efficiency in the UK.

### What are carbon budgets?

Insight
published 4 February 2025

This quick-read article explains the term 'carbon budget', which refers to emissions limits set by the UK Government. In 2025, the UK will set its seventh carbon budget, covering emissions up to 2042. Find out what the current carbon budget is, how progress against carbon budgets is measured and changes expected in future budgets.

### Changes to agricultural and business property reliefs for inheritance tax

Research Briefing 10181
published 27 January 2025

This briefing examines the proposed changes to agricultural and business property reliefs for inheritance tax announced in the Autumn 2024 Budget, including the policy's potential implications for farmers and business owners and the broader economic effects of these changes.

### Weight loss medicines in England

Research Briefing CBP 10171
published 17 January 2025

Focuses on the licensing, regulation, and supply of new weight loss medications in England. This briefing examines the role of GLP-1 medicines, such as semaglutide, in weight management and the availability of these medications through NHS weight management services.

## BRIEFINGS ON LEGISLATION

Our legislative briefings help you understand the content and journey of bills as they pass through parliament. Latest updates include:

### Data (Use and Access) Bill [HL]

Research Briefing 10186
last updated 7 February 2025

If passed, this bill would enact several changes, including enabling the use of "smart data" beyond the finance sector, regulating digital verification services and replacing the Information Commissioner's Office with an Information Commission. During parliamentary debates, amendments have focused on ensuring robust safeguards and effective implementation, in particular in relation to AI, copyright and the creative industries. Further briefing will be provided by the Library before Commons report stage, the date of which hasn't yet been announced.

### Rare Cancers Bill 2024–2025

Research Briefing CBP 10198
last updated 12 March 2025

The Rare Cancers Bill 2024-25, a Private Member's Bill introduced by Dr Scott Arthur MP, seeks to enhance research and investment in treatments for rare cancers. If enacted, it would require the Secretary of State for Health and Social Care to actively promote research, facilitate patient recruitment for clinical trials through improved data sharing, and review laws related to marketing authorisations for orphan medicinal products.

### Tobacco and Vapes Bill 2024–25: Progress of the Bill

Research Briefing CBP 10193
last updated 14 February 2025

If passed, the Tobacco and Vapes Bill 2024-25 would prohibit the sale of tobacco to individuals born on or after 1 January 2009, and impose stricter controls on the advertising and promotion of vapes. The bill has undergone significant debate, with discussions focusing on civil liberties, enforcement practicality, and the impact on small retailers.

### The Climate and Nature Bill 2024–25

Research Briefing 10176
last updated 7 February 2025

The Climate and Nature Bill 2024-25 is a Private Member's Bill introduced by Roz Savage MP. If passed, it would set legally binding targets for climate and nature, give the Secretary of State a duty to implement a strategy to meet these targets and mandate the creation of a Climate and Nature Assembly. The bill was debated for second reading on 24 January 2025 but MPs voted to adjourn the debate until 11 July 2025. Find out more in our briefing.

### Water (Special Measures) Bill 2024–2025

Research Briefing 10159
last updated 22 January 2025

This Act, which received Royal Assent on 24 February, is intended to address poor performance from water companies, including issues relating to financial management and water pollution. It aims to enhance regulatory oversight and governance of these companies. The bill underwent amendments during its committee stages in both the House of Lords and the House of Commons – read our briefing for more.

## DATA DASHBOARDS

The Library also produces a range of interactive data dashboards, helping you find data at constituency, regional and national levels. Our most recently-updated dashboards are:

### Constituency data: Households off the gas grid

Data last updated 7 March 2025

Accessing the mains gas grid is the most common way to heat a home in England, Wales, and Scotland. This dashboard pulls together estimates from the Department for Energy Security and Net Zero on homes not on the gas grid.

### Local area data: fuel poverty

Data last updated 3 February 2025

Fuel poverty is a devolved policy area. Our interactive dashboard lets you explore data on fuel poverty for constituencies in England and local authorities in Scotland, Wales and Northern Ireland.

## NEW LIBRARY WORKSPACE FOR MEMBERS' STAFF

The newly-refurbished Derby Gate Library (pictured above) is a quiet workspace located in 1 Derby Gate, Palace of Westminster. It offers a wide range of information services from the Commons Library, including access to topical research and hard-copy briefings, with Library staff on hand to help with requests for information and research. While principally for Members' staff, members of the wider parliamentary community can access the library on a first come, first served basis – make sure to pop in the next time you are on the Parliamentary Estate.

## GET REAL-TIME RESEARCH UPDATES FOR PARLIAMENTARY DEBATES

The Commons Library and POST have launched a new WhatsApp channel, bringing you impartial, curated research for the day's debates an hour before the Chamber sits.

Go to **ukparlresearch.info/whatsapp** on a browser or your mobile device to follow the channel, and make sure to click the bell icon to be notified when we share helpful research.

# SELECT COMMITTEES

## HOUSE OF COMMONS BUSINESS AND TRADE COMMITTEE

The Business and Trade Committee scrutinises the policy, spending and administration of the Department for Business and Trade and its public bodies.

### CURRENT INQUIRIES

Industrial strategy
Opened: 28 January 2025

Export-led growth
Opened: 15 January 2025

The Work of the Business and Trade Committee
Opened: 20 November 2024

Business and Trade Committee priorities
Opened: 13 November 2024
Report published: 13 February 2025

Make Work Pay: Employment Rights Bill
Opened: 31 October 2024.

