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I was saddened to hear that Dr Ian Gibson, the former Member of Parliament for Norwich North, had decided to retire before the end of this Parliament. We will all miss his many contributions to science in Parliament, and I know that many Members of Parliament want to thank Ian for the tremendous effort that he made in this policy area, including his impressive work on cancer.

I had just completed an article for the June edition of *Future Medicinal Chemistry* on the Government's re-organisation of its structures and on its new sense of direction on R&D that emerged during the last two years when my article immediately became out of date, with the Government's announcement of a merger of the Department of Innovation, Universities and Skills (DIUS) with the Department of Business, Enterprise and Regulatory Reform (DBERR), to form the Department of Business, Innovation and Skills (DBIS).

Some commentators have criticised already the transfer of further and higher education into this overweight department rather than back into the Department for Children, Families and Schools (DCFS).

This merger also means an end to the short-lived Innovation, Universities, Science and Skills (IUSS) Select Committee. Those of us who have served on the IUSS Committee have felt tensions between covering education and skills on the one hand and the STEM subjects on the other.

I have been critical of the loss of the cross-cutting remit that the former Science and Technology Select Committee had and have called, along with many others, for the reformation of this Committee. It is pleasing, therefore, that the Government has listened and that the Committee will be re-formed.

The Public Analysts Service has been in a state of decline for several years now. In 1959, there were 150 Public Analysts working in 45 laboratories; today, only 21 laboratories remain and 27 of the remaining Public Analysts are over the age of 50. The Food Standards Agency was set up in 2000, so what have they done to address this problem since then?

The IUSS Committee has recommended the appointment of a Chief Engineering Adviser to the Government and the Welsh Assembly will shortly appoint their first Chief Scientific Adviser.



Dr Brian Iddon MP
Chairman,
Editorial Board
Science in Parliament

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The Journal of the Parliamentary and Scientific Committee.

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



Science in Parliament has two main objectives:

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

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ANYONE OUT THERE?



Ian Taylor MP

Doom and gloom. Famine, floods, pestilence, terrorism, environmental degradation, recession. It is enough for us to cry "Stop the world, I want to get off". Yet where could we go? Are there other worlds like ours in the universe or are we alone?

We may soon find out, though sadly not soon enough for mortals to go there any time soon, unless we also invent 'Star Trek' propulsion systems to boldly go where no man has gone before. NASA has just launched the Kepler satellite to discover how many Earth-size planets there might be in our galaxy, orbiting their parent stars at just the right distances to have liquid water on their surfaces and rock formations.¹

Those of us who found exhilarating the story of the late 18th century astronomer Sir William Herschel in Richard Holmes' excellent book *The Age of Wonder* can now look forward to a feast of information that modern space technology can provide.

The Kepler Mission is named after Johannes Kepler (1571-1630), who discovered that planets travel around the sun in elliptical orbits. Since 1995, telescopes on Earth and in space have detected 340 planets elsewhere in the galaxy. The Kepler satellite has a much higher probability of detecting Earth-like planets than the Hubble Space Telescope, since it has a much larger field of view (approximately 10 degrees

square), and will be dedicated for detecting planetary transits. Hubble is, in contrast, used to address a wide range of questions and rarely looks continuously at just one starfield.

Most of the extra-solar planets detected so far by other projects are mostly the size of Jupiter and bigger. Kepler is designed to look for planets 30 to 600 times less massive, closer to the order of Earth's mass. It is looking for orbiting planets in the 'habitable zone' – sometimes known as the "Goldilocks zone" – where conditions are not too hot and not too cold but just right for life. With the Kepler observations, NASA expects to have a reliable estimate for the number of Earth-like planets in our galaxy.

Finding such planets in similar orbits will require the entire length of the 3.5-year Kepler Mission. By then its planetary census will hopefully tell us if this type of planet is common or rare in our neighbourhood of the Milky Way galaxy.

According to NASA, the spacecraft will simultaneously measure the variations in the brightness of more than 100,000 stars every 30 minutes, searching for the tiny "winks" in light output that happen when a planet passes in front of its star. The effect lasts from about an hour to about half a day, depending on the orbit and the type of star. The mission is designed to detect these

changes in the brightness of a star when a planet crosses in front of it, or "transits the star."

The task is not simple. A NASA official remarked, "Trying to detect Jupiter-size planets crossing in front of their stars is like trying to measure the effect of a mosquito flying by a car's headlight. Finding Earth-sized planets is like trying to detect a very tiny flea in that same headlight." Detecting planets with characteristics suited to life forms is one thing, confirming that life – even simple microbial life – exists on them is another matter altogether.

As Clive Cookson commented in the *Financial Times*, "Silicon-based life has featured in science fiction but most chemists say only carbon-based systems such as on Earth would be versatile and robust enough to evolve elsewhere. These would have to follow the rules of organic chemistry – and of Darwinian evolution".

Investing in the science and technology to send missions such as Kepler is vital. The UK has a proud record in this scientific activity (such as in the Hubble craft and many other missions²). Even though this mission is financed by NASA, our scientists will be poring over and interpreting the results. So let us with bated breath await the results. But once again, space exploration has the ability to enthral and inspire.

Ian Taylor MP is co-chairman of the Parliamentary Space Committee and Chairman of the Parliamentary & Scientific Committee.

¹ <http://kepler.nasa.gov>

² <http://www.bnsc.gov.uk/3200.aspx>

... The Kepler satellite has a much higher probability of detecting Earth-like planets than the Hubble Space Telescope . .

SCIENCE POLICY RE-EXAMINED



Tim Boswell MP

from “all-science short lists” and I do respect the right of constituencies to choose, but a little more attention to this within party structures would be welcome.

Second, we do need to revisit the mechanism for representing science in Parliament. I have served for some time on the Departmental Select Committee covering the recently-created (and now abolished) DIUS. It is little secret that we were hard-pressed to cover the full range of topics from astronomy to vocational skills. The new DBIS will be even wider-spread, however the change has opened the welcome possibility of re-establishing a dedicated Commons Science and Technology Committee.

This in turn would encourage Government itself to treat its scientists more constructively. The Chief Scientist at the Government Office for Science needs to do even more to encourage an informed science culture across government, insisting for example on a common rigorous approach to evidence in formulating departmental policies, and better use of the scientific manpower available within the Civil Service.

Even more strategically, we will not as a country remediate our perceived ‘science deficit’ unless we can capture the imagination of young people to study STEM subjects and obtain

at least some qualifications in science, engineering or technology.

In order to do this, we also need to re-examine our motives in calling for greater public engagement in science. It would be wrong to put all the emphasis on business competitiveness, important though that is. I know from my own practice as a farmer how much the efficiency of that industry, both quantity and quality of production, has been enhanced by scientific advances, notably in plant-breeding and agrochemicals. As MP for Silverstone I experience nearly every day the ‘buzz’ of local applied high-tech industry at world class levels.

Beyond this, we should recognise the vital role that science plays in safeguarding the population and improving public services. I have a strong interest in disability and long-term health conditions, which are nearly all expectant of scientific breakthrough (depending on a principled but science-friendly legislation framework); but similar conditions apply right across the public sector, for example in areas like data-mapping and certainly in resource and cost reduction. We cannot get off first base in tackling critical social issues like climate change and obesity without strong science.

I should add for the record that there will be a strong case

even in today’s difficult financial climate for maintaining both science capability within government and the excellence of the science base outside it. This applies both to resources channelled through the Research Councils and to curiosity-driven Funding Council monies – there is an argument also that we should leave ‘space’ for unconventional approaches.

Finally, though, I would not like us to write off the importance of ‘science for its own sake’. The excitement of discovery is a strong attraction for young people. I can still remember the first pictures from the hidden side of the moon. In public policy, the rigour of scientific method and the proper use of evidence extends beyond the traditionally scientific department, and can draw in appropriate cross-disciplinary contributions from social sciences and the humanities. And science can be beautiful; look at the products of electron microscopy or the patterns of fractals (like Hokusai’s waves). If those of us who do not already know about this can “suspend our disbelief” for a moment, we might learn something and actually benefit from the process! And we need to remember that however ‘useless’ some science may appear at present, it is virtually certain that ‘practical’ discoveries to come will derive from it – products of human curiosity and human imagination.

It is now half a century since C P Snow introduced us to the concept of ‘Two Cultures’. Even if that has been subject to criticism and modification, there is little doubt that the two cultures of politics and science do not meet. The recruitment of MPs with science backgrounds, and the level of Parliamentary attention to scientific matters, (at least in the Commons) is fairly minimal. I make no claim to be the exception in that I began as a classicist, though later, resisting arbitrary distinctions, I turned to social science and even had two enjoyable years as a public-interest member on a Research Council.

The first task in redressing this could be simply to recruit more scientifically literate MPs (even if not fully engaged, at least those with a grasp of concepts and method). I am sure that we are a long way

... The Chief Scientist at the Government Office for Science needs to do even more to encourage an informed science culture across government ...



CHALLENGES AS THE CHIEF SCIENTIFIC ADVISER FOR DEFRA



Professor Robert Watson

Key issues for Defra include sustainable food security, the conservation and sustainable use of biodiversity and ecosystems, and adaptation to climate change. Addressing these issues requires state-of-the-art scientific (natural and social), technical and economic information and innovative policy formulation and implementation.

My current main challenge is to think through Defra's strategy for investing in evidence and innovation over the next 3-5 years and beyond. We are considering the whole range of Defra's tools for gathering evidence and driving innovation, from our in-house expertise and intelligent customer capability and our advisory structures to our major programmes of monitoring and research. We are developing mechanisms to improve prioritisation and to deliver a holistic multi-disciplinary integrated Defra-wide evidence programme that meets the individual needs of the departmental strategic objectives. This policy-relevant strategy is being developed with input from a broad range of stakeholders through workshops and peer-review. A major workshop, involving scientists and policymakers from Defra, other government departments,

Research Councils, private sector and academia, was recently held to address the full range of Defra evidence activities

In addition, the revised strategy will be used to develop additional partnership outside Defra, thus leveraging evidence activities financed by other government departments. The recently launched "Living with Environmental Change" (LWEC) programme, which is co-sponsored by seventeen Research Councils and government departments, offers an excellent opportunity for the UK to develop a world-class programme that is intellectually stimulating to the academic community and provides timely evidence for cost-effective policy formulation.

My second major challenge is to scrutinise and challenge the evidence base underpinning key policy decisions by applying my own expertise and/or by brigading external advice. Recent policy issues in which I have been involved include:

- (i) the economic, environmental and social sustainability of first and second generation biofuels;
- (ii) whether culling badgers would decrease the incidence of bovine

tuberculosis, and the strategy for developing badger and cattle vaccines;

- (iii) short- and long-term food security domestically and globally;
- (iv) implications of genetically modified crops;
- (v) conservation and sustainable use of biodiversity and ecosystem services; and
- (vi) adaptation to climate change.

Based on my experience to date, Defra ministers and policy officials care deeply about using the best available evidence in formulating policy decisions, whether it be commissioned by Defra or by others.

As a member of the Defra management team I am fully engaged in a wide range of issues including budget and HR. I am also the responsible officer for the Defra Departmental Strategic Objective (DSO-4) of "An economy and a society that is resilient to environmental risks and emergencies". This has proven to be a stimulating challenge working with Defra experts on floods, animal diseases, chemicals, nanotechnology and genetic modification to develop an appropriate set of indicators to assess risk and preparedness for emergencies and longer term threats. A strategic framework and reporting structure is being developed for evaluating and prioritising comparative risks.

... A strategic framework and reporting structure is being developed for evaluating and prioritising comparative risks.

Let me highlight a couple of the policy issues in which I have been involved:

- During the last year I and other CSAs challenged the sustainability of first generation biofuels (food for fuel). Two key questions were whether the use of biofuels was increasing or decreasing greenhouse gas emissions, and whether it was contributing to an increase in food prices. This challenge led to the Gallagher review that concluded that there were numerous uncertainties associated with first generation biofuels but the evidence suggested that some biofuels may be increasing rather than decreasing the emissions of greenhouse gases and that some were contributing to an increase in food prices. The Gallagher review concluded that the UK Renewable Transport Fuel Obligation (RTFO) and the longer-term EU 2020 target targets needed to be revisited.

- With respect to the issue of biodiversity and ecosystems services, I provided input on:

- (i) the decision to prepare a UK-wide ecosystem assessment, which will assess the current state of ecosystems throughout the UK and how they and their services have changed over the past 60 years, the implications of changes in ecosystem services on human well-being, and assess how ecosystems might plausibly change in the upcoming 50 years, and policy and management options that would maintain their integrity;
- (ii) the decision to establish an Ad-hoc technical expert group (AHTEG) under the Convention on Biological Diversity (CBD), which would provide scientific information and advice to the United Nations Framework Convention on

Climate Change (UNFCCC) on climate change, biodiversity, deforestation and forest degradation; and

- (iii) a proposed intergovernmental platform on biodiversity and ecosystem services (IPBES), which would strengthen the science/policy interface internationally and could provide relevant information to all biodiversity-related conventions. I am currently co-chairing the AHTEG and UK National Ecosystem Assessment, and I co-chaired the first intergovernmental multi-stakeholder consultative process on the IPBES.

- Provided input to various papers and international debates on food security and genetically modified crops. My input was in part based on the International Assessment of Agricultural Science and Technology for Development (IAASTD), which I directed. The broad consensus of the experts who worked on IAASTD was that feeding an increasingly wealthier world with an expanding population and projected changes in climate in an environmentally and socially sustainable manner can be achieved, but not with a continuation of business-as-usual. It would require trade reform, an emphasis on agro-ecological practices, enhanced public and private investment in R&D, appropriate use of biotechnology, integration of local, traditional and formal knowledge, recognition of the needs of both small and large scale farmers, improved extension services, rural development and the empowerment of women farmers in developing countries.

My third challenge is to communicate effectively the state of understanding of the major environmental challenges

that the UK and the world faces, the implications of those observed and projected changes, and the options for action. Much of my time goes into communicating internally and externally with the public, private sector, governments and science community, through intergovernmental meetings, scientific conferences and workshops, meetings with external stakeholders, working with the media and publishing articles.

During the last year I have made numerous presentations within Defra on a wide range of environmental issues (climate change, food security, biofuels, the evidence programme), and dozens of keynote presentations nationally and internationally. For example, I was asked by Ban Ki Moon to make a presentation on climate change at a UN retreat with his senior staff. In addition, I made presentations on food security at Ministerial meetings of ECOSOC and the Commission on Sustainable Development; the US House of Representatives and a plenary session of the Convention on Biological Diversity. I also made a presentation at the Ministerial meeting of the UNEP Governing Council on the major environmental challenges that are undermining poverty alleviation and achieving the Millennium Development Goals. These and many more presentations have been complemented by radio, television and newspaper interviews.

Another important set of outreach activities has been to attend select committee hearings with Ministers on topics such as geo-engineering, food security and the marine bill, and inter-parliamentary committee meetings.

A fourth challenge is to promote scientific and technical

excellence in Defra as head of the Science and Engineering Profession by facilitating career paths for scientific and technical specialists in Defra.

In meeting the challenges, I have the great advantage of working with the Government's Chief Scientific Advisor, John Beddington, the other government departmental CSAs, and the chief executives of the Research Councils to ensure that we have a joined-up Government with respect to scientific advice and co-ordinated research activities. The collaboration and co-ordination among the CSAs is outstanding and there are regular meetings to discuss key issues such as climate change, food security, counter-terrorism, and pandemic flu.

Until the newly formed Department of Energy and Climate Change (DECC) has its own CSA, Brian Collins (CSA to DfT and BERR) and I are jointly acting as DECC's CSAs. This provides an excellent opportunity to provide input into DECC's domestic strategies for mitigating greenhouse gas emissions and their international strategy leading up to the Copenhagen meeting to negotiate a post-Kyoto agreement on mitigating and adapting to climate change.

I am also strongly supported in my job by an independent Science Advisory Council, whose function is to challenge, advise and support, as appropriate, me and Defra. The Council is an expert panel, with expertise spanning the range of issues associated with Defra. Recently SAC has provided input on risk, social sciences and a range of animal diseases. An evaluation of advice given by SAC to Defra shows a very high acceptance level by Defra, eg setting up DSO-4 and joint funding with NERC, ESRC and EPSRC on risk.



DISHING UP GOOD FOOD SCIENCE



Tim Smith
Chief Executive,
Food Standards Agency

The Food Standards Agency's science was put under the microscope recently and we were pleased to get a favourable lab report. The Government's science review led by Chief Scientific Adviser Professor John Beddington said our approach to the use of science has generally been 'impressive'.

The review highlighted what is special about the way we do science and went to the heart of the remit for the Agency. Science at our core – everything we do is based on good science. Our founding chair, Lord Krebs, was a distinguished scientist who set the tone for what was to come. His successor, our outgoing chair, Dame Deirdre Hutton, has devoted a significant part of her time to embedding science in our organisational processes. For me, educated as a microbiologist and zoologist, taking over the Agency has been something of a homecoming, but I bring my experience of years in the food industry, most recently as chief executive of Arla Foods, to the table.

The Government Office for Science's review praised our commitment to open policy making – singling out our pioneering decision to throw open our Board and committee meetings to the public. Bringing our science into the public gaze has been a huge success

because public trust in our science is key to our effectiveness. We were commended for our evidence based approach – relying on research in making risk assessments and reaching conclusions that have been endorsed by the scientific community. Now we have to keep up this high standard and continuously improve in the face of resource restraints.

One of my main challenges as chief executive is to ensure that we have the right people in place. We are proud that 46% of our staff are science graduates and postgraduates and we aim to continue to attract some of the brightest and best of each generation. At the moment we are extending our Continuing Professional Development (CPD) programme, which helps to retain staff and allow them to keep in touch with the latest developments.

Good though our staff are, they can't do it all, so it is also vital that we can call on independent experts from outside the Agency to advise and challenge us. Through our ten scientific advisory committees, we have direct access to 140 scientists at the cutting edge of their fields. The recently formed General Advisory Committee on Science, chaired by Professor Colin

Blakemore, has been given the specific task of investigating and commenting on the Agency's use of scientific evidence to formulate risk assessment. It is a challenge to attract the best, but as scientists become more interested in influencing policy making, we feel the exchange is a fair one. Over the years we have been refining our method of using research. Scientists who sit on our committees have a chance to see policy making at first hand, gaining useful skills for themselves, while having an input into the making of policy that is professionally satisfying and fulfils a pressing public need.