### MEMBERSHIP

Rt Hon Liam Byrne MP, Labour (Chair)
Antonia Bance MP, Labour
John Cooper MP, Conservative
Sarah Edwards MP, Labour
Alison Griffiths MP, Conservative
Sonia Kumar MP, Labour
Charles Maynard MP, Liberal Democrat
Gregor Poynton MP, Labour
Joshua Reynolds MP, Liberal Democrat
Matt Western MP, Labour
Rosie Wrighting MP, Labour

### CONTACTS

Committee Clerk: xxxxx

Email: commonsbtc@parliament.uk

General enquiries: 020 7219 8586

Media enquiries: 020 7219 4984

X: @CommonsBTC

Address: Business and Trade Committee, House of Commons, London, SW1A 0AA

## HOUSE OF COMMONS EDUCATION COMMITTEE

The Education Committee scrutinises the work of the Department for Education, covering children's social care, schools, colleges, the early years and higher education. The Committee also holds regular hearings with DfE's arms-length bodies, including Ofsted, Ofqual and the Children's Commissioner.

### CURRENT INQUIRIES

Further Education and Skills
Opened: 29 January 2025

Solving the SEND crisis
Opened: 20 December 2024

Children's social care
Opened 22 November 2024

### MEMBERSHIP

Helen Hayes MP, Labour (Chair)
Jess Asato MP, Labour
Sureena Brackenridge MP, Labour
Dr Caroline Johnson MP, Labour
Amanda Martin MP, Labour
Darren Paffey MP, Labour
Manuela Perteghella MP, Liberal Democrat
Mark Sewards MP, Labour
Patrick Spencer MP, Conservative
Dr Marie Tidball MP, Labour
Caroline Voaden MP, Liberal Democrat

### CONTACTS

Committee Clerk: xxxxx

Email: educom@parliament.uk

General enquiries: 020 7219 2370

Media enquiries: 020 7219 8895

X @CommonsSITC

Address: Education Committee, House of Commons, London SW1A OAA

## HOUSE OF COMMONS HEALTH AND SOCIAL CARE COMMITTEE

The Health and Social Care Committee. Its responsibility is to scrutinise the work of the Department of Health and Social Care and its associated public bodies. The Committee examine government policy, spending and administration on behalf of the electorate and the House of Commons.

### CURRENT INQUIRIES

Community Mental Health Services
Opened: 17 December 2024

The 10 Year Health Plan
Opened: 13 November 2024

Adult social care reform: the cost of inaction
Opened: 31 October 2024

### MEMBERSHIP

Layla Moran MP, Liberal Democrat (Chair)
Danny Beales MP, Labour
Ben Coleman MP, Labour
Dr Beccy Cooper MP, Labour
Deirdre Costigan MP, Labour
Jen Craft MP, Labour
Josh Fenton-Cooper MP, Labour
Andrew George MP, Liberal Democrat
Paulette Hamilton MP, Labour
Joe Robertson MP, Conservative
Gregory Stafford MP

### CONTACTS

Committee Clerk: xxxxx

Email: bridgespalmerj@parliament.uk

General enquiries: 020 7219 6182

Media enquiries: 020 7219 3138

X @CommonsHealth

Address: Health and Social Care Committee, House of Commons, London SW1A OAA

# SELECT COMMITTEES

## HOUSE OF COMMONS ENERGY SECURITY AND NET ZERO COMMITTEE

The Energy Security and Net Zero Committee scrutinizes the policy spending and administration of the Department of Energy Security and Net Zero and its public bodies, including Ofgem and the Committee on Climate Change.

### CURRENT INQUIRIES

Revisiting the nuclear roadmap
Opened 20 February 2025

Building support for the energy transition
Opened: 19 February 2025

The cost of energy
Opened: 18 February 2025

Industrial strategy for green power
Opened: 5 February 2025

Retrofitting homes for net zero
Opened: 19 November 2024

Unlocking community energy at scale
Opened: 11 November 2024

Work of the Department of Energy and Net Zero
Opened: 11 November 2024

Workforce planning do deliver clean, secure energy
Opened: 11 November 2024

### MEMBERSHIP

Bill Esterson MP, Labour (Chair)
Polly Billington MP, Labour
Sir Christopher Chope MP, Conservative
Torcuil Crighton MP, Labour
Wera Hobhouse MP, Liberal Democrat
Josh MacAlister MP, Labour
Anneliese Midgley MP, Labour
Luke Murphy MP, Labour
Mike Reader MP, Labour
Bradley Thomas MP, Conservative
Claire Young MP, Labour

### CONTACTS

Committee Clerk: xxxxx

Email: commonsesnz@parliament.uk

Media enquiries: 020 7219 4984
bridgespalmerj@parliament.uk

X @CommonsESNZ.

Address: Energy Security and Net Zero Committee, House of Commons, London SW1A OAA

## HOUSE OF COMMONS ENVIRONMENT, FOOD AND RURAL AFFAIRS COMMITTEE

Looking at issues from the air we breathe to the food on our plates, Parliament's Environment, Food and Rural Affairs Committee (EFRA) exists to scrutinise the administration, spending and policy of the Government's Department for Environment, Food and Rural Affairs

### CURRENT INQUIRIES

Fisheries and the marine environment
Opened: 23 January 2025

Animal and plant health
Opened: 9 January 2025

Fairness in the food supply chain
Opened: 20 December 2024

Reforming the water sector
Opened: 19 December 2024

The future of farming
Opened: 6 December 2024

Work of the Department and its arm's-length bodies
Opened: 6 November 2024

### MEMBERSHIP

Rt Hon Alistair Carmichael MP, Liberal Democrat (Chair)
Sarah Boot MP, Conservative
Charlie Dewhirst MP, Conservative
Helen Dollimore MP, Labour
Sarah Dyke MP, Liberal Democrat
Jayne Kirkham MP, Labour
Josh Newbury MP, Labour
Andrew Pakes MP, Labour
Jenny Riddell-Carpenter MP, Labour
Tim Roca MP, Labour
Henry Tufnell MP, Labour

### CONTACTS

Committee Clerk: xxxxx

Email: efracom@parliament.uk

Media enquiries: 020 7219 3138

X @CommonsEFRA

Address: Environment, Food and Rural Affairs Committee, House of Commons, London SW1A OAA

# SELECT COMMITTEES

## HOUSE OF COMMONS SCIENCE, INNOVATION AND TECHNOLOGY COMMITTEE

The Science, Innovation and Technology Select Committee examines the expenditure, administration and policy of the Department for Science, Innovation and Technology, and associated public bodies. It also exists to ensure that Government policies and decision-making across departments are based on solid scientific evidence and advice.

### CURRENT INQUIRIES

Digital centre of government
Opened: 3 February 2025

Under the microscope
Opened 13 January 2025

Innovation, growth and the regions
Opened: 6 December 2024

Innovation showcase
Opened: 4 December 2025

Social media misinformation and harmful algorithms
Opened: 20 November 2024

### MEMBERSHIP

Chi Onwurah MP, Labour (Chair)
Emily Darlington MP, Labour
George Freeman MP, Conservative
Dr Allison Gardner MP, Labour
Tom Gordon MP, Liberal Democrat
Rt Hon Kit Malthouse MP, Conservative
Steve Race MP, Labour
Josh Simons MP, Labour
Dr Lauren Sullivan MP, Labour
Dr Adam Thompson MP, Labour
Martin Wrigley MP, Liberal Democrat
John Whitby MP, Labour

### CONTACTS

Committee Clerk: xxxxx

Email: commonssitc@parliament.uk

General enquiries: 020 7219 5023

Media enquiries: 020 7219 0731

X @CommonsSITC

Address: Science, Innovation and Technology Committee, House of Commons, London SW1A OAA

## HOUSE OF COMMONS ENVIRONMENTAL AUDIT COMMITTEE

The Committee's remit 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.

### CURRENT INQUIRIES

Governing the marine environment
Opened: 16 December 2024

Flood resilience in England
Opened: 10 December 2024

The UK and the Antarctic environment (revived)
Opened: 5 December 2024

Environmental sustainability and housing growth
Opened: 18 November 2024

The role of natural capital in the green economy (revived)

Opened: 13 November 2024

### MEMBERSHIP

Toby Perkins MP, Labour (Chair)
Olivia Blake MP, Labour
Julia Buckley MP, Labour
Ellie Chowns MP, Green Party
Barry Gardiner MP, Labour
Anna Gelderd MP, Labour
Sarah Gibson MP, Liberal Democrat
Pippa Heylings MP, Liberal Democrat
Chris Hinchliff MP, Labour
Martin Rhodes MP, Labour
Blake Stephenson MP, Conservative
Alison Taylor MP, Labour
Cameron Thomas MP, Liberal Democrat
John Whitby MP, Labour
Rt Hon Sammy Wilson MP, Democratic Unionist Party

### CONTACTS

Committee Clerk: xxxxx

Email: eacom@parliament.uk

General enquiries: 020 7219 8890

Media enquiries: 020 7219 1034

X: @CommonsEAC

Address: Environmental Audit Committee, House of Commons, London SW1A OAA

# SELECT COMMITTEES

## THE HOUSE OF LORDS SCIENCE AND TECHNOLOGY COMMITTEE

The Committee is appointed to consider science and technology. It does this principally through undertaking inquiries.

### CURRENT INQUIRIES

There are no current inquiries

### MEMBERSHIP

The Lord Mair, Crossbench (Chair)
The Lord Berkeley, Labour
The Lord Borwick, Conservative
The Rt Hon The Lord Drayson, Labour
The Lord Lucas, Conservative
The Baroness Neuberger, Crossbench
The Rt Hon The Baroness Neville-Jones, Conservative
The Rt Hon The Baroness Northover, Liberal Democrat
The Lord Ranger of Northwood, Conservative
The Viscount Stansgate, Labour
The Lord Stern of Brentford, Crossbench
The Baroness Walmsley, Liberal Democrat
The Baroness Willis of Summertown, Crossbench
The Baroness Young of Old Scone, Labour

### CONTACTS

Committee Clerk: xxxxxxx

Email: hlscience@parliament.uk

Committee Staff: 020 7219 5750

Press Officer: 020 7219 1692

X @LordsSTCom

Address: Science and Technology Committee, House of Lords, London SW1A 0PW

## THE HOUSE OF LORDS UK ENGAGEMENT WITH SPACE COMMITTEE

The Committee was appointed to consider UK policies relating to space, and both the opportunities and challenges related to the UK's engagement with space.

### CURRENT INQUIRIES

UK engagement with space
Opened: 26 February 2025

### MEMBERSHIP

The Rt Hon The Baroness Ashton of Upholland, Labour (Chair)
The Baroness Bonham-Carter of Yarnbury, Liberal Democrat
The Lord Booth-Smith, Conservative
The Lord Clement-Jones, Liberal Democrat
The Lord Cromwell, Crossbench
The Baroness Donaghy, Labour
The Baroness Mobarik Conservative
The Lord Shamash, Labour
The Viscount Stansgate, Labour
The Rt Hon The Baroness Stowell of Beeston, Conservative
The Lord Tarassenko, Crossbench
The Rt Hon The Lord Vaizey of Didcot, Conservative

### CONTACTS

Committee Clerk: xxxxxxx

Email: hlukspace@parliament.uk

Committee Staff: 020 7219 0438

Address: UK Engagement with Space Committee, House of Lords, London SW1A 0PW

## THE HOUSE OF LORDS COMMUNICATIONS AND DIGITAL COMMITTEE

The Committee considers the media, digital and the creative industries.