The dilemmas are very real. The Scientific Advisory Committee on Nutrition (SACN), for instance, considered evidence that fortifying bread and flour with folic acid could reduce the incidence of neural tube defects in pregnancies. The science was clear that fortification would reduce the risk of these defects. But the advisory committee had to look at the wider picture which included research that suggested a slight risk of increased bowel cancers and a masking of vitamin B12 deficiency in older people. After SACN gave their advice to the Agency in 2006, the FSA Board had to weigh up carefully the conflicting scientific evidence as well as balancing

... Science at our core – everything we do is based on good science.

the needs of different groups in the population and the attitudes of the public to mandatory additives in food. As this article is being written, the advisory committee is preparing more advice on folic acid and cancer to government.

A recent development has been strengthening our expertise in the social sciences with a new Social Science Research Committee set up in 2008 and some interesting new staff appointments including a psychologist and social anthropologist. Their input will help us understand human behaviour in more scientific terms, which should help us get our messages across even more effectively.

Like every other public sector body, we have to be realistic about future budgets, and the impact on our research is one of the biggest challenges we face. Each year we have tried to be 'smarter' in our research spend so this is not a bolt from the blue. We try to identify the types of research that will make the most difference.

The field of nutrition is an example of how we try to get the best value for money out of our research. In February 2009 we commissioned a panel of independent external experts to review our nutrition research and to recommend what will be needed over the next few years to support the Agency's work.

Research we commission makes up only a proportion of our total input into scientific research. An important way of making our money go further is by collaborating with other agencies in funding research. An obvious example of this is European funded research. We make sure we have an input into the development of each framework programme for research, to try to ensure that it

is as relevant as possible to food safety, diet and health, and then take part in some of the projects. We also work closely with the UK Research Councils and other government departments and with specialist research funding groups. Our commitment to co-funding is growing, with a record one-fifth of our £20m research budget in 2007/08 going to co-funded projects.

Our research effort is not limited to the funding of outside research. Our in-house staff have a vital role to play in tracking research that is being done elsewhere, analysing its findings and making sure the results come to the attention of those who need to know about them. We see this as an activity that will increase in future.

This leads to one of the areas of greatest challenge facing the Agency, the dilemma memorably described by Donald Rumsfeld – how we deal with the 'unknown unknowns'. Food scares and product recalls impose a huge expense to the country and risk undermining consumers' confidence in the food they eat and the producers who sell it. With about 1,200 incidents a year we need to do everything we can to forestall these crises. So we are working hard to develop ways of anticipating where new problems will arise.

Horizon scanning is becoming part of our day-to-day work. It is partly about people – our staff are in touch with colleagues around the world, for instance through European Union and World Health Organization fora, and are ready to pick up on the first signs of new hazards or new practices that could lead to potential health risks. We are formalising some of these links, with working level agreements with food safety organisations in

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Canada, Australia, New Zealand and the US that allow us to share information before it is made public. Just listing a few of the issues – climate change, increased consumption of pre-prepared food – shows the complexity of the task facing our horizon scanners.

But above all we must be realists. We can do our best to identify the future before it happens but of course we won't succeed in all cases. We therefore give equal priority to improving our methods of dealing with incidents when they happen. Our incident prevention strategy helps us to meet any challenge and deal with it as effectively as possible. As part of this strategy, we are currently analysing all the food scares back to 2000 so we can better understand where the risks came from and how they can be prevented. Our relationships with the industry are crucially important here as their willingness to share information – and particularly how quickly they are prepared to tell us about problems – is the key to an effective response. We are developing new ways of involving industry partners and other stakeholders in devising

and implementing these initiatives.

This is a necessarily brief introduction to the way that the FSA is responding to the science challenges it faces. I don't want you just to take my word for it. This month, the Agency's Board will be focusing on science and discussing many of these issues and I'd invite you to take a look. View it as a video-on-demand and see how we do our science in the open.

Tim Smith is Chief Executive of the Food Standards Agency, the non-ministerial Government department set up in 2000 to protect the public's health and consumer interests in relation to food

Further information

Information about our science is on the Food Standards Agency website at

<http://www.food.gov.uk/science/>

The live webcast and video-on-demand of our July board meeting will be at <http://www.food.gov.uk/aboutus/ourboard/boardmeetings/>

The Scientific Advisory Committee on Nutrition website is at <http://www.sacn.gov.uk/>



THE LAUNCH OF THE FOOD AND ENVIRONMENT RESEARCH AGENCY



Hilary Benn addressing the conference audience of 230 invited guests drawn from across the public sector, academia, other research institutes and commercial clients involved in food and farming, horticulture, agrichemicals and pharmaceuticals.

The Food and Environment Research Agency (Fera) was officially launched on 15 June by Hilary Benn, Secretary of State for Environment Food and Rural Affairs, at an event held at Fera's state-of-the-art facility at Sand Hutton near York. It was attended by an invited audience of over two hundred guests representing Defra, sister agencies, academic partners, other government departments, private sector clients and overseas customers..

In his opening address Mr Benn spoke of how the new agency will strengthen Defra's ground-breaking food, farming and environmental research programme, bringing together Defra's Central Science Laboratory, Plant Health Division, Plant Health and Seeds Inspectorate and the Plant Variety Rights Office and Seeds Division, and UK Government Decontamination Service into one agency.

He went on to outline how Fera will continue to enhance Defra's work in plant and crop protection, food chain safety, environmental risk assessment and crisis response, whilst at the same time facilitating better integration between policy development, scientific evidence and inspection services. The merger will also enable a more rapid response to protect the public interest, and remove delays for businesses involved in both national and international trade.

AN INTRODUCTION TO THE ROLE OF FERA

Climate change, food security and environmental sustainability are presenting the global community with significant, complex and interrelated challenges. The Food and Environment Research Agency plays a vital role in horizon scanning, risk assessment and analysis of the evidence to guide policy response.

As Chief Scientist, my role is to ensure that Fera develops its scientists and scientific capability to deliver excellent quality research and evidence. We do this in strategic partnership with other organisations to ensure that our science and services have impact and provide value for money.

We see excellence in science as being at the top of our agenda to enable us to seek the right solutions to address the major national and global issues that threaten ecosystems, water and food supplies.

The Food and Environment Research Agency has organised its scientists into teams around the thematic science areas defined by our customers and so that we can deliver complex projects. Fera's science programmes and capabilities are outlined here.

EMERGENCY RESPONSE AND RECOVERY

Preparedness is at the centre of being able to respond to, and recover from, a deliberate or accidental Chemical, Biological, Radiological or Nuclear contamination incident. The programme is an essential part of a national capability to enable the UK environment and public life to be brought back to normal as soon as possible.

CHEMICAL RESIDUES

We provide scientific analysis, testing, research and development to help

responsible authorities across government ensure foodstuffs comply with regulations on pesticide and veterinary drug residues. Key to our success is the ability to develop faster or more sensitive detection techniques.

CONTAMINANTS AND AUTHENTICITY

There are many potential contaminants that can find their way into the food chain in addition to those relating to known interventions such as the use of pesticides and veterinary drugs.

Science teams in this area are expert in the tools and techniques for identifying other sources of contamination such as organic environmental contaminants, food processing contaminants and natural toxicants. In some cases the work may involve detecting and identifying unknown substances



Professor Nicola Spence Chief Scientist at Fera looks at some of the work the agency undertakes.

or profiling complex mixtures, both of which can be important in authenticating a substance or an origin claim in food stuffs.

CROP AND FOOD SECURITY

Our research in crop and food security is focused on finding new and sustainable ways to protect growing crops, stored food and the environment from pests and diseases. Using a multi-disciplinary approach from molecular biology through to field-based surveillance, the programme's main research themes include the development of novel diagnostic and bio-analytical methods, pest and disease management, bee health and innovative pest control strategies.

ENVIRONMENTAL RISK

Much of the work in this area centres on the effects of chemicals in the environment. This can range from the effect of pesticides on target and non-target vertebrate and non-vertebrate species, through to the fate and behaviour of pharmaceutically active compounds and nanomaterials, when they get into the natural environment.

WILDLIFE MANAGEMENT

Our science teams work with Government providing the research to inform the ongoing development of wildlife management and animal welfare strategies. They also play a significant role researching and modelling the population dynamics, risks and conflicts that occur between large-scale wildlife populations and conservation.

We also work with the aviation and renewable energy industries to reduce the risks of bird strikes.

WILDLIFE AND EMERGING DISEASES

Fera's science teams in this area provide research, advisory and operational services in relation to diseases of wildlife, livestock and zoonotic infections of humans. They contribute to disease control by developing effective wildlife management options and by helping implement these.

By integrating the skills of veterinarians, ecologists, mathematical biologists and wildlife management specialists, we have a unique breadth of understanding and the ability to deliver practical solutions to disease problems and human-wildlife conflicts.

PEST AND DISEASE IDENTIFICATION

Our work is focused on plant pest and disease identification and control, supporting both the development of plant health policy, Fera's Plant Health and Seeds Inspectors and the industry. Vital to both is the drive to develop faster and more accurate frontline in-the-field diagnosis techniques.

We have a broad range of science skills within these teams including bacteriologists, entomologists, mycologists, nematologists, molecular biologists and virologists.

INSPECTORATES

The inspectorates work in partnership with those required by law to use their services. Their aim is to educate users about Government policies and where possible to advise on how to avoid risks from pests and diseases or how to deal with issues relating to quarantine or enforcement notices. Fera's inspectorates cover bee health inspection, plant health inspection and certification of plant materials for import or

export, and meeting licence requirements or import restrictions on genetically modified organisms.

FERA AT A GLANCE:

Fera:

- has over 40,000 government and commercial customers
- runs over 600 research projects
- provides services to customers in over 100 countries
- analyses over 50,000 plant and food samples a year
- carries out over 150,000 plant and bee health inspection visits a year
- works with more than 1000 collaboration partners
- has a turnover in excess of £72 million a year
- employs around 900 people including over 500 scientists and 150 plant and bee inspectors
- is the National Reference Laboratory for chemicals in food, pesticides, veterinary drugs, dioxins and PCBs in feed
- scientists have published over 30 papers in peer-reviewed journals listed in the Science Citation Index since vesting in April 2009

CONCLUSION:

The Secretary of State set the bar high when he spoke at the launch of Fera in June, highlighting the global challenges we face – climate change, degradation of the environment, and scarcity of resources. And all this in the context of the world needing to be able to feed nine billion people by 2050.

The Food and Environment Research Agency has a key role to play in meeting these challenges. Our over-arching purpose is to support and develop a sustainable food chain, a healthy natural environment, and to protect the global community from biological and chemical risks.

Our role within that is to provide robust evidence, rigorous analysis and professional advice to Government, international organisations and the private sector.

Fera has accountability for a number of areas of Government policy in relation to plant health and other matters. In order to improve our policies in these areas, we need the assistance of our customers, including Parliamentarians, to work with us and express their views freely. I would ask and encourage all our stakeholders to participate in any future consultation programmes Fera undertakes. We will continue to use our stakeholder database to contact interested parties proactively but our website will always carry details of any active consultations Fera is involved with.

Looking ahead, the future is challenging and exciting. We will be applying our expertise to research, development and knowledge transfer to fill the knowledge gaps and provide robust evidence to support future policy.

However, we cannot do this alone, and we look forward to working together both with public, academic and private sector partners.

To find out more about us and our work programmes, please visit our website at www.defra.gov.uk/fera



JOHN INNES CELEBRATES ITS CENTENARY - GENETICS 100 YEARS ON

Sarah Wilmot and
Dee Rawsthorne
John Innes Centre

In 2010 the John Innes Centre will have been at the forefront of 100 years of scientific breakthroughs benefiting the world through pioneering research in genetics. Its Centenary focus celebrates the legacy of William Bateson, the first Director.



William Bateson, first Director of JIHI, coined the word genetics

Founded by the bequest of London property developer, John Innes (1829-1904), the John Innes Horticultural Institution (JIHI) opened in January 1910. Its remit was discussed by Trustees of the will, the Board of Agriculture, the Board of Education and the Director of Kew Gardens who established the JIHI as a training school for practical gardeners, a fruit-breeding research station, and an institution 'for the promotion of horticultural instruction, experiment and research'. William Bateson (1861-1926) was chosen as the first Director because he led the new science of genetics in Britain. He translated and

promoted Gregor Mendel's papers on plant hybridisation and coined the word 'genetics' in 1905. Bateson assembled a group of enthusiastic young scientists and used Mendel's principles to attack problems of inheritance in plants. From 1910 to 1948 the Institution was based at Merton in Surrey, centred on the Manor House at Merton Park, Mr Innes' former home. Two moves followed, first to Bayfordbury, a stately home south of Hertford in 1949, and in 1967 to Colney near Norwich (its present site) to form an association with the newly-established University of East Anglia.

For the first half of the twentieth century the JIHI was the only place in Britain undertaking research in plant genetics, and where students could train in the subject. During controversies over the role of genetics in biology, particularly with Russian science under Stalin, its scientists acted as spokespeople for genetics in Britain. Although University expansion has greatly increased Britain's resources for genetics, the John Innes Centre continues to play a world-leading role in research and training today.

From 1910 to 1946 the John Innes Horticultural Institution was an independent research centre funded by the John Innes Charity and much of its unique character was due to its valued independence. By 1946 the needs of the Institution had outgrown the resources of the

Charity and JIHI became a grant-aided station of the Ministry of Agriculture, later administered by the Agricultural Research Council (which became the AFRC, then BBSRC). Today, the John Innes Foundation trustees contribute to research and training, sponsoring several graduate studentships each year and supporting the study of the history of genetics. The Foundation owns a very significant collection of archival material, the History of Genetics Library and the 'Special Collection' of rare botanical books at JIC.

During the first phase of the Institution's history the fruit industry helped shape the research agenda with representatives of the Fruiterers' Company and the National Fruit Growers' Federation on its managing body. Fruit breeding was one of the main lines of research until the 1970s. Although many of the early crosses were made to study inheritance and not to produce new varieties, the JIHI ultimately released 53 fruit varieties, 28 flower varieties and 15 vegetable varieties. One of the lasting contributions of UK fruit development was the MM (Malling Merton) series of rootstocks, originally bred for woolly-aphid resistance in apples but now used in modern rootstocks to provide other properties.

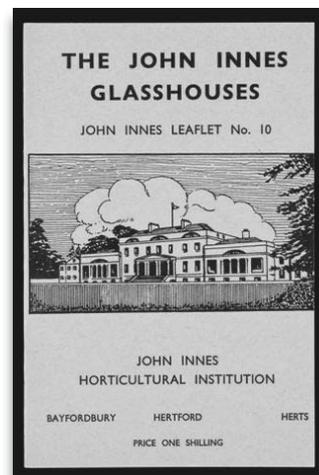
During World War II JIHI published a series of leaflets on fruit planting and fertility, and on



Fruit breeding was one of the main lines of research until the 1970s

composts for specific uses, as part of its contribution to the war effort. Later the horticultural trade made 'John Innes' a household name. But JIHI never made or sold compost and received no monetary gain from that major development in plant propagation, as the recipes were published and not patented.

Horticultural training was provided through the Institution's student gardener scheme which ran from 1911 to 1939. Six student gardeners ('exhibitioners') were taken on every year to receive specialist instruction in the gardens and glasshouses.



Glasshouse design was pioneered at JIHI

In 1960 the Institution changed its name to the John Innes Institute, signalling the inclusion of microbial science in the research programme and a move towards more fundamental research in biology. Applied genetics work moved away from fruit and began to concentrate on peas and other horticultural crops; today JIC does not breed new plant varieties. In 1994 the Institute was renamed again as the John Innes Centre, after the John Innes Institute integrated with the non-privatised part of the Plant Breeding Institute, relocated from Cambridge, and the AFRC Nitrogen Fixation Unit which moved from the University of Sussex.

The modern day JIC operates on a scale that allows studies from the atomic level to crop field performance, and promotes the rapid transfer of knowledge from model organisms to target crops and industrial microbes. This integrated, multidisciplinary approach enables JIC to tackle the unprecedented challenges facing the world such as food security, sustainable land use, increased cost of energy and commodities, living with the impact of rapid environmental change, rapid loss of biodiversity, reducing reliance on petrochemicals, increased population pressures, healthy ageing and control of infectious diseases, and the production of sufficient safe and nutritious food. The improvement or development of crop plants for enhanced food and feed quality and the production of raw materials is a priority, as is food composition for animal and human nutrition, the prevention of chronic diseases and healthy ageing.

Research at JIC continues to have a significant impact for wealth generation, quality of life

and human health because plants are our food and that of our farmed animals, providing most of our fossil energy reserves and a large range of industrial products. Plants are sustainable and eco-friendly 'factories' for the production of starches, oils and lubricants, drugs, plastics and pharmaceuticals. JIC scientists are underpinning the development of improved and novel crops by understanding plant function at the molecular level, genetic variation underlying important traits such as yield, and the impact of the environment and environmental change on productivity. Through bioengineering, JIC is developing efficient systems for protein production in plants, especially for high-value proteins, nanoelectronics, biosensors and drug delivery devices.

Healthy ageing is hampered by the emergence of antibiotic resistance which has led to an urgent requirement for new anti-infectives, and the need for a better understanding of the mechanisms of resistance. The discoveries being made at JIC and the exploitation of new antibiotics and other bioactive products from microbes will be critical for future disease control.

Our research is providing solutions to global challenges and securing our future.

A recent economic impact report highlighted significant benefits resulting from JIC's research. The identification and development of the semi-dwarfing gene in wheat has helped to increase production by £75M per annum in the UK alone. Work to mitigate major losses in world wheat production could potentially be as much as £4.3B pa. Gene mapping in cereals underpins actions to address world hunger, and can be seen as leveraging World Bank funding of £2.6M pa



John Innes Centre at Colney, Norwich

into organisations such as IRRI (Philippines) and CIYMMT (Mexico). Through research into semi-leafless varieties, JIC's work underpins the £38M annual UK pea market, with directly attributable sales of £2.9M pa. Newly-introduced "Super-Broccoli" is adding value to UK consumers of £0.5M pa, and may also contribute to reduced incidence of cancer. JIC discovered the genetic basis of antibiotic properties in *Streptomyces*, a global market now worth \$35B pa. The spin-out companies Novacta (in receipt of a £3M Wellcome Trust grant to work on solutions to *Clostridium difficile* and MRSA) and Procarta Biosystems (developing novel strategies for overcoming antibiotic resistance) have arisen from this fundamental science, and if successful could add £194M to the UK economy through prevention of avoidable deaths.

A focal event to celebrate 100 years of John Innes science takes place at the John Innes Centre in Norwich, UK from 9th-11th September 2009. An international line-up of science historians will cover the history of John Innes with topics including the background behind the founding of the 'John Innes Horticultural Institution', the role of women scientists in the John Innes workforce in the early years, Bateson's contributions to

evolutionary theory, and JI's place in the history of genetics from the inter-war years to the atomic age. They will be joined by scientists Mike Gale and Keith Chater, and science philosopher Sabina Leonelli, to cover JIC's contribution to the modern sciences of crop genetics, bacterial genetics and *Arabidopsis* research - history in the making! This will be followed by a science symposium reflecting on the various areas of human interest that have been transformed by a genetic approach, examining where these areas are now and where they might be in the next 100 years. The meeting is being opened by Nobel Laureate Professor Sir Paul Nurse, delivering the Bateson Lecture.

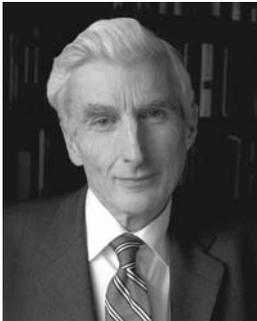
To view information on these and other Centenary events including 'Discovery Day' for the public to explore the science at JIC, a planned Economic Impact event at the House of Lords and a Forward Look Conference in London, go to www.jic.ac.uk/centenary/

Front Cover Image

Scientists at JIC have expressed two genes for production of anthocyanins in tomato fruit which originated from the garden flower *Antirrhinum* (snapdragon). Genetic modification offers the opportunity to develop food with large amounts of phytonutrients (in this case, anthocyanins) with health promoting properties.



SCIENCE: OUT OF THE ECONOMIC DOWNTURN



Lord Rees of Ludlow OM PRS
President, The Royal Society

Ever since the Industrial revolution, science has been driving the global economy. As a scientific nation, the UK is, by most indicators, second only to the US. But this is not fully reflected in our economic strength, so where have we gone wrong?

In these tough economic times, we are refocusing on how best to harness this strength to our national advantage. Political responsibility for nurturing our academic talent and for unlocking the economic benefit now rests with a single 'super ministry', the Department for Business, Innovation and Skills, and particularly in the hands of Lords Mandelson and Drayson.

It seems clear in retrospect that this country was precariously over-dependent on its financial sector; the new ministry's aim should be to ensure that our science and engineering strength enables us to emerge from the downturn with a more diversified economy. There should plainly be special boosts for topics ripe for exploitation – via

procurement policy, and via the Technology Strategy Board and other bodies. It is nonetheless important that long-term prospects – and the strength and breadth of the UK's underlying academic base – shouldn't be jeopardised.

There have been concerns about this balance, especially from those in the university sector – after all, 'business' comes first in the new department's name; neither science nor universities is mentioned.

If the new department were to analyse the UK's 'assets' most relevant to the recovery, what would they find? High among them would be our universities. We are the only country outside the US with several universities in the top international league, and research excellence is spread throughout the sector.

The most readily measurable economic benefit of academic research is direct knowledge transfer from university labs to industry. But that is only a small part of the total. Research universities fulfil other key roles that are harder to quantify. They are networked with the whole world's research. Their graduates spread expertise throughout the private and public sectors. The worry must be that if we do not continue to invest in our graduates and provide them with opportunities they will be tempted to the US or countries such as China where opportunities are increasingly available.

Our leading universities (like Harvard, Stanford and MIT in the US) are not primarily places for

'applied' research. It is within them that transformative discoveries emerge, unpredictably and unplanned. But there is a strong correlation between the research quality of a university and the strength of the commercial cluster that is attracted around it. Talent attracts talent, and big companies, too. In these high-tech communities, success breeds success and – just as important – failure is accepted as a step towards later success. Around Cambridge alone there are over 1000 start-up companies, a number of which have become multibillion dollar international enterprises.

I am fortunate to know many of the leading UK scientists – those who have won Nobel Prizes or the equivalent. They are all individualists, but on one thing they would all agree: they would highlight the long-term nature of their work, the unpredictability of its outcome and the need for a supportive environment. To ensure that our universities stay competitive (and retain top talent despite the blandishments of top research centres in the US and the Far East), it is crucial that they continue to offer this environment.

Lord Mandelson recently offered reassurance that the science budget channelled through the Research Councils is 'safe' and 'ring-fenced'. He confirmed that the funding would continue to be run according to the Haldane principle which dictates that scientists, rather than politicians, are best placed to decide which projects should be supported. He recognised that fundamental

science is essential to maintain our ability to produce pioneering research that will support a sustainable base for our future prosperity. He has also lauded our universities and their contribution to the economy. This is all excellent news.

It's in our interests to support real excellence right across the board – and indeed it's affordable even in these straitened times. One of my predecessors as President of the Royal Society, George Porter, averred that there are two kinds of science: applied and not yet applied.

None of those who worked on the magnetic properties of atomic nuclei had any thought that their work would one day (through the Nobel Prize-winning work of Peter Mansfield at Nottingham) have medical applications via the MRI scanners we find in every hospital. Similarly, the pioneers of lasers had no idea that they would be used in eye surgery or in DVDs.

The Royal Society has convened a group with wide ranging expertise (it contains two former science ministers, two Nobel Prize-winners, and others with commercial experience) to study the long-term value of science to the economy. Its report will be entitled 'The Fruits of Curiosity' – a phrase that captures the value of science. Most great breakthroughs do start with the curiosity of the scientist but in science, engineering and medicine the payoff for research and development can take

decades rather than years.

It clearly makes sense also to look at where we have been successful and where we might do better. The pharmaceutical industry has flourished in synergy with the UK's research base in biomedical science. And that base is strong because public support for biomedical sciences has been massively supplemented by charities, and by the industry itself. There are many examples of financial success in the medical sector – the winner of this year's Royal Society Mullard Award, Shankar Balasubramanian, received a £200,000 Research Council grant in the 1990s to study rapid DNA sequencing, and within a decade this led to a business worth about \$2 billion.

But what about other sectors? The earlier ministerial stint of Lord Drayson, at the MoD, where he oversaw procurement of high-tech equipment (a responsibility that is once again in his remit) will have convinced him that our manufacturing sector in physics-based industry is patchy. There is a paucity of major high-tech manufacturing companies in the UK. Indeed the weakness of our electronics industry stems from short-sighted policies and lost opportunities in the 1970s and 1980s, from which lessons can surely be learnt. We had the science but we failed to capitalise on it.

At a time when we need to rebalance our economy towards high-tech manufacturing and services, we should build on the momentum developed during the last 12 years of sustained government support and invest in efforts to recover our strength in the industries based on the physical sciences.

Indeed, to retain our international competitiveness, we must raise our game. That's

because the pull of the US is now much stronger. Lord Mandelson has asked that the Government be judged on their policies and that is fair, but the policies must not only be judged against previous measures but must be seen in the light of the efforts in other countries. The Obama administration has given America's scientific community a massive boost – in morale and in substance – promising to

move science to the heart of government and the economy. Our success in attracting and retaining mobile talent will be at risk unless we respond – and unless we can deploy our

limited resources even more cost-effectively than the US does.

This article first appeared in The Times on 23 June 2009.

... Lord Mandelson recently offered reassurance that the science budget channelled through the Research Councils is 'safe' and 'ring-fenced'...

The Royal Society celebrates its 350th anniversary in 2010, with a programme that begins on the 30th November 2009 (known in the Society as Anniversary Day from the date of its founding) and running until November 2010.

In the run up to its anniversary, the Society is establishing a Science Policy Centre. We want to strengthen the voice of science in UK, European and international policy. We want to champion the contribution that science can make to economic prosperity, quality of life and environmental sustainability. And we want to be a hub for global debate about science, society, policy and politics.

More information about the Science Policy Centre is available at royalsociety.org/policy.

The anniversary will be celebrated with a year-long series of events, exhibitions, and publications to increase both the public's involvement in and the profile of science, promoting a spirit of enquiry, excitement and engagement with science.

The Society will be working with organisations across the country to raise the profile of science and bring scientific activities to a new audience. This will include:

- A unique nine-day science festival in the summer of 2010, held at the Southbank Centre in London. There will be collaborations with artists and performers, debates, broadcasting and the participation of audiences. In particular, it will include an enhanced version of the Society's annual summer science exhibition, which gives visitors the opportunity to meet the scientists and engineers at the forefront of the UK's research activities and to explore their work through interactive exhibits.
- The Local Heroes programme – the Society will be working with fifty museums and galleries around the UK to celebrate their local scientific heroes, whether they are pioneers of the industrial age, geniuses that changed the way we see the world today or contemporary scientists finding solutions to today's problems.
- The Capital Science programme – the Society will be working in partnership with leading museums and galleries, as well as other organisations in London, to celebrate the Royal Society's anniversary and explore the impact of science within the wider cultural landscape. The programme is wide ranging and includes major keynote events and lectures, as well as fun events and learning activities, which popular London museums will be running for families and younger audiences.
- Public lectures, debates and discussion meetings at the Society's premises in Carlton House Terrace.
- Publication of special editions of the Society's scientific journals and a popular book covering the unique history of science and scientific issues of the last 350 years.

More information about the anniversary year can be found on the back cover of this publication and at seefurther.org.

IT'S NOT ALL ABOUT DEAD BODIES



Dr Suzy Lishman
Consultant Histopathologist,
Assistant Registrar of The Royal
College of Pathologists

When you think of pathology what comes to mind? If you think about mortuaries and solving crimes you're not alone. Research has shown that most people learn about pathology from the television, where programmes such as *Silent Witness* and *CSI* give a rather unrealistic view of the specialty. The reality of pathology in modern healthcare is very different.

MULTIPLE DISCIPLINES

There are eighteen different disciplines within pathology, the largest being cellular pathology (the study of disease by studying tissue microscopically), haematology (the study of diseases of the blood), chemical pathology (the study of chemicals in the blood and other body fluids) and medical microbiology (the study of infections). Smaller disciplines include immunology, toxicology, clinical embryology and genetics.

The pathologists most commonly portrayed on television, forensic pathologists, make up less than 1% of the specialty.

WORKING FOR THE LIVING

Far from being doctors to the dead, the vast majority of pathologists work for the benefit of the living. If you've ever had a blood test, a cervical smear, a biopsy or allergy test, you have been cared for by a pathologist. As well as working in laboratories, pathologists work on hospital wards and in outpatient clinics. Pathologists are core members of the multidisciplinary teams of healthcare professionals who care for every cancer patient, contributing information about diagnosis, prognosis and the effect of treatment. Far from being the isolated, repetitive job sometimes portrayed, pathology is a dynamic and exciting specialty, full of professionals who care deeply about providing high quality healthcare.

PUBLIC ENGAGEMENT

In November 2008 the Royal College of Pathologists organised the first National Pathology Week, giving everyone working in the specialty the opportunity to raise awareness of the role of pathology in modern medicine. Over 70% of diagnoses made in the NHS involve pathology, making it a vital part of almost everyone's healthcare experience. Over three hundred events were held during National Pathology Week in hospitals and communities around the country.

NATIONAL PATHOLOGY WEEK 2008 EVENTS

Events included interactive workshops, scenario events, presentations to trust Boards, school visits, photographic and art competitions, quizzes, laboratory tours and open days, stands in shopping centres and even a pathology bus. Events were targeted at a wide range of audiences including school students from Key Stage 2 to 5, medical and other university science students, the general public including families, healthcare professionals, MPs and other policy makers. National Pathology Week was launched at an event at the House of Commons, where MPs had the opportunity to talk to pathologists about the contribution of the specialty to healthcare, focusing on current topics including cancer screening programmes, point of care testing and the treatment of long term conditions.

FEEDBACK

Evaluation was a key part of National Pathology Week and was very positive, with almost everyone who attended an event being keen to attend another one. Encouragingly, half the people who attended events had not attended anything similar before, which means that National Pathology Week helped introduce thousands of people to science and pathology. It wasn't just members of the audience who found National Pathology Week educational and fun, event organisers also benefited from the experience.

Plenty of constructive feedback was also received. Audiences wanted more opportunity to talk to pathologists, so informal question and answer sessions have been incorporated into subsequent events. Audiences also asked for full day events, which require catering facilities and a time commitment that most pathology departments cannot provide. We have addressed this by working more closely with science centres, integrating pathology into established public engagement programmes.

Some of the comments made following National Pathology Week 2008:

"The most useful thing was having real scientists to talk to"
GCSE student

"I learnt that pathologists find ways to improve people's lives"
A level student

"I really enjoyed the experience and found it very motivating"
Event organiser

"I've learned more today than I have in the last year"
GCSE student

"Absolutely fascinating – a great event showing the NHS at its best and clearly demonstrating value for money."
Member of public

"It's not like it is on the telly!"
Member of public

TEAM WORKING

National Pathology Week provided a great opportunity for all those working in the specialty to get together to develop and deliver an event. There are

several different professional groups working in pathology, including medically-qualified pathologists, clinical and biomedical scientists, laboratory and mortuary technicians, cytology screeners and administrative staff. National Pathology Week was a great team-building exercise, allowing colleagues who had perhaps never worked together to join forces to promote their specialty. Several pathologists even commented that organising an event had reignited their passion for the subject. Trainees in all professional groups were particularly enthusiastic and were popular with younger audiences.

NATIONAL PATHOLOGY WEEK 2009

The second National Pathology Week is being held from 2nd to 8th November this year. Over three hundred events are being organised around the country. This year the theme is *Pathology: the heart of modern healthcare*, focusing on the central role of all pathology disciplines in the prevention, diagnosis, treatment and monitoring of all types of heart disease. For example, chemical pathologists will highlight their role in the interpretation of cholesterol and heart enzyme levels, haematologists will explore their role in treating blood clotting disorders, microbiologists will demonstrate the diagnosis of infections that affect the heart, immunologists will look at the pathology behind heart transplantation, geneticists will reveal how some heart disease is inherited, and paediatric pathologists will explain their role in the diagnosis of congenital heart disease. All of this will be presented in the context of the busy, modern NHS pathology service, with expert pathologists and scientists giving up their own time to

share their passion for patient care through the science of pathology.

COLLABORATION

Pathology is all about teamwork, and National Pathology Week is no different. In 2008 The Royal College of Pathologists worked with other specialist societies including the Association for Clinical Biochemistry and the Pathological Society to develop successful public engagement events. Links with specialist societies are even closer this year, with representatives of the larger societies being core members of the central co-ordinating team. The team also includes representatives from each of the College's eleven regions, ensuring that pathology professionals around the country have access to local support and information.

This year, the College is working with the British Heart Foundation to promote heart health and healthy lifestyles. The Royal College of Pathologists has also developed links with science centres around the country and events are planned in collaboration with the Science Museum in London, W5 Science Centre in Belfast, Thinktank Science Museum in Birmingham, the Thackray Museum in Leeds, Sensation Science centre in Dundee, Glasgow Science centre, the Centre of the Cell in London and The Centre for Life in Newcastle. Joint events are also being held with the Royal College of Surgeons, the Royal Geographical Society, the Wellcome Collection and the Royal Institution. By working with such a diverse group of partners the College hopes to take pathology to a wide audience who might otherwise not have the opportunity to discover the fascinating science behind so many familiar medical tests and procedures.



Object handling at a virtual autopsy event held at the Royal College of Surgeons during National Pathology Week 2008, one of over 300 public events held throughout the country.

PATHOLOGY ALL YEAR ROUND

Furthering public understanding of pathology is one of the key aims of the Royal College of Pathologists and National Pathology Week is just one part of the public engagement programme of the College. Pathologists around the country visit schools and communities all year round and the College is developing an outreach project to provide resources for those involved in these events. Many pathologists have taken advantage of science communication training, developed by the College in collaboration with the Science Museum. Participants have learnt how to plan events to meet the needs of different audiences. Many members of the College are also STEMNET Science and Engineering Ambassadors, part of a nationwide network of trained science communicators.

NATIONAL PATHOLOGY WEEK WEBSITE

There is a dedicated National Pathology Week website (www.nationalpathologyweek.org) with information and resources for members of the public, those considering a career in pathology and pathologists and scientists who would like to

develop a public engagement event. There are glossaries, frequently asked questions and links to websites where further information can be found. For event organisers there are downloadable posters, handouts, presentations, event templates and tips on how to organise and publicise an event.

WHAT CAN YOU DO?

Everyone can get involved in promoting science in general and pathology in particular. There is a programme of events taking place during National Pathology Week on the website, so have a look and see if there's anything near you. If you're involved in health policy-making, this is an ideal opportunity to find out first hand what happens in a pathology department and how important the specialty is to patient care. If you're part of an organisation with a public engagement role, could you work with us to reach an even wider audience?

I'd also like to thank our sponsors Siemens for their continued support.

For more information about National Pathology Week visit www.nationalpathologyweek.org or contact me.

Dr Suzy Lishman, National Pathology Week Lead
suzy.lishman@pbh-tr.nhs.uk

LEADING THE SEARCH FOR ANIMAL ALTERNATIVES



Dr Vicky Robinson
Chief Executive, National Centre
for the Replacement, Refinement
and Reduction of Animals in
Research (NC3Rs)

Astonishing advances are being made across the life sciences, from developments in stem cell technologies to personalised medicines, which will pave the way for novel therapeutics for some of today's unmet medical needs. As with most advances there are accompanying ethical issues which society has to address. One of the most long-standing and contentious issues is the use of animals in research and testing. Public opinion polls consistently show a high level of concern about the use of animals and support for their use is conditional on the application of principles known collectively as the 3Rs, that is replacement with non-animal

methods and, where this is not possible, minimising the numbers and suffering of the animals used (reduction and refinement respectively).