### CURRENT INQUIRIES

The future of news: impartiality, trust and technology
Opened: 17 January 2024
Report published: 25 November 2024
Government response: 6 February 2025

Scaling up – AI and creative tech
Opened: 4 September 2024
Report published: 3 February 2025
Government response: due 3 April 2025

### MEMBERSHIP

The Baroness Keeley, Labour (Chair)
The Viscount Colville of Culross, Crossbench
The Lord Dunlop, Conservative
The Baroness Fleet, Conservative
The Baroness Healy of Primrose Hill, Labour
The Lord Holmes of Richmond, Conservative
The Rt Hon The Lord Knight of Weymouth, Labour
The Rt Rev The Lord Bishop of Leeds, Bishops
The Rt Hon The Lord McNally, Liberal Democrat
The Lord Mitchell, Labour
The Baroness Owen of Alderley Edge, Conservative
The Lord Storey, Liberal Democrat
The Baroness Wheatcroft, Crossbench

### CONTACTS

Committee Clerk: xxxxxxx

Email: holcommunications@parliament.uk

Committee Staff: 020 7219 8662

Press Officer: 020 7219 8535

X @LordsCommsCom

Address: Communications and Digital Committee, House of Lords, London SW1A 0PW

## UK Research and Innovation

Christopher Brown
UKRI, 7th floor, Caxton House
Tothill Street, London
SW1H 9NA

Email: externalaffairs@ukri.org

www.ukri.org

UK Research and Innovation

Big challenges demand big thinkers – those who can unlock the answers and further our understanding of the important issues of our time. Our work encompasses everything from the physical, biological and social sciences, to innovation, engineering, medicine, the environment and the cultural impact of the arts and humanities. In all of these areas, our role is to bring together the people who can innovate and change the world for the better.

We work with the government to invest over £7 billion a year in research and innovation by partnering with academia and industry to make the impossible, possible. Through the UK's nine leading academic and industrial funding councils, we create knowledge with impact.

### Arts and Humanities Research Council

Website: www.ahrc.ukri.org

AHRC funds outstanding original research across the whole range of the arts and humanities. This research provides economic, social and cultural benefits to the UK, and contributes to the culture and welfare of societies around the globe.

### Biotechnology and Biological Sciences Research Council

Website: www.bbsrc.ukri.org

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

### Economic and Social Research Council

Website: www.esrc.ukri.org

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

### Engineering and Physical Sciences Research Council

Website: www.epsrc.ukri.org

EPSRC invests in world-leading research and postgraduate training across the engineering and physical sciences. This research builds the knowledge and skills base needed to address scientific and technological challenges and provides a platform for future UK prosperity by contributing to a healthy, connected, resilient, productive nation.

### Innovate UK

Website: www.ukri.org/councils/innovate-uk

Innovate UK drives productivity and economic growth by supporting businesses to develop and realise the potential of new ideas, including those from the UK's world-class research base. They connect businesses to the partners, customers and investors that can help them turn these ideas into commercially successful products and services, and business growth.

### Medical Research Council

Website: www.mrc.ukri.org

MRC is at the forefront of scientific discovery to improve human health. Its 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

Website: www.nerc.ukri.org

NERC is the driving force of investment in environmental science. Its 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

Website: www.re.ukri.org

Research England creates and sustains the conditions for a healthy and dynamic research and knowledge exchange system in English universities. Working to understand their strategies, capabilities and capacity; supporting and challenging universities to create new knowledge, strengthen the economy, and enrich society.

### Science and Technology Facilities Council

Website: www.stfc.ukri.org

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

# SCIENCE DIRECTORY

Contact: Dr Jane Gate, Executive Director
AIRTO Ltd, c/o Net Zero Tech Centre,
20 Queens Road, Aberdeen AB15 4ZT
E: enquiries@airto.co.uk
W: www.airto.co.uk
X: @airtoinnovation

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: Lucky Cullen, Policy, Public Affairs and Diversity Manager
Salisbury House, Station Road, Cambridge CB1 2LA
T: +44 (0)20 3880 2881
E: lucky@appliedmicrobiology.org
W: www.appliedmicrobiology.org

Applied Microbiology International believes that global challenges need to be solved by global, interdisciplinary experts who apply their diverse experience and unique voices to achieve a common goal. Because of this, we're a truly inclusive, international organisation.

With a strong focus on influencing international policy, we are organised around seven goals which align with core UN Sustainable Development Goals and encourage partnership between industry and academia to increase our impact. We publish the leading industry magazine, *The Microbiologist*, and in partnership with Wiley and Oxford University Press, publish six internationally acclaimed journals.

Contact: Colin Danson, Distinguished Scientist & Head of Profession for Physics and Mathematics
AWE, Aldermaston, Reading RG7 4PR
T: +44 (0)118 98 56901
E: colin.danson@awe.co.uk
W: www.awe.co.uk

For over 70 years, AWE has supported the UK Government's nuclear defence strategy and Continuous At Sea Deterrence.

On behalf of the Ministry of Defence, AWE manufactures, maintains and develops the UK's nuclear warheads, and applies its unique expertise to support nuclear threat reduction and to protect national security.

The company provides guidance to UK military and police counter-terrorism teams, as well as emergency response in the event of nuclear or radiological incidents.

## British In Vitro Diagnostics Association

Contact: Ben Kemp, Policy and Public Affairs Executive
British In Vitro Diagnostics Association
299 Oxford Street, London W1C 2DZ
T: +44 (0)333 3208 823
E: ben.kemp@bivda.org.uk
W: 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: Policy Officer
British Pharmacological Society
The Schild Plot, 16 Angel Gate, City Road, London EC1V 2PT
T: +44 (0)20 7239 0171
E: policy@bps.ac.uk
W: 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.