This year marks an important anniversary – the 50th anniversary of the 3Rs. Since they were first described by William Russell and Rex Burch in their publication *'The principles of humane experimental technique'* in 1959, the 3Rs have become adopted around the world as an ethical framework for the use of animals. In the UK and elsewhere in Europe, the 3Rs have been incorporated in legislation controlling the use of animals in scientific procedures. The European Directive 86/609 for the protection of animals used for experimental and other scientific purposes is currently being revised and this has important implications for the implementation of the 3Rs. However, aside from the legislative and ethical framework provided by the 3Rs for the humane use of animals, there is increasing recognition that the 3Rs are also important from a scientific perspective.

Animals play an important role in medical research, to understand why diseases occur and how they might be treated, and to ensure that any new medicines are safe and efficacious. However, the process of developing new

medicines is inefficient with many medicines which work in animal experiments failing to meet expectations in humans. In order for new and exciting advances in the life sciences to fulfil their potential there is a need to find scientifically robust solutions to the current use of animals in some areas of research. This may involve the development of more predictive animal models or the use of non-animal methods. In either case the 3Rs provide an important tool for stimulating innovation in the development and use of non-animal methods and improvement in the welfare of the animals used. Indeed, the scientific community is increasingly aware that the results of experiments using animals can be affected or even compromised depending on the way animals are housed and handled. Healthy and 'happy' animals are essential for ensuring research is interpreted accurately and conducted to the highest possible standards.

In order to maximise the scientific benefits of the 3Rs and address the ethical and societal concerns about the use of animals in research, in 2004, the Government established the National Centre for the Replacement, Refinement and Reduction of Animals in Research – more commonly known as 'the NC3Rs'. The role of the NC3Rs is to align cutting edge science and technology and the UK's best scientific 'brains' with stimulating advances in the 3Rs. The Centre works with scientists in universities, industry, regulatory authorities and research funding

bodies and has an annual budget of approximately £4.5 million. It is funded by the Government, the Medical Research Council, the Biotechnological and Biological Sciences Research Council (BBSRC), the Wellcome Trust and the pharmaceutical and chemical industries.

Since its launch, the NC3Rs has funded over 40 research projects in leading universities and companies. The NC3Rs is the largest funder of 3Rs research in the world with £8 million awarded to date. This investment is already yielding benefits. For example, researchers at Imperial College London, funded by the NC3Rs, have developed a refined mouse model of pulmonary embolism which avoids the high level of animal suffering previously involved, minimises the number of mice used and provides a scientifically better model with which to investigate new treatments for the disease, which is potentially fatal. The Centre's research portfolio is broad, covering a range of species from monkeys to mice to fish, and a range of disease areas from asthma to diabetes to spinal injury. Elsewhere, work funded by the NC3Rs at Newcastle University has provided the first definitive evidence that mice used in cancer research can experience pain. Although this may seem intuitive to most, until now it has been difficult to identify animals which may be in pain. One possible reason for this is that mice may have evolved strategies to conceal signs of suffering from potential

... The European Directive 86/609 for the protection of animals used for experimental and other scientific purposes is currently being revised ...

predators. Without this information, it is impossible to ensure that animals are provided with analgesia of the right type, at the right dose, and for the right duration. This research therefore represents an important step in ensuring that cancer studies are conducted as humanely as possible.

The NC3Rs has also awarded grants for 3Rs projects in veterinary research, particularly focusing on vaccine testing which uses large numbers of animals in tests which can cause substantial suffering. For example, Clostridial bacteria cause a wide range of diseases in animals, including tetanus and forms of dysentery, and are associated with a high degree of illness and death. As a result, vaccines to protect against these diseases are among the most common veterinary treatments used in farm animals. Each batch of vaccines has to be tested to ensure it is safe and efficacious to use and this involves the use of many thousands of mice each year. Funded by the NC3Rs, the animal health company, Intervet/Schering-Plough, has successfully developed *in vitro* methods for the testing of Clostridial vaccines. Further work at the Veterinary Laboratories Agency, also funded by the NC3Rs, involves the development of non-animal analytical methods for *Leptospira* vaccine potency testing. Leptospirosis is a potentially fatal bacterial infection transmitted from animals to humans and this project aims to replace the hamsters currently used in the UK each year for testing the canine vaccine.

Aside from the research funded by the NC3Rs, the Centre has developed an extensive programme of collaborative activities led by its

own scientists, who work to inspire and foster new approaches to the 3Rs in the life sciences community by providing a constructive and open environment for sharing ideas, data, practice and solutions. Working with scientists in academia and industry, the NC3Rs staff lead over 20 projects which are also delivering real progress, including changing international regulations. Many of the projects have long-term and ambitious goals. Unfortunately, replacing, reducing and refining animal use is not as trivial as some groups claim and there is a need for sustained investment and commitment. This is exactly what the NC3Rs has embarked on with the tissue engineering community.

Tissue engineering has great promise as a tool to replace animal use because it involves the development of tissues which will function effectively in the body and mimic what happens *in vivo*. To date, most of the research into tissue engineering has been for clinical purposes to repair dead or diseased tissues in patients, however, the NC3Rs, working with the BBSRC, is leading a programme of activities to raise awareness about the prospects that tissue engineering could have in replacing animal use in a range of scientific disciplines. The NC3Rs has recently held two symposia on the alternative commercial and scientific applications of tissue engineering and a 'speed-networking' event. These have promoted collaboration between academic and industry scientists and encouraged exploitation of the technology, particularly with regard to modelling the skin, liver, airways and cardiovascular system.

Many regulations exist which require animals to be used in tests to ensure new medicines

... collaboration has led to an 80% reduction in the number of animals used. . .

and chemicals are safe for man and the environment. Work co-ordinated by the NC3Rs and involving 18 European pharmaceutical companies has led to a significant reduction in the use of one test 'single dose acute toxicity' in rodents. This was the only test in drug development which involved the death of the animals as a measurement of toxic effects. By sharing data across the companies this NC3Rs/industry collaboration has led to an 80% reduction in the number of animals used and demonstrated that this test is no longer required to provide information for human safety. Importantly, this work has led to a revision of the international regulations for the test, which should end the use of single dose toxicity studies.

The success of the NC3Rs has been its scientific approach and ability to embed the 3Rs in the mainstream life sciences. It is the scientists who must be actively engaged as it is their expertise which ultimately will lead to further progress in the 3Rs. A survey by the NC3Rs has shown that the majority of scientists who use animals are supportive of the 3Rs but few have carried out specific 3Rs research in their area. The NC3Rs is working to expand 3Rs research across the life sciences and in its short history has already made a significant impact. Progress can only take place in an environment where scientists can talk freely and openly about their use of animals and the opportunities for the 3Rs. The polarised debate that often accompanies the use of animals does not facilitate this and has been

further fuelled by the revision of the Directive 86/609. Whether the provisions in the Directive relating to the 3Rs have the desired impact remains to be seen. However, the plan for a national reference laboratory for the validation of alternatives in each member state is unlikely to yield the intended benefits as it will marginalise replacement as a satellite activity focused on a single area of animal use (safety testing) and may not take account of reduction and refinement. Animals are used in many areas of science and success in the 3Rs is similarly dependent on engaging with a diverse range of experts from a range of disciplines and at all stages in their careers. This year, as part of its commitment to capacity building in the 3Rs, the NC3Rs has launched a new studentship scheme. This is an important project aimed at embedding the principles of the 3Rs in the training of young scientists and tomorrow's research leaders, from the start of their careers. These are exciting times for the 3Rs and the advances in science and technology provide unprecedented opportunities for progress.

Further information on the work of the NC3Rs can be found at www.nc3rs.org.uk and in its latest annual report www.nc3rs.org.uk/annualreport

The NC3Rs held an event in the House of Lords earlier this year to highlight its work to Members of Parliament and Peers. Abstracts of the research showcased can be found at www.nc3rs.org.uk/westminster



INFORMATION AND SECURITY TECHNOLOGY – DEVELOPMENTS AFFECTING PERSONAL FREEDOMS



Professor John Pethica,
Chief Scientist, National Physical
Laboratory (NPL)

Information and security technology is advancing rapidly, and each new development brings with it a new set of issues relating to the freedom and privacy of individuals. This in turn creates significant responsibilities for those involved in the use of personal data for security or commercial reasons. Both the public and the private sectors need to be aware of how the landscape is changing and the risks and responsibilities that arise from the access they have to large amounts of information.

The fall in cost of data storage, especially flash memory, has made it practical to keep vast banks of information which can be speedily accessed and copied. People leave an ever-growing set of digital fingerprints and an accumulating personal digital history. Phones track calls and locations to within a few metres, browsing history and timings can be monitored, and travel, health, and financial transaction information are all readily stored on databases. These can be called up almost instantaneously

for analysis and correlation, all of which is very handy for advertising, efficient service delivery, or security.

The consequences of all this are far reaching. Data accumulates over time and users' history becomes more powerful and accessible. Once online, information is permanently public. Information on Facebook, for example, provides new links to a previously anonymous past. The people with privileged access to this data have a duty to act responsibly.

This all sounds a bit 'Big Brother', yet it has been accepted by many because of the conveniences that ready data access brings. We can now do our car tax online, medical databases speed up research and access to treatment, and the ability to carry out national and international trade without leaving your desk has a positive impact on the environment.

For the most part, it is where we are and who we talk to that is being monitored, not (yet) so much the content of what we

say. As long as such databases provide tangible benefits which clearly outweigh the risks and disadvantages, and do not have direct, unacceptable consequences for our personal privacy, most people will tolerate them.

However, using such data for security purposes or for commercial gain raises issues which need to be addressed if organisations are to avoid further damage to public confidence in IT systems. One such problem is that of human error, and however often we hear 'this won't happen again', it will. Actions inevitably lead to errors. The laws of thermodynamics can be paraphrased as 'you can't win; and in practice you can't break even'. More prosaically, Murphy's Law states: anything that can go wrong, will go wrong.

Take car insurance data for example, as used for on-line taxing of vehicles. It is estimated that roughly one entry in every 1000 is in error. That means problems for 0.1% (some 25,000 people) not least because their cars appear uninsured when caught on an ANPR (Automatic Number Plate Recognition) camera. However, it also means the other 24.975 million are potentially satisfied customers.

... Both the public and the private sectors need to be aware of how the landscape is changing ...

It is probably reasonable for an insurance company or bank to do a cost/benefit analysis, and conclude that it is cheaper to fix and compensate a few errors than to spend vast amounts trying to get a 'perfect' system. If it works for 999 out of 1000, that might be OK.

It is much less reasonable for security organisations to do so. Someone who has been wrongly detained as a terrorist due to incorrect data will rightly be much less forgiving than someone with a minor car insurance error, especially if the data cannot be readily erased. False positives and negatives can make data useless when looking for 1 in 100,000. Security is quite different from general customer convenience. We need to be very clear about the purpose of data collection *before* aggregating it and our policies need to be appropriate to how we plan to use the data.

Data used for security requirements must stand up to a certain level of scrutiny, but E-commerce and IT are too important for government data policy to be dominated by security services. It is important that policies relating to data storage are formed based on clear information about what the data will be used for and the risks associated with it.

However brilliant IT systems may be, it is impossible to eliminate human effects and errors. Wrong information might be entered. More serious, and regrettably common, is that data can be accessed or misused by insiders. *'Quis custodiet ipsos custodes?'* applies – who guards the guardians? Once leaked, all control is lost and risk of misuse aggravated. The more personal or irrevocable the data, especially DNA, the greater the potential harm that could result from error or misuse. Either we should not accumulate the data,

or if there is real cost-benefit or security value (and this must be rigorously tested) then stringent regulations and segregation, and meaningfully serious penalties for abuse should be put in place.

In the USA, the National Institute of Standards and Technology (NIST), an independent and fully open state laboratory similar to NPL, draws up open security standards for government information technology. A recent example is their guidelines for electronic voting. Britain has no such system. Instead, government agencies must rely on standards produced by the intelligence services or private companies, organisations which are confidential and cannot be openly tested for weaknesses, and are therefore less trusted by IT experts. Openness is the essential basis of scientific confidence.

It is important to understand that just because data appears to be anonymous does not mean it is secure. Anonymity is becoming increasingly hard for the average person to maintain. People have various identifiers which can all be correlated, from online names, IP addresses and phone numbers, to bank accounts, medical records and DNA. Some identities, and DNA in particular, provide a unique, irrevocable means of identification, and therefore a serious single point of failure. The risks are much greater for irrevocable data, and so their use and propagation require very great care. This is a particular problem for government IT, which has recently seen the consequences of carelessness when accumulating and handling sensitive data.

Even where personal information is not available, names and other details can be

. . . It is important to understand that just because data appears to be anonymous does not mean it is secure. . .

deduced from metadata and structured searches. This becomes vastly more powerful if large multiple datasets can be searched and cross-correlated. Though known for some time in censuses, awareness of this issue has been raised by the Netflix/AOL case, where the companies in question released supposedly anonymised data, which researchers quickly managed to use to identify specific individuals.

It is disingenuous to say, as do some Governments and companies, that the content of messages is not monitored, and therefore that anonymity is respected. Traffic analysis and network structure are often all that is needed to establish comprehensive surveillance information about data subjects.

These rapid developments in technology do not look set to slow down. More and more data will be recorded and will become easier to access and correlate. New services are developing all the time which throw up new privacy issues. We are not far off ubiquitous internet access, widespread location services through mobile phones and extensive data-mining – the process of extracting hidden patterns from sets of data. We can also expect machine learning in the near future, whereby computers will hone their performance as they acquire new data, and this could lead to decisions being taken without human intervention. This too raises a whole host of issues around whether a computer can, or should, do the job of a

human and what the consequences could be when something goes wrong.

The technical developments, as long as they are used properly, will continue to lead to improvements in a very wide range of areas of life, from personal convenience, the efficiency of e-commerce and reduced carbon emissions, to medical research, and to understanding and tolerance of others across the world.

It is easy to get carried away by the benefits of comprehensive data collection both to security and commerce, but those using data need to remember that they are in a privileged position. It is essential to be honest and open with customers and citizens about the purposes to which data can, and also might, be put. Secrecy doesn't help. Regulation must be informed by independent, open research and testing, to give a level of confidence appropriate to the sensitivity of the data.

John Pethica is Chief Scientist at the National Physical Laboratory, the UK's National Measurement Institute. NPL has a strong heritage in computing; it is where the groundwork for today's computer and internet world was achieved through the pioneering work of scientists such as Alan Turing and Donald Davies, and it continues to be active in areas of computing which support measurement science.



DOES SECURITY TECHNOLOGY RESTRICT PERSONAL FREEDOM?

SECURITY TECHNOLOGIES, FREEDOM AND PRIVACY



Dr David Murakami Wood
ESRC Research Fellow,
Newcastle University

Do real 'risks' mean that safety and security must be prioritised and must freedoms be reduced in doing so? Or do the freedoms that we are supposed to be defending constitute our security and cannot therefore be infringed? These debates are as old as modern politics: Benjamin Franklin made the latter argument in the early days of the US state. However, many things have changed and in this short piece I will concentrate on the challenges for policy-makers from new security technologies and from the deterministic 'logics' that they produce: that more information is always necessary for security, and that if technological capabilities exist then they must be used.

The usefulness of information depends on the architectures used to collect, store, process and share it. In these computer databases and the connections between them reside many key political questions concerning information, age, security and liberty. Digitisation of information allows not just vast storage capacity, but also sorting. Links and patterns can be recognised in superficially disparate data through data-mining or dataveillance. This can be used

to create profiles of people, places, and things, which are categorised by risk or profit. Contemporary marketing, policing, health and social welfare all increasingly depend on these 'actuarial' judgements.

Thus, when we consider the National DNA Database, for example, there are not just traditional questions of justice and liberty (legal compliance, discrimination against black men or the poor, retaining the DNA of the innocent and children etc) but also what is done with the data and why. These questions are inevitably international: we may establish security around national databases, but when government signs an agreement on data-sharing with the USA, for example, such questions become moot after our data is stored and processed in the FBI's Investigative Data Warehouse.

At the same time, the methods of data collection grow more sophisticated. The world is increasingly transparent, with the use of surveillance technologies from scanners in airports, through CCTV cameras in cities to global satellite mapping and location technologies. Access to

and use of these systems is no longer the preserve of the military or the intelligence services, but they are far from equal and democratic. Whilst both risks and profits are unequally distributed, some are more likely to be subjected to surveillance, and some to use it.

Dataveillance and surveillance processes are increasingly automated and algorithmic. Not only are links, profiles and categories often automatically detected and generated in databases, but simulation, anticipation and, the dream is, pre-emption, are possible. Biometric surveillance systems, like facial recognition, iris scanning and gait recognition as well as more esoteric areas like olfactory detection, are progressing rapidly. Facial recognition is being introduced in eight major UK airports this year; however it is less effective in open spaces... for now.

There are two more key developments. The first we already know: connection. The Internet is simply the biggest and most accessible of the many networks linking computers (and databases) together. It panics governments that are used to well defined national borders, and this has led to technologically and socially naive attempts to 'control' it through regulation. But the Internet is already generating new trans-border knowledge communities; government has to learn to live with and use it.

The other issue is one of

... The usefulness of information depends on the architectures used to collect, store, process and share it. . .

scale. It is not simply that computers and sensors are both ever smaller and more powerful, but that potentially they can be distributed and embedded into everything from walls to living beings, or become part of mobile systems, connected by wireless. Ubiquitous computing means ubiquitous surveillance, because to function, the 'Internet of things' needs to locate, identify and address every element. How this new technological infrastructure is built, for what purpose, by whom and who can connect to which parts for what reason, matters. Again, it is not a question of restricting development, but it is easy to see how ubiquitous computing infrastructures could be both empowering, democratising and enriching but also a perfect tool for totalitarian rule, and any number of possibilities in between.

SO WHAT ARE THE CHALLENGES?

Difficult regulatory questions emerge simply from size. The smallest available sensors are the 'smart dust' 'motives' manufactured by Dust Networks of California, and these 4mm² platforms will seem large within a few years as micro- and nanotechnology progress. Such tiny sensor platforms and their larger mobile cousins (Unmanned Aerial Vehicles or UAVs) are also being programmed to imitate natural biological systems like swarms or flocks, which will operate independently rather than by traditional human remote-control. How do we regulate things which relate to security or privacy, that you cannot see or perhaps even detect, and which can be scattered and collected casually, and could have a virtually independent existence?

It is clear then that policy is lagging some way behind technological development. As current technological limits and problems cannot be a substitute for adequate foresight and regulation, we need to 'get ahead of the game.' We need not (and cannot) anticipate every technology, but we must establish systems and criteria by which we can judge proposed technological changes quickly, within and beyond government. Tools like Privacy Impact Assessment (PIA) are essential, but government also needs to regulate for human rights, like privacy, to be built-in to the architectures of systems. It should start with its own: as the Joseph Rowntree Reform Trust revealed, more than 25% of government databases (proposed and actual) contravene data protection and/or human rights law. Government can also help by facilitating recognised standards internationally: from the base architectures through languages, protocols, and to the specifics of media, identification systems and so on.

Current laws are also inadequate. Britain's regulations are better than the EU's on data protection, but they are still based on a rather 1980s conception of computing and the information society. Freedom of Information is likewise premised on paper files (on which much information remains, but will be less and less so). We need to bring these and other concepts together in a comprehensive new Information Act setting the ground rules for the information relationships between citizens, state and private sector. This needs to be premised on the citizen's ownership of data. The state must accept that data is not just information *about us*, that it can demand and use as it

likes, as it increasingly determines our life chances: and it *is us*. At the same time, the state and private sector themselves need to be more transparent. Corporate confidentiality is not equivalent to personal privacy and should not be allowed to excuse secrecy. But privacy too is changing and has to change further. It is not dead – although anonymity might be – but privacy in a society where information flow is taken for granted cannot be the same as it was.

Above all, we must refute 'security technology logic.' CCTV in Britain is a case in point. CCTV expanded both in location and use in the 1990s, becoming rapidly 'normalised', largely without public debate or parliamentary scrutiny. The 9/11 and 7/7 attacks merely intensified this; despite the fact that when we watched CCTV images of the attacks and the attackers, we were witnessing the failure of CCTV as the prophylactic we had been promised. For the Government and developers, CCTV is now essential 'infrastructure', written in to crime reduction strategies and contingency planning. Public objections now prompt a defensive reaction: armouring cameras and portraying 'interest' in CCTV as inherently suspicious. What is it that is

. . . the Internet is already generating new trans-border knowledge communities; government has to learn to live with and use it. . .

being secured? Increasingly it seems that it is not just the state, but the security architecture itself! This is not conspiracy; it is simply the result of unchallenged security technology development logic. We need instead to consider how government can facilitate both the other positive logics of technologies (for example, the possibilities of freedom, empowerment, and expanded sensoria offered by the 'Internet of things') and the positive social effects of technologies, whilst accepting and enhancing the ability of people to change, adapt *and even refuse* new technologies.

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DURING DISCUSSION THE FOLLOWING POINTS WERE RAISED:

Any Member of Parliament will tell you instantly that their constituents do not want any security cameras applied to them, but to every other constituent! The growth in scale of mobility and the freedom to travel results in a desire for more information about the activities of the much larger, but much less well known, groups of people that we now interact with. The legal situation concerning photography in the street is not well understood. With regard to Government databases how can individuals find out what information is already on the database about themselves? Much of the technology and information used is obtained from third parties. In the case of the G20 demonstration in the City, office workers were requested to dress down so as to become indistinguishable from protesters and therefore able to go about their work undisturbed. Could this lead to subsequent misidentification of City employees as protesters by association? What protection, if any, do we have from misuse or misinterpretation of such data by potential employers or others? The order of magnitude of surveillance and analytical ability to interpret data have both increased, resulting in greater awareness and concern. The upcoming Olympic Games in London will pose a wide range of security issues, yet the public will expect this to be conducted in a non-intrusive manner. This increases personal freedom to move around, knowing that surveillance is providing protection but at the cost of privacy.

How do the police know about us? They don't, suspicion is categorical, if you are in a certain place at a certain time alongside people who are suspects, you are also a suspect. You are on a categorical database. This may affect you later in your life. There will be increasing concern in future at the growth and use of databases. You cannot be sure you are not on a database. Their power is greatly extended as the number and variety of databases increases. There are already a very large number of databases in existence providing information about individuals that cannot be deleted by those affected. There is already a hierarchy of quality of information so who do you trust? The chances of controlling personal data in the public domain are essentially zero. The National Institute of Standards and Technology (NIST) in the US have concluded that regulation is a waste of time as it is impossible to keep up with the growth in technology. It is better to establish benchmarks and legal expectations and obligations on those who hold the data, as there is no technical fix available. "City air makes you free" due to the anonymity which exists in cities which we are now losing. We never fully adjusted to the new freedoms and we have not adjusted yet to the new restrictions. These are big issues.

TAKING SCIENCE TO THE STREET

Meeting of the Parliamentary and Scientific Committee on Tuesday 19th May 2009

TAKING SCIENCE TO THE STREET



Professor Anthony J Ryan OBE
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In December 2008 BBC Radio 4 ran a week of programmes called 'Street Science'. The basic premise was that most scientists are passionate about what they do and believe that it's in a good cause. But the programmes asked the question "What happens when scientists are taken out of their comfort zone, to church or to the school gates, to try to explain what they do and why, to members of the public?"

I was one of those scientists and spent a couple of afternoons in Sheffield's Winter Gardens talking to the public, quite literally accosting people as they walked down the street, asking them their hopes and

fears about nanotechnology. The technical level of the debate was somewhat variable but discussing the applications of carbon nanotubes with retired miners and giant magneto resistance with school kids obsessed with their iPods was, I hope, as entertaining for them as it was for me.

The potential dangers of nanotechnology have been in the media and fear of the world being overrun with "grey goo" was even highlighted by HRH Prince Charles. This fear comes from an unfortunate extrapolation of a reasonable argument. The idea that atom-by-atom construction could build fantastic devices that could reproduce themselves and take

over the world has its proper place in the world of fiction, as exemplified by Michael Crichton's book 'Prey'. But all the potential problems of nanotechnology, both real and imagined, have to be balanced against all the potential benefits it could bring to medicine and the environment, with nanomachines saving lives and cleaning up pollution. If one asks the question "What will a nanobot look like?" the answer won't be the shrunken submarine envisaged by Hollywood. Physics at the nanoscale mean that shrunken submarines won't work and nanobots will actually look more like bacteria or sperm and that soft nanotechnology, based on self-assembly and Brownian motion, is the way to go.

The substance of my 'Street Science' programme surrounded the economic and ethical

... What happens when scientists are taken out of their comfort zone. . .

implications of nanotechnology, how it might affect people's lives in unanticipated ways and what kinds of research are needed to ensure that we don't create new environmental problems. I was challenged repeatedly about how nanotechnology could be used for malevolent purposes and, as a researcher, what was I going to do about it. It was this part of the debate that I found most illuminating because, as a citizen, I am just as concerned that the fruits of human ingenuity are not put to nefarious uses for political or economic reasons and that technology results in a more equitable distribution of the world's resources amongst its vast population.

But why should a scientist go out into the street? One reason might be to ensure democratic approval for the public funds that have been spent on expensive research. Another could be to secure appreciation for all the minor miracles that we take for granted, the seemingly trivial things that scientific progress brings us, like 2-in-1 shampoo and conditioner, or the ubiquitous mobile phone that has more computing power than the Apollo mission which put man on the moon. But it is essential that people also realise that science and technology are responsible for the earth's population growing to be more than six billion people, and that this population explosion was based on the exploitation of fossil fuels and the fertilisation of the earth to grow enough food. We existentially depend on oil for much of our nutrition and need to find new sources of clean energy if we are to continue feeding the population and at the same time combat global warming.

Communicating science has gone through many transformations since the Royal

Society's work in the 1980s. We have moved through public understanding to public engagement and now we are in the era of dialogue and the people's jury. The standard reasons given for engaging are: to ensure a good supply of young people to train as the next generation of scientists and engineers; to enable the individual and society to make informed choices; and to enrich our cultural life. All three are important and drive my work in this area. Science can be both beautiful and inspirational, appealing to the natural inquisitiveness of children. Ensuring that we (you!) set policy wisely, based on evidence and logic rather than emotion and prejudice, requires appropriate dialogue. Had we engaged with the public in a different way, and the economic model of exploiting progress not been so divisive, we might now be taking advantage of genetic modification in the production of more nutritious food with fewer "chemicals" and more efficient use of scarce water resources.

Science as part of culture is something I am most passionate about. It never ceases to amaze me that in polite society it is perfectly acceptable to be scientifically illiterate, in fact people are often proud of it, and this in one of the most technically advanced countries in the world.

Wonderland is a collaboration between an artist (Helen Storey from The London School of Fashion) and a scientist (me).

. . . Science can be both beautiful and inspirational, appealing to the natural inquisitiveness of children. . .

We took science to the streets via an exhibition of disappearing dresses that was seen by two million people in Sheffield's Meadowhall shopping mall. Wonderland's ambition was to challenge people's attitude to consumption and waste. It uses the dress as a metaphor for waste in the world. It took a visually striking and quite beautiful creation and destroyed it, in an interesting and engaging way, over a period of a month as shoppers went about their business. The dresses were made of a specially-developed, water-soluble plastic and had neat little chemical tricks embedded in them so that the material danced as it entered the water and the garments shot out little underwater fireworks from buttons and buckles. We wanted to provoke the question "Why are you destroying these dresses?" so we could turn the question around. The ambassadors who worked on the exhibition wore T-shirts emblazoned with the slogan "Plastic is Precious" because plastic is buried sunshine. Plastic is made from oil, which we all know is geologically derived from plants grown millions of years ago using energy from the sun. People were shocked to hear that we are burning through this fossilised energy at the rate of millions of years of history per year. Apart from the dresses, the majority of the materials of the exhibition were made from reused or recycled materials. A comment/drawing book and message-board were used to record the public's

response and many children took the opportunity to sketch their own inventions to save the planet or make drawings of their own disappearing dresses.

Whilst we were always pleased to see that people found the exhibition beautiful and interesting the most satisfying responses were those from people who had not previously considered the environmental impact of their visit to a shopping mall and who would alter their patterns of consumption as a result. Using fashion as a lure we had managed to engage people who would have walked past something that was obviously scientific or environmental. Once people were intrigued, we could both introduce the science and have some dialogue about environmental responsibility.

There is a collateral benefit to scientists in engaging with the public. The public will often ask questions that you wouldn't ask yourself, and these can lead to new research ideas and applications of science. We have started research into water purification technology because a non-scientist realised that we had all the technology to make such a device when we were explaining how we are constructed of wholly synthetic muscles based on block copolymers. In another example our research on tissue engineering has adapted some of the technology used in the production of textiles for haute couture to fabricate scaffolds for the culture of cells in



replacement organs. Devoré is a process for making delicately patterned fabrics by weaving and printing a dense cloth with a variety of materials and then removing some by dissolution in acid. When making nanofibres by electrospinning we faced difficulties in controlling the pore size and fibre diameter independently. If the pores were big enough for the cells to come through the fibres were the wrong size for them to attach to, and the scaffold did not work. Without the interaction with artists we would have never thought of applying the devoré technique to the production of nanotechnology devices for regenerative medicine.

Now we are really taking science into the street, in a new project that uses the clothes that people wear to clean the environment. Catalytic clothing has the potential to be a significant intervention, only

made possible through the collaboration of the arts and creative sector and those working in science and technology. There are already a number of self-cleaning applications of nano-titania, for example the self-cleaning glass on the walls of tall buildings, and the technology has the potential to be widely applied. There is a self-whitening church in Spain and self-cleaning roads in Japan but these applications have a limited effect on the wider environment because they have a relatively small surface area. But taken from a chemist's viewpoint, the fibres that constitute clothing provide a very large surface area for catalyst support. For each person carrying two kilos of fabric in the clothes they wear, there is, at nano-scale, a 'passive' surface area the size of a football field. So the population of London, say 10 million people, has a

useful surface area for chemistry collectively covering more than the total area of the UK. Currently, despite many advances in smart materials and 'smart clothes', this surface area has not been used to catalyse a reaction for environmental benefit. We are working on the development of a system in which the surface of a fibre can be given a secondary function such that it can actively remove airborne pollutants whilst the wearer goes about their daily life. One manifestation is that the treated fibres would be able to collect volatile organic compounds and an embedded catalyst could render them harmless through washing. A second is that the fibres could absorb nitric oxides (which cause smog) that would then be neutralised on washing.

Art-science collaborations, and collaborative research in general, allow researchers to

break out of their traditional restrictive boundaries, and it is these cross cutting interdisciplinary areas that will be the key to tackling the 'big' issues and translating research into real life solutions. The process of engagement has fundamentally affected my scientific development. Whilst maintaining my presence at the forefront of hypothesis-driven, fundamental research, I have become involved in science-art collaborations that have a definite social and economic outcome through the innovative application of established science and technology in new areas. So the next time I take science to the street it will be to ask the people if they want to be a part of a great big clean-up process by *them* taking science into the street!

TAKING SCIENCE TO THE STREET

PUBLIC TRUST IN SCIENCE OR SCIENTISTS TRUSTING THE PUBLIC?



Dr Daniel Glaser
Head of Special Projects,
Public Engagement,
The Wellcome Trust

I will suggest that 'street science', properly understood, is a true implementation of public engagement, seeking the democratic empowerment of a scientifically literate citizenship by taking science into territory and language which they own and control.

Public engagement with science is the preferred UK term to describe organised relations between scientists and the

public. It is not a term used for example in the US where the 'deficit model' still pertains, where science communication is supposed to fill a deficit in the public understanding of science, allowing citizens to attain their full potential through more complete knowledge of scientific facts in particular. As John Durant has pointed out, scientific facts are only one aspect of what the public needs to know about science. The

other two are 'how science works', for example scientific methods such as hypothesis testing or statistical analysis, and 'how science *really* works' which deals with the political and social underpinnings that determine how science is conducted as a professional endeavour. Arguably the UK move towards engagement speaks as much to the last two elements. It was promulgated in response to the well-known crises in public trust

in science of the late 1990s. At the time a concern about the public trust in all kinds of authority was frequently expressed. This was perhaps best summarised in the House of Lords Science and Technology Select Committee Report on Science and Society 2000. While the commitment was sincerely entertained it is arguable that many scientists today regard public engagement as merely the new term for science communication. Actual public participation in scientific decision making is still extremely restricted.

But is it defensible that the public are not directly engaged? Is professional scientific training a proper preparation for making practical determinations? Perhaps it is civil servants, lawyers or even politicians who should be responsible for drawing up consensus views on scientific questions. Clearly top-level funding decisions about state-sponsored science do fall within more general political spending considerations. Here, scientists lobby like any other special interest group, selling the importance of the scientific sector and of their own area within it. Of course, increased scientific literacy among politicians and civil servants would enhance the likelihood of reasonable decisions, but equally, public understanding of all aspects of science must increase if there is to be a meaningful democratic engagement at the level of funding priorities and ethical frameworks.

Unfortunately, in public discourse scientific questions tend to be put under an ethical spotlight in a small set of 'issues' which evolve from year to year and from country to country. In the UK obvious recent examples include the MMR vaccine and its possible link with autism, the

siting of mobile phone masts, GM crops and foods, and questions surrounding human fertility, reproduction and cloning. The focus on polarised issues generates specific problems. Firstly, since they are newsworthy, they are generally covered in the press and media by news and features journalists rather than the skilled and generally very professional science correspondents. This often results in the effective but emotive communication of restricted aspects of a question, and can rapidly generate intuitively compelling imagery that is impossible to modify (Frankenstein foods; the dangers of railway travel). These issues can spawn activist groups some of which promote a frankly, anti-scientific agenda, which in turn can generate a symmetrically closed response from elements of the scientific community. The escalating cycle of mistrust which sometimes results is extremely difficult to combat.

With particularly entrenched arguments, such as those which triggered the crisis in trust in the first place, public consultation is often too late. For example, work to promote informed public debate about genetically modified food in the UK had a

worrying outcome. It has been a theoretical commonplace in science communication that public understanding of science is not the same as public acceptance of science, but in the GM case it was found that the more exposure people had to scientific information, the more opposed they became. This may confirm suspicions that efforts to direct new scientific research and public engagement activity towards issues where public alarm has been generated are often doomed, since many will automatically disbelieve a conclusion that does not support their entrenched position. Interestingly, efforts to bring together different sides to discuss these questions succeed best when role playing is employed to generate discussion of fictitious or unrelated scientific scenarios.

How can public ignorance especially about 'How science really works', be combated? Of course the media, education – both general and scientific, the structure of scientific discourse, including peer review and the politics behind science and science funding, can all be improved. But I would like to emphasise a particular approach that harnesses a bottom-up

process, not one restricted to a small number of popularisers, or lay members of ethics committees. What is required is an extensive social interpenetration, allowing scientific practice to escape from the laboratory and the library and engage a broad and curious public.

A most effective example of this is Café Scientifique, a model which has now spread across the UK and into many other countries. This is one particular practical attempt to promote local, regular interactions between scientists and non-scientists, which is derived from the French Café Philosophique, and was developed by a television producer from Leeds named Duncan Dallas. It is a non-hierarchical and democratic formula for involving non-scientists in a scientific discussion, and is held in a café or other informally seated setting, ideally outside an academic institution, often with an experienced facilitator. A speaker talks for 20 minutes or so and gives an outline of his or her field and a couple of relevant questions, generally without slides or visual aids. There is then a ten-minute break for informal discussion and refilling of drinks. This pause

. . . Actual public participation in scientific decision making is still extremely restricted. . .

. . . How can public ignorance especially about 'How science really works', be combated?

combats the 'thinking of a question on the bus on the way home' phenomenon, allowing individuals and small groups to formulate and mutually validate their responses. There is then a discussion, typically just under an hour, involving – but not led by – the speaker. It is not a question and answer session, and the expert's voice does not dominate. Paradoxically, it is often the silent presence of a professional that legitimates and promotes an empowered discussion.

The idea is to generate community-based structures in a non-professional context, where the public can discuss scientific issues with experts. These are not lectures or demonstrations. Since they are not primarily about contentious issues, they escape from many of the

problems outlined earlier. By weakening the conventional power relationships and specialist language that conversations in a scientific institution involve, they encourage individual non-scientists to develop their own scientific questions and opinions. An appreciation of the practice of science weakens common misconceptions, such as the assumption that a dissenting scientific voice necessarily means that a field is fatally split. These insights are not conveyed didactically, but arise naturally from a new familiarity with the everyday life of science.