Contact: Tracey Guise, Chief Executive Officer
British Society for Antimicrobial Chemotherapy
53 Regent Place, Birmingham B1 3NJ
T: +44 (0)121 236 1988
E: tguise@bsac.org.uk
W: 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 Jennie Evans, Director of External Affairs
British Society for Immunology
9 Appold Street, London, EC2A 2AP
T: +44 (0)20 3019 5901
E: bsi@immunology.org
W: www.immunology.org

The British Society for Immunology is the leading UK charity representing scientists and clinicians who study the immune system in humans and animals.

As a membership organisation, we act as a focal hub for the immunology community, supporting and empowering immunologists working in academic, industry and clinical settings to drive forward scientific discovery and application. We aim to harness the knowledge generated by our membership to ensure society is aware of and can gain from the health benefits that immunology research can deliver.

Contact: Maggie Mitchell, Chief Executive
BSAS, 18 North Street, Glenrothes, KY7 5NA
T: +44 (0)7952 970325
E: maggie.mitchell@bsas.org.uk
W: www.bsas.org.uk

The British Society of Animal Science (BSAS), the principal body for animal science in the UK, was established in 1944.

We work globally with members and partners to shape the future of animal science, supporting the advancement of responsible, environmentally and economically sustainable animal production, addressing issues such as the role of animal science in resolving the world's food crisis.

BSAS disseminates research findings to ensure practical and beneficial application of positive outcomes to include livestock, animal health and welfare, the care of equine, companion, and zoo animals.

Contact: Sarah Garry
BSSS, Building 42a Cranfield University, Cranfield, MK43 0AL
E: exec@soils.org.uk
W: www.soils.org.uk

The British Society of Soil Science (BSSS) was founded in 1947 and is an established international membership organisation and charity committed to the study of soil in its widest aspects.

The society brings together those working within academia, practitioners implementing soil science in industry and all those working with, or with an interest in soils. We promote research and education, both academically and in practice, and build collaborative partnerships to help safeguard our soil for the future. This includes hosting the World Congress of Soil Science 2022 in Glasgow, where those with an interest in soil science met to discuss the critical global issues relating to soil.

# SCIENCE DIRECTORY

Brunel University London

Contact: Geoff Rodgers
Brunel University London, Kingston Lane, Uxbridge UB8 3PH
T: +44 (0)1895 265609
E: g.j.rodgers@brunel.ac.uk
W: 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

UNIVERSITY OF CAMBRIDGE

Contact: Communications Team
The Cavendish Laboratory, JJ Thomson Avenue, Cambridge CB3 0HE
E: communications@phy.cam.ac.uk
W: 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

CIPA THE CHARTERED INSTITUTE OF PATENT ATTORNEYS

Contact: Neil Lampert, Deputy Chief Executive
CIPA, 2nd Floor, Viaro House, 20–23 Holborn, London, EC1N 2JD
T: +44 (0)7405 9450
E: neil@cipa.org.uk
W: www.cipa.org.uk

CIPA represents virtually all of the UK's 2,600 registered patent attorneys in industry and private practice. We are the UK's largest intellectual property organisation with over 4,700 members, including 1,100 trainee patent attorneys.

It is our members that support British SMEs, universities and large companies in protecting their innovative technology worldwide. The reputation of the UK for IP advice draws work from around the world; only 11% of European patent applications by British representatives are for UK applicants. Consequently, the profession generates around £1 billion for the economy in gross value added and approaching £750 million in exports.

The Cosmetic, Toiletry & Perfumery Association | ctpa

Contact: Dr Emma Meredith
CTPA, 49 Whitehall, London SW1A 2BX
T: +44 (0)20 7491 8891
E: info@ctpa.org.uk
W: www.ctpa.org.uk
W: 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.

CLIFTON SCIENTIFIC Trust

Contact: Dr Eric Albone MBE, Director
Clifton Scientific Trust, 49 Northumberland Road, Bristol BS6 7BA
T: +44 (0)117 924 7664, +44 (0)7721 683528
E: eric@clifton-scientific.org
W: www.clifton-scientific.org

We bring school students and their teachers to:
• work closely with scientists and engineers
• experience science as a creative, questioning, team exploration
• add real-life meaning and motivation, from primary to post-16
• internationally build global awareness and experience science as a cultural bridge
• build transferable skills for employability and citizenship

Two powerful exemplars:
• Post-16; our unique UK-Japan Young Scientist Workshop Programme hosted in universities in England and Japan since 2001
• Primary; our local Meet-a-Medic Programme since 2005

Clifton Scientific Trust Ltd is registered charity in England and Wales 1086933

The Council for the Mathematical Sciences

Contact: Jennifer Gunn
De Morgan House, 57–58 Russell Square, London WC1B 4HS
T: +44 (0)20 7637 3686
E: cms@lms.ac.uk
W: 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

THE FRANCIS CRICK INSTITUTE

Contact: Louise Wren, Head of External Affairs
The Francis Crick Institute
Midland Road, London NW1 1AT
T: +44 (0)20 3796 5252
E: louise.wren@crick.ac.uk
W: www.crick.ac.uk

The Francis Crick Institute is an independent charity, established to be a UK flagship for discovery research in biomedicine. The Crick's mission is discovery without boundaries. We don't limit the direction our research takes. We want to understand more about how living things work to help improve treatment, diagnosis and prevention of human disease, and generate economic opportunities for the UK. In our institute more than 2,000 staff and students use their wide-ranging knowledge and expertise to work across disciplines and explore biology at all levels, from molecules through cells to entire organisms.