Café Scientifique offers a practical tool to address many of the issues of empowerment and alienation that have been identified in all sorts of spheres. The undeniable fascination that

... Café Scientifique offers a practical tool to address many of the issues. . .

scientific stories generate among non-experts of all ages makes these kinds of scientific engagement an attractive model for more general grass-roots, non-hierarchical democratic activity. But, the structure has the power to undermine hierarchical knowledge tyrannies of all sorts. As more scientists gain the courage and experience that enables them to engage directly in this kind of publicly validated ethical practice, the scientific domain may come to be seen as a leading example of this kind

of transformation, and other areas of expertise, other concentrations of power, remote from engaged public scrutiny, will come to seem more and more anomalous.

TAKING SCIENCE TO THE STREET

SCIENCE IN A NEW KEY



Dr Mae-Wan Ho
Director, Institute of Science in Society (ISIS)

ISIS was co-founded by my husband, Peter Saunders, and myself in 1999; our motto is "Science in action, in and for society." We don't take science to the street just for the sake of popularising science. Our mission is to provide accessible and reliable science information to society, which is very important as corporations are taking over science. We promote critical understanding and appreciation of science, or science literacy, which is vital for democracy. And we want social

accountability and sustainability in science and science policies. Science in the most general sense is reliable knowledge of nature that enables us to live sustainably, regardless of how that knowledge is acquired, either in the laboratory or in life, and includes the use of indigenous, local knowledge.

CP SNOW AND BEYOND

This year is the 50th anniversary of CP Snow's lecture "The Two Cultures" about the failure of science and the

humanities to intercommunicate, and the lack of scientists in positions of power, thus obstructing solutions to serious problems such as poverty. We share those concerns. We also encourage appreciation of both art and science through our trend-setting magazine and website with an e-mail list of thousands. Art historian Martin Kemp and others lament the general decline in the appreciation of culture and overspecialisation in education. ISIS is well placed to tackle

... Our mission is to provide accessible and reliable science information to society . . .

those problems; our scientists are all polymaths, and very keen on the humanities and art. Where we part company with CP Snow is that he belonged to the establishment that recognises only one science. Science is inherently anti-establishment; it can't help but challenge the status quo as it advances. ISIS keeps abreast, and often ahead, of mainstream science; especially concerning the new opportunities that cutting-edge science can offer for a world, which after 50 years of development is now facing a crisis in food, fuel, and finance, while attempting to respond to climate change.

The good news is we have all the knowledge and technologies to exit the crisis and save the climate. The bad news is the lack of political will and vision as our leaders are stuck in the mindset of the obsolete scientific paradigm that created the problems. Einstein's saying, "We can't solve problems by using the same kind of thinking we used when we created them", is now a cliché. Nevertheless, it's a good launch pad for the new science and new thinking we need. Let me set the scene with the briefest history of science starting from the Enlightenment.

FROM MECHANISM TO ORGANISM

The European Enlightenment brought many good things. It was the age of reason over received wisdom; it transferred creation from God to nature, which we can begin to understand through science. The Enlightenment also reinforced a powerful view of the world as a machine that ushered in the industrial revolution; and with that, the enclosure of the commons, capitalism, imperialism, colonialism, world wars, and the industrial,

mechanised, chemical 'agriculture without farmers' we have today. It has been 200 years since Darwin's birth, 150 years since his *Origin of Species*. Darwin and Victorian England elevated 'competition for survival of the fittest' to the way of progress. Add Darwinism to Adam Smith's *The Wealth of Nations*, and we get the neo-liberal economy that has dominated the world since, fuelling the accelerating over-exploitation of planet and people that has brought the world to its knees. The mechanistic model was becoming obsolete at the beginning of the past century with the emergence of the organic model. The three books that influenced me the most were all inspired by the new physics, especially quantum theory. Whitehead's eloquent critique of the static, flat, and colourless Newtonian universe in *Science and the Modern World* is all of a piece with Bergson's insistence in *Time and Freewill* that time is multidimensional and heterogeneous, giving unique qualities to our innermost experiences. Whitehead argued we can only understand nature as an organism embedded within the super-organism of

nature. Schrödinger's *What is Life?* predicted the genetic material DNA. But that's only the half of it. The other half predicted the molecular coherence of organisms discovered in my laboratory in 1992. Living organisms have such a high degree of molecular coherence that they appear as dynamic liquid crystal displays under the polarising microscope geologists use for identifying crystals. Some of these images grace the cover of the 3rd edition of my book *The Rainbow and the Worm, the Physics of Organisms*.

CIRCULAR ECONOMY OF THE ORGANISM

One main reason organisms are so coherent is because they use energy and resources in a circular way, a circular economy that minimises waste. In the ideal, the organism accumulates no entropy (representing waste energy and disorganisation), and even the waste exported is minimum. The key to a sustainable circular economy is to maximise co-operation and reciprocity, instead of competition. The organism has structured activities spanning all space-time scales, those yielding energy are directly coupled to those requiring it, and the giving

and taking can be reversed so both material and energy are recycled. In contrast, the dominant neo-liberal model of infinite unsustainable growth based on competition has no closed cycle and no structures within; it thrives on profligacy and waste, and tends to spiral out of control. Boom and bust are inherent to the model.

SUSTAINABLE SYSTEMS AS ORGANISMS

It soon occurred to me that all sustainable systems are like organisms. And this applies especially to sustainable farming, as documented in ISIS' report *Food Future Now* launched in April 2008 in this Parliament. It shows how farming, according to nature's circular economy, can potentially compensate creatively for all greenhouse emissions, and free us from fossil fuels. Circular economy is very productive. For example, Takeo Furano in Japan releases ducklings in the rice paddies. Weeds and pests become food for the ducklings, while the ducklings provide mechanical stimulation and aeration for the rice plants to grow big and strong, resulting in a bumper harvest from the two hectare farm that supports his family of nine, and vegetables for another

. . . Biogas provides a smokeless fuel for cooking, for co-generating electricity and heat, and is the most environmentally friendly transport fuel. . .

. . . Geneticists are now documenting how exposure to toxic substances affects several generations. . .



100. The dyke-pond systems, perfected by the peasants of Pearl River Delta in China, supported on average 17 people per hectare in their heyday. One involved growing mulberry, elephant grass and vegetables, and raising pigs and silkworms on the dykes, the wastes going to fertilise the plankton and macrophytes in the ponds, thus feeding five species of Carp. Professor George Chan, who trained as an environment engineer at Imperial College, spent five years near retirement in the Pearl River Delta and developed an Integrated Food and Waste Management System, which I have schematised as Dream Farm 1. It is an incredibly productive mixed farm with diverse crops, livestock, fish, and fowl, organised around a biogas digester to recycle livestock manure and waste water into nutrients and energy.

DREAM FARM 2 TO FEED AND FUEL THE WORLD AND MITIGATE CLIMATE CHANGE

By incorporating other renewable energies such as wind, solar and hydroelectric, food and energy are thereby integrated in Dream Farm 2. The ideal would be to set this up as a model for education and research, serving as an incubator and showcase for new technologies, information exchange and a resource centre for Dream Farms around the world, all using local resources and biodiversity. Biogas provides a smokeless fuel for cooking, for co-generating electricity and heat, and is the most environmentally friendly transport fuel, as Sweden discovered. If Dream Farms were adopted the world over, it would mitigate an estimated 56.6 per cent of greenhouse emissions and 50.5 per cent of

energy use on biogas alone. Fossil energies could well be eliminated altogether in combination with the other renewable energies. There is a lot of interest in Dream Farm 2; versions are implemented everywhere. The closest to home is an urban Dream Farm for London proposed by Alex Smith who owns an organic food factory near the Eurostar terminal.

BAN GM CROPS

There's no need for GM crops. They have failed on every count: less yield and income for farmers, bad for biodiversity, more pesticides and water use, more dependence for farmers and more suicides, more vulnerability to pests, disease and climate extremes, and outstanding safety concerns. GM crops belong in the old mechanistic paradigm superseded by the fluid

genome, as the first GM plants were created in the 1980s. The fluid genome belongs in the new science of the organism. Geneticists are now documenting how exposure to toxic substances affects several generations by changing the heritable expression of genes. Decades of sequencing and dissecting the human genome have only confirmed that the overwhelming causes of ill health are environmental and social; early nutrition and parental care are crucial for physical and mental health. Consequently, organic, localised and biodiverse agriculture is the most effective way to deliver health, wealth, and happiness to the world's nations; and that's the message we should be taking to the street.

For a fuller version of this paper and all issues raised go to www.i-sis.org.uk.

IN DISCUSSION THE FOLLOWING POINTS WERE MADE:

Public understanding of science is important but is not equivalent to the public acceptance of science. Appreciation of what scientists are intending to do is also important since the debate which follows will be more informed with the evidential processes better understood. Unfortunately in the House of Commons too few members want to know about science. The differences between how science works and how science really works requires explanation. For example, how does a scientist get funded? What happens when students fall out with their PhD supervisors? Why is research on some diseases much better funded than on others? Whereas artists reflect, scientists are remarkably unreflective and do not spend much time considering such questions. Taking science to the street enables scientists to become more reflective but this raises other issues.

Does this imply therefore that Peer Review should not be done by one's Peers? Is a little knowledge a dangerous thing? How does one convey as a scientist the importance of energy and overpopulation and the need for change? For example, the claims advanced for a global sustainable human lifestyle based on organic food (unsupported by ammonia generated by the Haber/Bosch process from limited supplies of natural gas) would however only suffice to feed 2 million people worldwide, which is the estimated extent of the naturally sustainable population base.

The public expect certainty from scientists rather than the answers received, which are often based on risk and probability. However, scientists are also members of a society where conflicts between scientists and politicians, on the one hand, and also between scientists on the other, arise and often confuse people in the street,

probably due to the mathematical basis underlying much science which is not generally understood. A wider recognition of the mathematical core to science is therefore likely to be one of the keys to a better understanding of science. Outreach to non scientists in the street can encounter even more fundamental problems of trust and engagement.

The media, however, may not help by focusing on issues which may be considered marginal to the main issues challenging science, such as the Brent Spar and Climate Change Deniers, for example, where they are often given equal prominence to viewpoints supported by the majority of scientists. You don't get ahead in science by agreeing, as successful scientific publications have an innovative component. Disagreement is fundamental to the progress of science.

The evidence of a perceived need for an increased supply of scientists is usually generally lacking, as indicated by the struggle to survive and obtain tenure in a permanent job in science. And if there is a shortage of scientists there should be no difficulty obtaining a job as a scientist, which is clearly not the case. Scientific jobs have to be fought for and it is an arduous process.

Science in the street is important because it brings society into the scientific process and enables science and society to interact constructively. Scientific answers can then be provided to societal questions from the street. Other ways forward are to make all laboratories open to the general public and to give the public a greater say in what science is undertaken and a better understanding of risk versus certainty.



CATALYST SCIENCE DISCOVERY CENTRE: AN EXCITING PLACE TO BE!

Catalyst Science Discovery Centre is an Independent Discovery Centre and Museum offering a great range of Science lessons and interactive shows, along with 4 award winning galleries, to a wide audience from the North West and beyond.

Catalyst Science Discovery Centre is operated by an independent charitable trust and is located in Widnes in Cheshire giving great accessibility for the whole of the North West and surrounding regions.

The Trust has been in operation some 25 years with Catalyst starting its life as the Museum of the Chemical Industry. The building was extended some 15 years ago to enable



Catalyst to offer a formal Education department with a suite of Educational studios and supporting ante rooms. The philosophy of offering high quality Science Education and providing inspiration for young people to take an interest in science has continued and the Trust has recently added three new facilities with the support of the NWRDA and Millennium ReDiscover.

The Catalyst team aim to provide a stimulating and memorable visitor experience which is based on 3 key principles of being fun, relevant and tangible. Research has shown that these principles help to engage the audience and really make a difference.

THE CATALYST MISSION:

- To engage and excite the audience about Science and its importance in our lives
- To provide high quality and stimulating information to help impact on peoples lives, specifically in the areas of 'Science is all around us', 'Science based careers' and 'Science and its impact on the environment'
- To provide a unique and clearly defined Museum component focused on Chemistry and the History of the Chemical Industry and its impact in the locality

Catalyst opens its doors to some 30,000 visitors per annum. Two thirds of these visits originate from schools, who come to enhance and enrich subjects being covered in school. Of these, 75% of visits are of Key stage 2 and 3 level. The remaining visits are made up of KS1, KS4 and special needs visitors. The remaining third of visits are made from the general public who visit mainly at the weekend or in school holidays.

During weekends and school holidays, a range of additional activities is offered daily; typically these are interactive science shows and/or workshops in addition to make and take activities. Activities are varied from week to week in order to encourage families to make return visits.

The team is led by CEO Julie Burgess-Wilson (Jules) who, along with Chair of the Board of Trustees, Dr Tony Bastock OBE, has been responsible for managing a major change in its fortune from ailing Museum to dynamic Science Discovery Centre.

Jules comments "We believe that the work of Catalyst is vital to promoting the understanding of science and provides an exciting route to the enjoyment of scientific discovery outside of school. We cater for all ages and all abilities. We do not expect to discover great scientists or provide the wider population with a thorough science education, but we do believe it is essential that enquiring minds are stimulated to consider the challenges of this increasingly technological world. Informing and educating the community, especially children, in science and science-based industries is vital to making sure that the public are equipped to make informed decisions about the safety, ethics and the desirability of new technology, such as Nanomaterials, GM foods, Biofuels etc. It is equally important that we all have at least the basic understanding of the challenges of climate change, sustainable development, ozone depletion and other pressing problems."

Engaging the public is vital and the education team is led by inspirational Sue Halliday, a highly qualified education manager, who, having trained as a scientist, later went into



teaching and then to be an educational advisor. The Trust feels it is essential that the educational standards are not only high, but are genuinely inspirational to all who participate, as encouraging people into science is the key *raison d'être* for the Trust.

Chairman Dr Tony Bastock OBE comments, "We see our role as delivering sound scientific knowledge to our visitors, be they classes of young children or senior citizens, to allow them to evaluate the tabloid approach to science of 'grey goo' and 'Frankenstein Foods' and consider its validity or indeed, hysteria."

VISION FOR CATALYST

The Catalyst team believe passionately that inspiring young scientists is vital for the region in view of its deep heritage in science and innovation. Indeed, it is vital for the nation generally, with a projection that STEM-related jobs nationally will increase by 750,000 by 2014.

Catalyst and other Science Centres have a vital role to play not only in helping to attract young people into science but to help educate the public to the wonders of science and its importance on all our lives. We

know that by inspiring people at a young age, there is a higher propensity to continue with an interest in Science and to explore further the possibilities Science has to offer in a chosen career.

KEY CHALLENGES FOR CATALYST: REVENUE FUNDING

Being a charitable trust with limited funds available, it is imperative costs are tightly managed. Catalyst operates with just 3 full time staff, supported by 15 part time employees.

Finance is often precarious especially in the current economic climate; the Trust is funded by a combination of donations, some industry sponsorship and self-generated revenue. Generating sufficient income is a constant challenge. Dr Bastock makes the point, "If we are to provide this essential service to deliver the 'wow' of scientific discovery to a growing number of visitors, new and sustainable funds must be made available. Only with dependable funding will we be able to inspire the scientists and innovators of the future. Committed teachers and helpers, often working as volunteers, even at weekends, funded by erratic and unpredictable revenue income deliver these programmes, at low cost and high efficiency. This is not sustainable, as it does not allow for the development of

our programmes and the growth of our scientific influence. We cannot even be sure of survival with funding on this basis."

ACCOLADES

Last year Catalyst won a national award from the Chemical Industries Association for Promoting Science and Engineering to Future Generations.

At a recent visit to open the latest developments, Lord Sainsbury commented, "It makes such a difference if children, from the very youngest age, are able to see what Chemistry can do and how it plays a vital part in our lives. These new facilities will encourage even more children to open their minds to what chemistry can do in the future and how it can enrich our lives still further."

Steven Broomhead, CEO of the NWDA said: "Catalyst Science Discovery Centre is a unique attraction for the Northwest and the Agency is pleased to have played a part in its transformation. I am sure that the centre's innovative new interactive facilities will help to inspire the scientists of the future, something which is vital to maintaining the Northwest's reputation as a leader for science and innovation."

And more importantly, a typical recent visitor: "I am writing to thank you for a wonderful visit my pupils and I had on the 9th March. We had our very own partying particles workshop, which was wonderful. Please thank Sue again. She has inspired the girls I brought with me, my current year 7s are really looking forward to their year 8 visit to your Discovery Centre."

VITAL SUPPORT

CEO Jules comments "We believe that the work of Catalyst and other science centres across the nation is a vital requirement for today and the future. Stimulating an enquiring mind and giving rise to thought about our surroundings are essential if we are to be able to attract young scientists and innovators for the future and to help inform the public on the increasingly important scientific debates about topics such as GM Foods, Nanotechnology, Bio fuels and Sustainability, and I am passionate that we succeed in our endeavours. Centres like Catalyst can currently only exist through the passion, energy and tenacity of the trustees and staff; we strongly believe we must continue to attract greater audiences and deliver more Science to the public, but we can only do this with the appropriate funding"

THE CATALYST COMPONENTS

Birth of an Industry

A museum gallery, charting the development of the Chemical Industry, supported by a large and growing collection of artefacts and papers relevant to the Industry and locality. Catalyst plans to continue to enlarge the collection and to develop artefact-handling sessions to engage the public.

Scientrific

A deeply popular hands-on gallery for all visitors, Scientrific offers individual exhibits which demonstrate Scientific principals and encourage visitors to discover and probe new concepts.

Observatory

A unique rooftop Observatory gallery affords stunning views from the Welsh hills to the Pennines and is accessed by a wonderful scenic glass lift. The observatory provides a fantastic space for learning about the environment and for viewing Science and Engineering in the locality.

Education Centre

This purpose-built Education suite provides 2 teaching studios and 1 multifunctional room. This space is used predominantly by schools but hosts the family

science sessions in the school holiday periods.

A World of Opportunities - Championing Science Based careers

A highly acclaimed and unique careers gallery featuring young scientists who give a valuable insight into their jobs and career prospects via DVD clips and interactive displays. Young scientists profile their career, their path to success, providing advice for other young people. Young ambassadors tell it like it is and answer the questions most people want to know: salary, the type of work involved, number of holidays, the good and the bad bits!

Alchemy Theatre

The state-of-the-art interactive Alchemy Theatre provides stunning 3D virtual tours, currently providing young scientists with a unique insight in to chemical plants, pharmaceutical development paths and recycling plants – completely unattainable by other means. A groundbreaking and unique concept in education and public engagement combines interactive voting with a "live" tour of facilities impossible to visit and 3D imagery.

Catalytic Laboratory

The exciting, state-of-the-art "Catalytic Discovery Lab" hosts a wide range of hands-on activities and experiments carefully designed to involve and inspire all. Catalyst actively encourages Pupils to participate in laboratory activities as soon as possible, for example pupils of around 8 years old are invited to "Become a Scientist", where they learn how to conduct an experiment. Older pupils at KS4 have access to hands-on activities in a truly inspirational environment.

For further information visit www.catalyst.org.uk



LEADING LIGHTS – STEM AMB

Challenging perceptions of science, technology, engineering and mathematics

The STEM Ambassadors Programme involves a network of 19,000 volunteers who use science, technology, engineering and maths (STEM) skills to push the boundaries of what is possible and to make the world a better and more exciting place to live. It is co-ordinated by STEMNET, a government-funded organisation leading UK initiatives to enthuse young people about STEM.

STEM Ambassadors across the UK work with local schools and colleges on a voluntary

basis to run workshops, activities and experiments, give careers talks and mentor promising students. In the majority of cases these Ambassadors are supported by their employers. Over half of them are under 35 and 40% are women. Their day-jobs range from astrophysics to materials technology, web design to sustainability. STEMNET is aiming to recruit 8,000 more STEM Ambassadors by 2011.

At a recent awards ceremony at the House of Lords Roger Highfield, Editor of *New*

Scientist, said: "It is a no brainer that our economy is going to be ever more dependent on STEM subjects but it is a matter of some angst just how we get young people animated by science. I love the STEM Ambassador idea. It sends out a signal that science, engineering, technology and maths are useful and relevant. It shows the human face of science (not the crazy, white-haired, old bloke). It gives teachers much needed support. There's no better way to turn kids on to STEM than to connect them with people who

have a genuine passion for the subject. "Enthusiasm is infectious," he added, before calling on STEM Ambassadors to "keep on fanning those little embers of interest into flames."

Yvonne Baker, Chief Executive of STEMNET, said: "The STEM Ambassadors programme has gone from strength to strength since its establishment in 2002. More and more employers and professionals in science, technology, engineering and maths are realising that for their pioneering work to have a future, a new generation of young people

RANNA PATEL



Richard Cannon / STEMNET

Ranna Patel did a doctorate in Biochemical Engineering at UCL which broke new ground in the development of processes to make antibiotics, vaccines and monoclonal antibodies. Monoclonal antibodies are similar to the antibodies created by our own body's immune system, and are providing the latest breakthroughs in the treatment of cancer and other debilitating diseases.

Ranna's research contributed to making

these life-saving treatments faster, safer and cheaper. Ranna says of her job: "It's challenging and I get to use my knowledge of science and technology to make a direct difference to society. Meeting an engineer at my school was enough to make me realise it was the career I wanted to pursue – I want to do that for the next generation."

Ranna is pictured here inside a giant bubble – her career as a process engineer has included making washing-up liquid and glycerine, both of which are ingredients of bubble solutions.

LIZA BROOKS



Richard Cannon / STEMNET

Liza Brooks is a mechanical engineer in the third year of her engineering doctorate at Cranfield University. She is also co-founder and technical director of True Snowboards in Wiltshire. Liza uses her engineering skills to analyse the performance characteristics of different snowboards, and develops new materials for them – she then has the fun of testing them out on the slopes at Morzine in the French Alps.

True Snowboards

sponsored a team at the British Snowboarding Championships in 2008 which had a 74% medal win rate.

"I love my job", says Liza, "because of the variety. One day I can be in the laboratory testing materials for a new board, and the next day I'll be out testing it on the slopes to see if all my work has paid off."

Liza is pictured testing one of her True Deviant snowboards in Sevenoaks in Kent.

ASSADORS

must be interested and excited enough to want to take over the baton. Their support for the STEM Ambassadors Programme, through making it part of their educational outreach, CSR or staff-development programmes can be shown to reap real and tangible rewards all round.

"We are determined to ensure that the widest possible number of teachers get to know about the extra dimension that the programme can bring to their classrooms and how the real world insights of a STEM Ambassador, coupled with their own inspirational teaching, can spark a life-long love

of science, engineering, technology or maths in a young person."

To showcase STEM Ambassadors, STEMNET has commissioned Leading Lights – an inspiring new exhibition of portraits by award-winning photographer Richard Cannon, four of which are featured here. The exhibition challenges perceptions about the kind of people who work in these fields and bring to life the ground-breaking projects and cutting-edge research that these young men and women are working

on. It can be seen at Explore@Bristol 4 July-27 August and The Lightbox, Woking 5-10 September.

Their work takes them all over the world from the deserts of South Africa to the French Alps. Their dedication is preventing diseases like cancer. Their expertise is helping the UK to break the world land-speed record. Their vision is protecting our precious energy resources and their creativity is finding new ways for us to communicate with each other.

HEATHER WILLIAMS



Richard Cannon / STEMNET

Heather Williams is a senior medical physicist at the Manchester Royal Infirmary. She works primarily in nuclear medicine imaging, a non-invasive and painless way of diagnosing a variety of diseases, including many types of cancer, heart disease and other disorders within the body.

Nuclear medicine imaging typically involves giving a slightly radioactive injection to the patient and then using a gamma camera to pick up the

radiation it gives off as it is taken up in the body. The images show whether tissues and structures, such as the heart, kidneys, liver and brain, are working as they should.

Talking about her work in schools Heather says: "When I talk to groups of young people there are always some that have a 'light bulb' moment, and realise that science is exciting and rewarding, and something that they can and want to do for a living."

Heather is pictured in a gamma camera at the Manchester Royal Infirmary, holding an image of a nuclear medicine bone scan.

JO CARRIS



Richard Cannon / STEMNET

Jo Carris developed a passion for sustainable technology during her undergraduate degree in Technology at the University of Birmingham. Her university studies, and internships at Arup and Scott Wilson, cemented her interest in the area. Jo started working for Laing O'Rourke as a sustainability advisor in 2006, and became qualified in assessing the environmental impact of building and civil engineering projects.

Jo now works within the Sustainability Team for London 2012, specialising in energy and waste. She is helping to ensure that the next Olympic and Paralympic Games are the greenest games in history, and is working on the installation of one of the first-ever large scale wind turbines in an urban environment.

Talking about her work, Jo says: "Being able to implement green initiatives on a project of this scale is hugely satisfying."

Jo is pictured in front of a wind turbine at Coldham Wind Farm in Cambridgeshire.

WATER SCARCITY AND FOOD SECURITY



Colin Chartres and Samyuktha Varma; International Water Management Institute

By the year 2050 we will be facing the formidable challenge of feeding 9 billion people equitably, and safely. While developments in biotechnology and plant sciences are providing one set of potential solutions to improving food production, water is still going to be the single most important factor in our ability to achieve food security.

Water is often left out of the debate on food. Much of the developing world is water scarce – either in physical terms with a lack of water resources, or in economic terms with a lack of the critical infrastructure and institutions required to make the water accessible. This means that a vast majority of the world's poor are living in areas where growing food is difficult and only going to get harder given unprecedented population growth and climate change that

are predicted to put huge stress on our resources. Two years ago, the Comprehensive Assessment of Water Management in Agriculture¹, which brought together over 700 scientists to ask how lessons from the past fifty years of water development and management can guide the future, stated that we cannot continue with “business as usual.” If we are to focus our attention on solutions, the key questions to ask are – how are the richer countries going to help poorer countries increase food production and resilience against unexpected shocks? And, what can poorer countries do to help themselves?

DRIVERS OF WATER SCARCITY

The scale and extent of the water scarcity that we will face is being driven by several factors most of which are fairly clear.

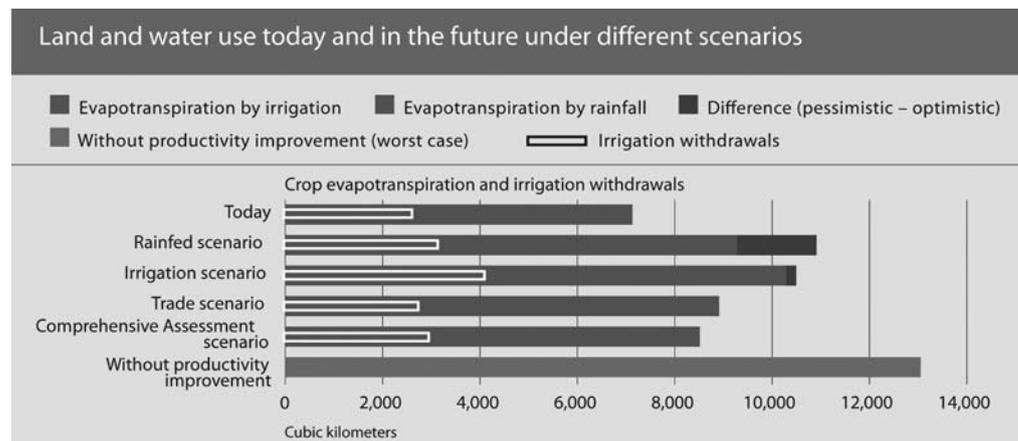
It is estimated that around 1.4 billion people live in areas where water is over-exploited, and about 1.1 billion of those live in areas with a severe water shortage. With the world's population forecasted to reach 9 billion by 2050, between 3 and

5 million people will live in areas with acute and chronic water shortages (equal to or less than 1000 cubic metres per person per year). To date, it has been the environment that has suffered as water use-to-availability ratios rose. Whilst many ecologists would argue that a 40% ratio is a threshold above which ecosystem health is impacted, there is a growing number of major rivers that hardly reach the sea any more resulting in “closed basins”. Included in this number are the Murray (Australia), Yellow (China), Krishna (India) and Colorado (USA) rivers. Population growth therefore represents the biggest single threat to water supplies and food production.

Changing diet is proving to be an important driver of water scarcity. In order to grow 1 calorie of food, 1 litre of water needs to be evapotranspired. As large numbers of people in developing countries grow more affluent their taste in food has moved from diets rich in grain and vegetables to consumption of more protein-rich foods. A diet without meat requires about

2000 litres of water per day to produce, while it would take about 5000 litres per day for an animal protein-based diet. Put another way, a global population of 9 billion will need a further 2500-6000 km³ of water for food production depending upon the degree of crop/water productivity, food losses prior to market and wastage after preparation. The upper figure is almost twice the amount of water used in agriculture in the year 2000.

Although the global financial crisis has seen oil prices fall from US \$150 per barrel to US \$37-70 per barrel over the last 6 months, fossil fuel demand over the forthcoming decades will inevitably see demand for biofuels similarly increasing. So-called first generation biofuels production, derived from corn, beans and sugar, create competition not only for land, but also for water. If ultimately this competition takes over 10-15% of agricultural land, the impacts on food production will be very significant. However, there are many uncertainties on the future impact of biofuels on food production.



In 2008 the world saw a transition from one in which more people lived in rural environments to one with more people in cities and towns. The transition point has not yet been reached in developing countries, however worldwide bigger cities with more industry clearly already compete with agriculture for water resources and this competition will increase. Cities also have more political power and the wealth to buy water from other users. Currently many agricultural developing countries and developed countries/states such as Australia and California use 70% or more of their total available

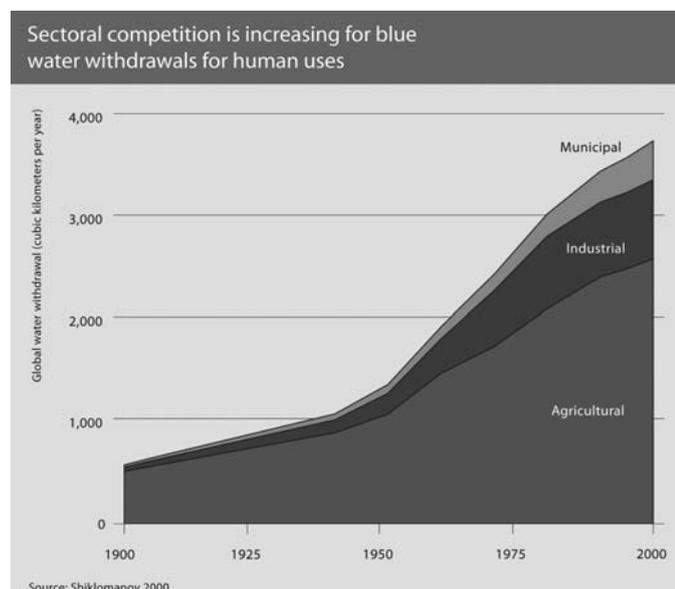
large food importing countries wanting to buy up large tracts of land in developing countries for food production. Competition for water from the hydropower industry also means that water for agriculture is no longer available at the right place at the right time. All these kinds of drivers may significantly impact food production in developing countries and have both beneficial and adverse impacts on their populations.

Climate change research has yet to provide us with an understanding of just how it will affect food production at local and regional levels. However,

at least 30%. In some of the subtropics of Africa, rainy seasons are starting later, have more intense rainfall and are of a shorter duration. Even in areas where rainfall is predicted to increase, increases in rainfall intensity may lead to more erosion and flooding. To what extent such climate change and variability induced impacts on water availability may be compensated for by production being enabled in areas previously too cold for grain is uncertain but an inescapable fact is that many of the world's poor live in tropical and subtropical countries likely to be deleteriously impacted by climate change.

large and often dysfunctional irrigation schemes will also bring the required productivity increases. Wise, risk-free reuse of wastewater from growing cities will also be needed. Of course these actions need to be paralleled by development of drought tolerant crops and the provision of infrastructure and facilities to get fresh food to markets.

In Asia, agricultural productivity can be enhanced not only from improved yielding and disease resistant crop varieties and varieties adapted to changing climate conditions, but also through a revolution in irrigation system performance based on improving infrastructure and water users' participation in system operation. Similarly, better understanding and management of groundwater may be the difference between life and death for some poor south Asian farmers and an effective climate change adaptation strategy for some African farmers. The challenges are immense and must not be underestimated. A critical point in our view is that, given the complexity of current agricultural and natural resource systems, effective solutions to increasing food production have to be broader than just crop breeding.



water resources in the agricultural sector. Even if growing urban demand only requires a redistribution of 5% of this water it will have a significant impact on the ability to grow food. Globalisation is also having a range of impacts on food production as the demand for luxury goods, such as cut flowers, creates competition for land and water near international airports. Other similar trends include product sourcing policies of supermarket chains in developing countries and the recent phenomenon of

there are several signs that indicate that there is cause for some concern. Rainfall and runoff records from countries with Mediterranean climates, such as southern Australia, Spain and Morocco, already indicate that declines in rainfall of up to 30% may be expected. Studies are also indicating that in some environments for each unit decline in rainfall there is up to a threefold decline in runoff. Data from Central Asia also suggest that in the long term (30-50 years), runoff from mountain snow melt may also reduce by

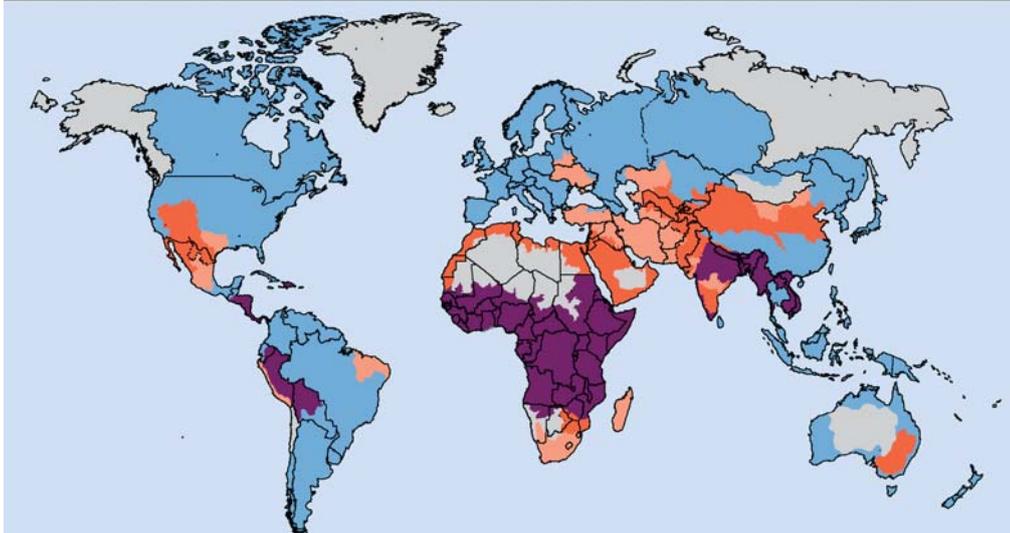
SOLUTIONS DO EXIST

Easy as it is to say that we need to change the way we think about water and agriculture, one of our biggest challenges will be to look beyond rivers and groundwater as our main sources of water for food production. In parts of the world that are dependent on seasonal rain for food production, improving water storage to save and collect this valuable resource could improve the productivity of smallholder farmers, particularly in Africa. Ethiopia, which is typical of many sub-Saharan African countries, has a water storage capacity of 38 cubic metres per person. Other simpler solutions are also part of the equation. These include the construction of small reservoirs, sustainable use of groundwater systems including artificial groundwater recharge and rainwater harvesting for smallholder vegetable gardens. Improved year-round access to water will help farmers maintain their own food security using simple supplementary irrigation techniques. The redesign of both the physical and institutional arrangements of

Water for agriculture is coming under severe competition and needs to be an integral part of the solution. With approximately 1 billion people, predominantly in Asia, under the poverty line and at risk of further malnutrition, the stakes are also very high from a social and political perspective. The challenge of feeding the world and providing enough water to facilitate this is daunting, given that the consequences of failure will have profound ramifications for rich as well as poor countries. It is a challenge that

Areas of physical and economic water scarcity

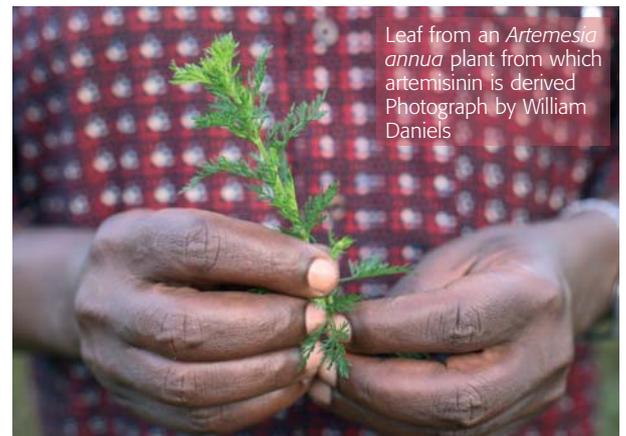
■ Little or no water scarcity
 ■ Approaching physical water scarcity
 ■ Not estimated
■ Physical water scarcity
 ■ Economic water scarcity



will only succeed if investment in agriculture and natural resources management is seen as the key to a more prosperous and stable future for the poor and a basis for helping poor countries increase their gross domestic product and thus move up the development pathway.