Daphne Jackson TRUST

Contact: Dr Katie Perry, Chief Executive
The Daphne Jackson Trust, Department of Physics, University of Surrey, Guildford GU2 7XH
T:+44 (0)20 1483 689166
E: katie.perry@surrey.ac.uk
W: 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. Recently, we have expanded our remit to incorporate the social sciences and arts & humanities. Our Fellowship programme, working in partnership with universities, UKRI, 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 their research credentials, update skills and redevelop confidence, in a suitably supportive environment.

EngineeringUK

Suzanne King, Policy and Voice Manager
EngineeringUK, Northern & Shell Building, 5th floor, 10 Lower Thames Street, London, EC3 6EN
E: sking@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.

# SCIENCE DIRECTORY

Contact: Dr Megan O'Donnell FGS, Head of Policy and Communications
The Geological Society, Burlington House, Piccadilly, London W1J 0BG
E: megan.odonnell@geolsoc.org.uk
W: www.geolsoc.org.uk

The Geological Society of London is the UK's national society for geoscience, providing support to 12,000 Fellows (members) worldwide.

The Fellowship encompasses those working in industry, academia and government, with a wide range of expertise on policy-relevant science, and the Society is a leading communicator of this science to government bodies and other non-technical audiences.

The Society aims to be an inclusive and thriving Earth science community advancing knowledge, addressing global challenges, and inspiring future generations.

Contact: Lynda Rigby, Executive Head of Marketing and Membership
IBMS, 12 Coldbath Square, London, EC1R 5HL
T: +44 (0)20 7713 0214
E: mc@ibms.org
W: www.ibms.org
X @IBMScience

**Advancing knowledge and setting standards in biomedical science**
With over 20,000 members in 61 countries, IBMS is the leading professional body for scientists, support staff and students in the field of biomedical science. Since 1912 we have been dedicated to the promotion, development and delivery of excellence in biomedical science within all aspects of healthcare, and to providing the highest standards of service to patients and the public. By supporting our members in their practice, we set quality standards for the profession through training, education, assessments, examinations and continuous professional development.

Contact: Michelle Medhat
Institute of Innovation & Knowledge Exchange
Rex House, 4–12 Regent Street, London SW1Y 4PE
W: 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 Measurement and Control

Contact: Steff Smith, Chief Executive
InstMC, 297 Euston Road, London NW1 3AD
T: +44 (0)20 73874949
E: steff.smith@instmc.org
W: www.instmc.org
Registration Charity number: 269815

The InstMC is a professional engineering institution and learned society dedicated to the science and application of measurement and control technology for the public benefit. The Institure 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: Elizabeth Chamberlain, Head of Policy
IOP, 37 Caledonian Road, London N1 9BU
T: +44 (0)20 7470 4824
E: elizabeth.chamberlain@iop.org
W: www.iop.org

The Institute of Physics (IOP) is the professional body and learned society for physics in the UK and Ireland.

The IOP's mission is to raise public awareness and understanding of physics, inspire people to develop their knowledge, understanding and enjoyment of physics and support the development of a diverse and inclusive physics community.

As a charity, the IOP seeks to ensure that physics delivers on its exceptional potential to benefit society.

Contact: Philip Morgan, Chief Executive Officer
Fairmount House, 230 Tadcaster Road, York, YO24 1ES
Tel: 01904 610821
E: phil@ipem.ac.uk
W: www.ipem.ac.uk

Physicists, engineers and technologists play vital roles in delivering our healthcare. The Institute of Physics and Engineering in Medicine (IPEM) is the professional organisation that represents this diverse workforce. We are a charity with more than 4,600 members drawn from healthcare, academia and industry.

Our Mission is Improving Health through Physics and Engineering in Medicine. Our vision is one in which professionalism drives improvements in diagnosis, treatment and care, transforming the lives of patients.

Our members, the professional community of medical physicists, biomedical engineers and clinical technologists working in hospitals, academia and industry around the world are the people who make it happen. We work to support them through professional development, community and leadership services and initiatives. IPEM is licensed by the Science Council to award CSci, RSci and RSciTech, and by the Engineering Council to award CEng, IEng and EngTech.

Contact: Duncan Lugton, Head of Policy and Impact
E: dlugton@icheme.org
W: www.icheme.org

The Institution of Chemical Engineers (IChemE) is the UK based and internationally recognised qualifying body and learned society for chemical, biochemical and process engineers.

We advance chemical engineering's contribution for the benefit of society, facilitate the development of chemical engineering professionals across a wide range of sectors including energy, water, food and health, and provide connections to a powerful network of 30,000 members in more than 100 countries.

Contact: Joanna Cox
IET, Michael Faraday House, Six Hills Way, Stevenage SG1 2AY
T: +44(0)1438 765690
E: policy@theiet.org
W: 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
T: +44 (0)20 8943 7000
E: info@lgcgroup.com
W: www.lgcgroup.com

LGC is a leading global life science tools company, providing genomics and quality assurance solutions into high growth application areas within human healthcare and applied market segments. Our core purpose is Science for a Safer World.

Our 180 years of scientific heritage, combined with a focus on innovation and value-enhancing acquisitions, has enabled us to build a highly valued product portfolio, and to closely collaborate with our customers, partners and the global scientific community.

As the UK Government Chemist www.gov.uk/government/ organisations/government-chemist, LGC acts as the referee analyst and advises Government and the wider analytical community on analytical measurement matters for policy, standards and regulation.

LGC is also the UK's National Measurement Laboratory for chemical and bio-measurement, finding solutions to fundamental and emerging measurement challenges, driving innovation, productivity and economic growth.

# SCIENCE DIRECTORY

The Linnean Society

Contact: Professor Gail Cardew, Chief Executive Officer
The Linnean Society of London, Burlington House
Piccadilly, London W1J 0BF
T: +44 (0)20 7434 4479 Ext 212
E: gail@linnean.org
W: 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*

Institution of Mechanical Engineers

Contact: Matt Rooney, Engineering Policy Manager, Head of Content & Communications
1 Birdcage Walk, London SW1H 9JJ
T:+44 (0)20 7304 6833
E: matthew.rooney@imeche.org
W: 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.

Met Office

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

Microbiology Society

Contact: Policy Officer
Microbiology Society, 14–16 Meredith Street, London EC1R 0AB
T: +44 (0)20 3034 4870
E: policy@microbiologysociety.org
W: www.microbiologysociety.org

The Microbiology Society is a membership charity for scientists interested in microbes, their effects and their practical uses. It has a worldwide membership based in universities, industry, hospitals, research institutes, schools, and other organisations. Our members have a unique depth and breadth of knowledge about the discipline.

The Society's role is to help unlock and harness the potential of that knowledge. Our principal goal is to strengthen our culture of being a community-driven Society by amplifying our members' voices, wherever they are in the world, and empowering them to embed the benefits of microbiology within wider society.

NPL National Physical Laboratory

Contact: Dr James Claverly
National Physical Laboratory
Hampton Road, Teddington, Middlesex TW11 0LW
T: +44 (0)20 8977 3222
E: james.claverley@npl.co.uk
W: 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.

Natural History Museum

Advancing the science of nature

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

University of Northampton

Contact: Nick Allen
Executive Officer, Office of the Vice Chancellor
University Drive, Northampton, NN1 5PH
T: +44 (0)1604 735500
E: nick.allen@northampton.ac.uk
W: 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.

The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA

Contact: Alex Miles
Deputy Director, External Relations (Public Affairs)
University Park, Nottingham, NG7 2RD
T: +44 (0)7917115197
E: alex.miles@nottingham.ac.uk
W: www.nottingham.ac.uk
X: @AlextoMiles

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.

The Nutrition Society

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

The Nutrition Society, formed in 1941, is a diverse community with the independence and courage to challenge, question and progress the field of nutrition.

Through a progressive approach that champions collaboration and breaking down research silos, we welcome members from around the world, regardless of their level of expertise. They must however have a genuine interest in pushing forward the field of nutrition for the benefit of people, animals while balancing the health of our planet too.

# SCIENCE DIRECTORY

## The Physiological Society

Andrew Mackenzie
Head of Policy and Communications
Hodgkin Huxley House, 30 Farringdon Lane, London EC1R 3AW
T: +44 (0)20 7269 5728
E: amackenzie@physoc.org
W: www.physoc.org

As the largest network of physiologists in Europe, with academic journals of global reach, we continue our 140-year tradition of being at the forefront of the life sciences.

We bring together scientists from over 60 countries, and our Members have included numerous Nobel Prize winners from Ivan Pavlov to John O'Keefe.

## Quadram Institute

Contact: Andrew Stronach, Head of External Relations
Quadram Institute, Rosalind Franklin Road, Norwich, NR4 7UQ
T: +44 (0)1603 255000
E: andrew.stronach@quadram.ac.uk
W: www.quadram.ac.uk

The £75m Quadram Institute opened in 2019 and is focused on fundamental and translational research into the interfaces between the gut microbiome, food, and human health.

The Quadram Institute combines leading-edge bioscience capabilities with NHS endoscopy, clinical trials and biobank facilities.

The Quadram Institute is a partnership between the Norfolk and Norwich University Hospital, University of East Anglia, Quadram Institute Bioscience and BBSRC.

## Royal Academy of Engineering

Contact: Michael Williams,
Senior Public Affairs Manager
Royal Academy of Engineering
3 Carlton House Terrace
London SW1Y 5DG
T: +44 (0)20 7766 0600
E: michael.williams@raeng.org.uk
W: 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
- Promote engineering at the heart of society.

## Kew

Contact: Office of the Science Directorate
Royal Botanic Gardens, Kew, Surrey, TW9 3AB
T: +44 (0)0 8332 5050/5248
E: scienceadmin@kew.org
W: 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 Society

Contact: Daniel Callaghan, Head of Public Affairs
The Royal Society, 6-9 Carlton House Terrace, London SW1Y 5AG.
T: +44 (0)20 7451 2500
E: daniel.callaghan@royalsociety.org
W: 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: Susie Rabin, Associate Director of Parliamentary and Public Affairs
Royal Society of Biology
1 Naoroji Street London WC1X 0GB
T: +44 (0)20 3925 5607
E: susie.rabin@rsb.org.uk
W: 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, Public Affairs Manager
Royal Society of Chemistry, Thomas Graham House (290), Science Park, Milton Road, Cambridge, CB4 0WF
T: +44 (0)1223 438 322
E: daviesm@rsc.org
W: 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 Underwater Technology

Contact: Dr Cheryl Burgess, Chief Executive
HQS Wellington, Victoria Embankment, London WC2R 2PN (correspondence address only)
T: +44 (0)7947 911992
E: jane.hinton@sut.org
W: 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

Contact: Liane Farrer
Head of Communications and External Affairs
SCI, 14–15 Belgrave Square, London SW1X 8PS
T: +44 (0)20 7598 1562
E:l iane.farrer@soci.org
W: 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.

# SCIENCE DIRECTORY

## Society of Cosmetic Scientists

Contact: Gem Bektas,
Head of Operations
Society of Cosmetic Scientists
Suite 118–119, 960 Capability Green, Luton,
Bedfordshire LU1 3PE
T: +44 (0)1582 726661
E: secretariat@scs.org.uk
W: 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.

## The Society for Radiological Protection

Contact: Tessa Harris
SRP, DS009 Dartington Hall, Dartington, Devon
TQ9 6EN
T: +44 (0)1803 866743
E: admin@srp-uk.org
W: www.srp-uk.org

The Society for Radiological Protection is the principal independent professional body for radiation protection in the UK.

Its members operate in the fields of medicine, the nuclear power cycle and other industries, research, and teaching.

We offer a profession-wide view to regulators and are involved in training and educational outreach. We ensure that professional standards are maintained at the highest levels.

## UK INNOVATION & SCIENCE SEED FUND

Contact: Dr Andrew Muir
c/o STFC Innovations Ltd
Harwell Campus Oxford OX11 0QX
T: +44 (0)121 710 1990
E: Andrew.muir@midven.co.uk
W: https://ukinnovationsscienceseedfund.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.

The 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.

## University of Essex

Contact: Dr Rob Singh, Deputy Director, Enterprise
Wivenhoe Park, Colchester CO4 3SQ
T: +44 (0)1206 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

Contact: Dr Huw Golledge, Chief Executive and Scientific Director
The Old School, Brewhouse Hill, Wheathampstead,
Herts. AL4 8AN
T: +44 (0)1582 831818.
E: ufaw@ufaw.org.uk
W: www.ufaw.org.uk
Registered in England Charity No: 207996

The Universities Federation for Animal Welfare (UFAW) is an international independent scientific and educational animal welfare charity and membership society. UFAW's vision is a world where the welfare of all animals affected by humans is maximised through a scientific understanding of their needs and how to meet them. We promote an evidence-based approach to animal welfare by funding scientific research, helping develop the next generation of animal welfare scientists and sharing animal welfare science knowledge with both experts and the wider public.

# SCIENCE DIARY

## Forthcoming discussion and other meetings

■ Tuesday 29th April 2025

DISCUSSION MEETING

**Artificial Intelligence: Transforming Science and Law**

in partnership with the University of Liverpool
5.15pm to 6.30pm, Palace of Westminster
Chairman's Reception 6.45pm to 7.30pm, One Parliament Street
(Preceded at 5.00pm by the presentation of the Westminster Medal)

---

■ Tuesday 20th May 2025

DISCUSSION MEETING

**Celebrating World Metrology Day**

in partnership with the National Physical Laboratory
5.15pm to 6.30pm, Palace of Westminster
Chairman's Reception 6.45pm to 7.30pm, One Parliament Street

---

■ Tuesday 17th June 2025

DISCUSSION MEETING

in partnership with the Chartered Institute of Patent Attorneys (CIPA)
5.15pm to 6.30pm, Palace of Westminster
Chairman's Reception 6.45pm to 7.30pm, One Parliament Street

---

■ Tuesday 1st July 2025

**Annual luncheon**

12.15pm to 2.30pm, Cholmondeley Room, House of Lords
Guest Speaker: Professor Virginia Murray, Head of Global Disaster Risk Reduction, UK Health Security Agency

---

■ Tuesday 9th September 2025

DISCUSSION MEETING

**Celebrating the International Year of Quantum Science and Technology**

In partnership with the Institute of Physics
5.15pm to 6.30pm, Palace of Westminster
Chairman's Reception 6.45pm to 7.30pm, One Parliament Street

---

■ Tuesday 14th October 2025

P&SC ANNUAL GENERAL MEETING

5.00pm to 5.15pm, Palace of Westminster

DISCUSSION MEETING

In partnership with the Institution of Chemical Engineers
5.15pm to 6.30pm, Palace of Westminster
Chairman's Reception 6.45pm to 7.30pm, One Parliament Street

---



ISSN 0263-6271

The Parliamentary and Scientific Committee is an All-Party Parliamentary Group funded by Membership.

2nd Floor, 201 Great Portland Street, London W1W 5AB
www.scienceinparliament.org.uk
Email: office@scienceinparliament.org.uk
Follow on X: @ParlSciCom
Follow on Instagram: @parlscicom

Officers:
George Freeman FRSA MP (Chair)
The Viscount Stansgate FRSB (President)
The Baroness Northover (Vice-Chair)
Sam Carling MP (Vice Chair)

Secretariat:
Leigh Jeffes MCIPR
Karen Smith FRSA
John Slater FRSA

STEM for BRITAIN: Dr Isabel Spence
Website manager: Ben Allen
Social media adviser: Roger Brown
Discussion meeting reports: Sue Wharton

SCIENCE IN PARLIAMENT sip

Published by Parliamentary and Scientific Committee.
Correspondence to: karen@scienceinparliament.org.uk.
Published four times a year.
**Editor:** Leigh Jeffes, leighjeffes@outlook.com
**Design:** Westminster European
**Printed by** Premier Print Group Ltd

## SUBSCRIPTIONS

The 2025 subscripton rate is £80. Single numbers £20.

## ADVERTISING

Space for cover advertising in the Summer 2025 (18th June) and Autumn 2025 (20th September) journals is currently available. To take an advertisement, please contact the Editor.

| Current advertising rates | P&SC members | Non-members |
|---|---|---|
| Front Cover | £948 | (members only) |
| Back Cover | £779 | (members only) |
| Inside Front or Back Cover | £667 | (members only) |
| Other Full Page | £450 | £900 |
| Half Page | £300 | £500 |

VAT will be added (except for registered charities).

# AI and the Future of Innovation Culture

WWW.IKEINSTITUTE.ORG

IKE®
Institute of Innovation & Knowledge Exchange

IKE CERTIFIED INNOVATION PROGRAMME®

IKE CERTIFIED GRADUATE DEVELOPMENT PROGRAMME® (INNOVATION)