¹ The Comprehensive Assessment of Water Management in Agriculture was led by the International Water Management Institute. Results of the five-year long study was published in "Water for Food; Water for Life: A Comprehensive Assessment of Water Management in Agriculture" (2007).

THE ANCIENT SCOURGE OF MALARIA: IS THE END IN SIGHT OR IS THE PARASITE ABOUT TO STAGE A COMEBACK?



Stephen O'Brien MP Chairman of the All Party Parliamentary Group on Malaria & Neglected Tropical Diseases; Chairman of the Malaria Consortium; Vice-Chairman, Liverpool School of Tropical Medicine; and Prudence Hamade from Malaria Consortium

Malaria has been described in medical literature for over 2000 years and has seriously impeded the economic and social development of endemic countries. Nearly one million deaths are recorded each year, and in 2009 half the world's

population remains at risk. In Africa, where transmission is highest, deaths are most common in pregnant women and children under five, but older children and men are also affected by malaria that can lead to chronic anaemia and result in loss of school attendance and work.

Malaria disproportionately affects the poor, particularly where housing is inadequate and where there are many breeding sites for mosquitoes. High numbers of cases and deaths are found in conflict and

post-conflict settings such as Democratic Republic of Congo and in countries with weak health systems such as Nigeria. However, we have excellent tools to control malaria such as long-lasting insecticidal nets, easy to use rapid diagnostic tests, efficient insecticidal sprays and effective treatments, in addition to an increase in funding for malaria programmes over the last few years. In Parliament the All Party Parliamentary Group on Malaria & Neglected Tropical Diseases has dedicated its energies to

establishing the evidence and opportunities to tackle this devastating scourge by advocating, with authority, the need to highlight and prioritise this battle and win it – it is achievable with sustained effort.

Why, then, is the disease continuing to devastate communities? There are several reasons, and at present the main ones are that the systems to make sure these excellent tools reach the people who need them are very deficient. Lack of skills, lack of resources and sometimes lack of interest

mean we are not making the most of the methods we have. Past efforts to bring malaria down have eventually been blocked by technical obstacles, especially resistance of the parasites to the drugs and resistance of the mosquitoes to insecticides. We need to make the most of the good interventions we have while they are still working by supporting delivery systems, and at the same time always keep a pipeline of new interventions under development.

Drugs such as chloroquine and Fansidar (sulphadoxine/pyrimethamine) developed decades ago were very effective for up to 30 years but are now virtually useless against the main killer parasite *Plasmodium falciparum*. Highly effective drugs, based on artemisinin extracted from a plant *Artemisia annua* were rediscovered in the 1970s by Chinese scientists. The World Health Organization advises that they should be taken in combination with another longer acting drug to prevent resistance developing.

Artemisinin Combination Therapies (ACTs) are one of the mainstays of malaria control programmes. They act rapidly to

clear parasites reducing the risk of transmission and the progression of the disease to more severe forms such as cerebral malaria. They rapidly reduce fever and have few side effects.

Research on the Thai-Cambodian border (long a nursery for emerging resistance to antimalarials) has recently demonstrated reduced efficacy of artemisinin based drugs. The drugs are still curing patients but this first sign of parasite tolerance is a warning to the malaria community that we need to act quickly to prevent resistance from spreading outside the area, especially to high burden countries in Africa. No genetic change has yet been demonstrated but the search continues; if a genetic marker can be found it will be easier to detect and manage the parasite. If resistance spreads to Africa we could see the resurgence of malaria and reversal of the decline in morbidity and mortality in countries such as Rwanda, Ethiopia and Eritrea.

A containment project funded by the Bill & Melinda Gates Foundation and led by the World Health Organization has been rapidly launched.

Partners include the National Programmes in Thailand and Cambodia, Mahidol-Oxford Tropical Medicine Research Unit (MORU) and the UK-based organisation Malaria Consortium, a specialist in malaria control. This group hopes to eliminate malaria on the Thai-Cambodian border and thus completely destroy the resistant parasite before it spreads to the rest of the world. Challenges encountered thus far include inadequate funding in the region and weak health delivery systems – especially in post conflict Cambodia where poverty, lack of infrastructure and poor surveillance restrict rapid progress.

In recent years many new drug combinations are being developed. Public-private partnerships have been created such as Medicines for Malaria Venture, and biotechnology companies have been funded to develop semi-synthetic drugs to reduce dependence on growing the plant. Agricultural research institutions such as at the University of York seek to produce better plants with more artemisinin per leaf and with shorter growing times. However, almost all these drug

developments depend on artemisinin and it will be at least ten years before a non-artemisinin alternative can be developed.

Even if we have the tools we still need to deliver them rapidly to those most in need. They have to be affordable, accessible and acceptable to affected populations. And we must use the full range of tools available, as there is no 'magic bullet'. Moreover, wherever malaria control is producing successful results, the world community must recognise that the resources required to keep the lid on malaria transmission do not lessen as the rate of transmission is reduced.

Governments and their partners are exploring innovative ways of getting commodities to the people including innovative finance mechanisms to make drugs cheaper, such as the Affordable Medicines Facility malaria, and the use of community volunteers who have been trained by organisations such as Malaria Consortium to provide diagnosis and treatment at village level.

TACKLING PNEUMOCOCCAL DISEASE - THE WORLD'S BIGGEST KILLER OF CHILDREN

Dr Desmond Turner MP

Chairman, All Party Parliamentary Group on Pneumococcal Disease Prevention in the Developing World

Pneumococcal disease kills up to 1 million children under age 5 each year, 98 per cent of whom are from the developing world. It is the leading cause of childhood pneumonia, the world's biggest killer of children, and a primary cause of

meningitis which kills and disables many hundreds of thousands. Pneumococcal disease has a devastating impact on social and economic structures in the developing world. However, the ultimate tragedy is that pneumococcal

disease is preventable by immunisation.

Western nations, such as the UK, have access to a childhood pneumococcal vaccine and indeed, it is part of the UK immunisation rota. However, children in the developing world



have not had access for a variety of reasons, in particular cost and the lack of awareness surrounding the disease burden. The market price has previously meant that an effective vaccine has been out of reach of the developing world while the lack of awareness has led to insufficient political will to combat this easily preventable disease.

Dr Orin Levine, Executive Director of PneumoADIP at Johns Hopkins and a key supporter of the All-Party Parliamentary Group on Pneumococcal Disease Prevention in the Developing World (APPG), once described pneumococcal disease as the biggest killer no one has ever heard of. Now, however, thanks to Dr Levine and his team at PneumoADIP, whose mission is "to improve child survival and health by accelerating the evaluation and access to new, lifesaving pneumococcal vaccines for the world's children", as well the work of the GAVI Alliance, the WHO, UNICEF and other organisations, the true burden of pneumococcal disease has become increasingly understood and significant efforts have been put in place to deal with the problem.

In 2007, the pilot pneumococcal Advance Market Commitment (AMC) was created as the first global mechanism in the fight against pneumococcal disease. The AMC is an innovative funding mechanism, designed to unite developing and developed world governments, international health agencies, the pharmaceutical industry and donors in the fight against pneumococcal disease. The AMC aims to speed up the development and delivery of a pneumococcal vaccine that is fit for purpose for the developing world at an affordable price, thanks in part to the AMC donors; the UK, Italy, Canada, Norway, Russia and the Bill and Melinda Gates Foundation, who have agreed to provide US\$1.5 billion collectively, to assist low income countries in purchasing the vaccine.

The APPG, for which I serve as the Chair, has been working since 2007 to highlight the issues of pneumococcal disease prevention to Parliamentarians and civil society both here and internationally. In October 2008, the APPG launched its first report *Improving Global Health by Preventing Pneumococcal Disease* to Parliamentarians,

Ambassadors, High Commissioners, members of Civil Society, NGOs and Department for International Development (DFID) and HM Treasury representatives.

The event was very successful and, as a direct result of the report, the APPG has presented keynote speeches to a number of events focusing on pneumococcal disease and vaccination programmes in the developing world including the 4th Annual Regional Pneumococcal Symposium in Johannesburg, March 2009, and the Asian Strategic Alliance against Pneumococcal disease (ASAP) meeting in Taiwan, March 2009. These events have enabled the APPG to impress on the pneumococcal and developing world community how political advocacy is vital to create an environment of awareness and effect meaningful change.

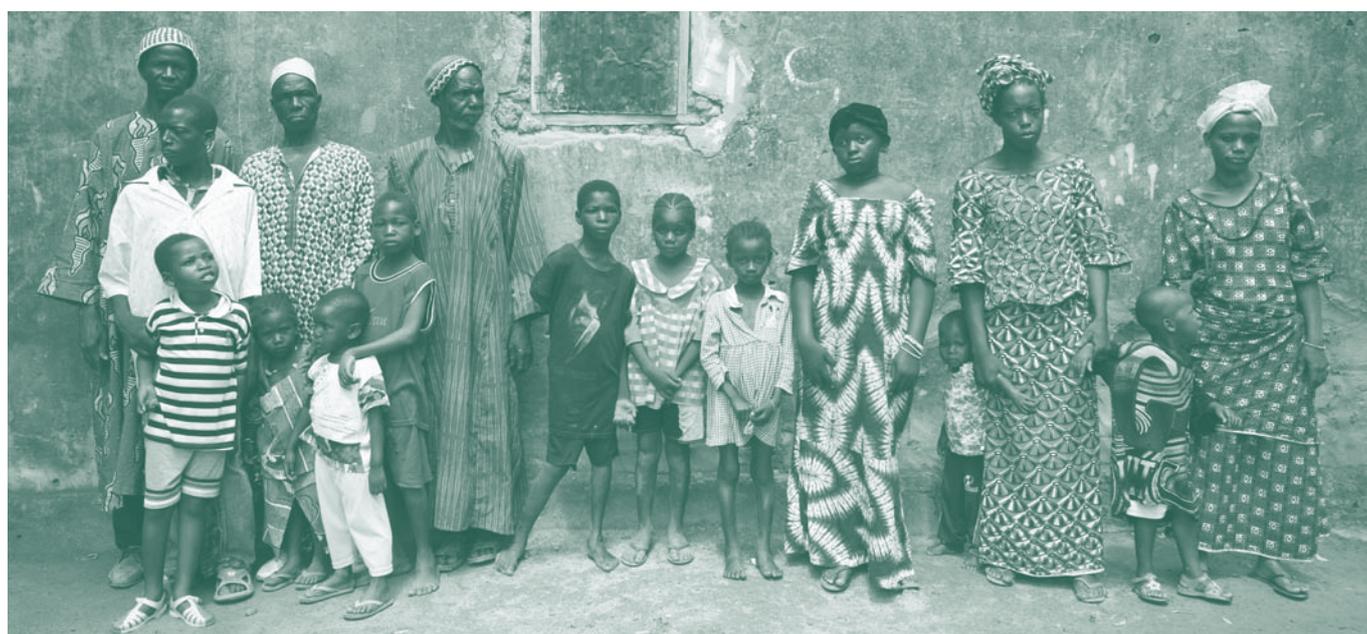
The APPG was also very proud to have received an invitation from the Italian Government on June 12th 2009, when the AMC was legally ratified by donor nations. Now we await the final piece of the puzzle – the vaccine itself – which will soon be available through the AMC for

introduction in the developing world. Congratulations must be directed to all the stakeholders in this enterprise including the vaccine manufacturers, GAVI, the World Bank, WHO, UNICEF and others. Without their collective efforts, this ambitious project could not have succeeded.

The APPG is also proud to support the first World Pneumonia Day on November 2nd 2009, a day with the express purpose of increasing awareness of the global burden of childhood pneumonia and its prevention and treatment. The APPG will join the global pneumonia and pneumococcal community to raise the awareness of this terrible, but preventable disease.

If you would like any more information about these events or for a copy of the APPG's report, *Improving Global Health by Preventing Pneumococcal Disease*, please visit <http://www.appg-preventpneumo.org>.

For information about the AMC, please visit: www.vaccineamc.org and for more information about pneumococcal disease and vaccines, please visit: www.preventpneumo.org



Meningitis sufferers from Mali. Everyone pictured suffers some of the long-term effects of the illness including deafness, partial paralysis or blindness

THE PRIME MINISTER IN BRAZIL: NEW APPROACHES TO INTERNATIONAL COLLABORATION IN RESEARCH

Damian Popolo

Vice-Consul for Science & Innovation, British Consulate General – São Paulo

The Prime Minister's visit to Brazil in March 2009 included the announcement of important activity in the areas of science and innovation. The joint declaration with President Lula includes statements such as:

"The President and Prime Minister welcomed the excellent outcomes from the UK/Brazil Year of Science & Innovation in 2007/2008, which had led to a step change in scientific collaboration. They looked forward to the launch in 2011 of Brazil's Amazonia-1 satellite containing a British camera for deforestation monitoring and deeper collaboration on agricultural sciences with the opening of a Brazilian research laboratory in the UK. They emphasised the importance of continuing to build scientific collaboration to find ways to address global challenges and the need to support UK and Brazilian companies in their efforts to commercialise the results of their innovative research."

The fact that collaboration in science was highlighted in such fashion and in the context of overall UK-Brazil strategic partnership shows that UK scientific expertise can be successfully used to assist overall UK interests overseas. As the statement makes clear,

collaboration in science played a pivotal role in enhancing UK-Brazil collaboration in food, space and energy.

The establishment of a solid partnership in research with Brazil faced multiple challenges. First, the status of Brazil as a leading and emerging scientific power is not always clear in the UK. Yet, recent bibliometric research shows that the Brazilian science base was the fastest-growing in the world throughout 2007-8, as the number of Brazilian publications in indexed journals increased by 50% in this period. This is the most dramatic increase in the history of Brazilian science. These recent developments mean that Brazil now produces 2.12% of world publications. Last year's performance means that Brazil has overtaken Russia and the Netherlands in terms of research production, and is now the world's thirteenth largest producer of publications (up from fifteenth last year). If current trends continue, Brazil may gain one more position next year.

Importantly, the Prime Minister made reference to the need of using collaboration in science and innovation as a means of facing global economic challenges. Implicit in the statement is the idea that a solution to the global economic meltdown has to be export-led, and that innovation plays a crucial role in initiating an export-led recovery.



The UK-Brazil partnership in science and innovation has demonstrated that collaboration often generates opportunities for high-tech companies in both countries across the two markets.

Innovation activities in Brazil have focused on four priority areas: best practice in innovation management, the licensing of Brazilian technology through the UK, the licensing of UK technology through Brazil and support for UK spin-out companies wishing to enter the Brazilian market on the bases of shared IP. The exchange of best practice has allowed Universities, science parks and incubators in both countries to form networks in which commercial and research opportunities are circulated. The licensing of Brazilian technology through the

UK means that UK stakeholders now have preferential access to patents that were previously unknown and which were not adequately exposed to the international market. Meanwhile, solid collaboration in science and innovation has paved the way for UK spin-out companies to enter the Brazilian market through the formation of joint ventures.

Apart from outlining the overall status of UK-Brazil scientific relations, the Prime Minister and President Lula also announced a new collaboration programme on second generation biofuels. The programme will enable up to 15 Brazilian scientists to do research in UK Universities and laboratories on micro-organisms, plant genomics and enzymes.

AND IS THERE HONEY STILL FOR TEA? ... AND AT WHAT PRICE?



Tim Lovett
President, British Beekeepers' Association

Rupert Brooke's rhetorical question posed in his poem *The Old Vicarage, Grantchester*, back in 1912, still gets the answer 'yes' almost 100 years on, but only just! Few will have missed the raised public and media interest in the honey bee and its various vicissitudes over the last few years. Honey itself is the least of our worries as far as the honey bee is concerned. Although the UK honey crop was so reduced last year that supplies ran out around Christmas, the shortage of this wholesome and healthy sweetener is but an indicator of the greater threat to the UK and indeed world population of the European honey bee, *apis mellifera*. A reduction in honey bee populations represents a decline in this principal insect pollinator, said to be responsible for one third of the food we eat, and what's more, the rather more toothsome and nutritionally important part of our diet. Imagine your breakfast in a bee-less world; no honey on the toast, of course, no orange juice nor coffee and perhaps no butter too, from cattle fed on forage crops like alfalfa, which depend on bee pollination. Lunch will be little better, with the cereal derived pizza base looking rather anaemic minus its tomato passata and mozzarella cheese topping!

... A reduction in honey bee populations represents a decline in this principal insect pollinator, said to be responsible for one third of the food we eat. . .

The value of honey bee pollination has been estimated at many billions of dollars around the world, and here in the UK an ADAS study in 2001, updated in 2007, based on just 10 crops, produced a figure of some £165 million per annum. With some 240,000 hives in the UK, each has a value to the economy of more than £600 pa. So the honey bee plays an important economic role in our agricultural economy, diet and food security. Then, there are all those wild animals and birds that depend on bee pollinated fruits and seeds for their survival. The hard working honey bee thus occupies an important niche in our ecosystem and one that we can ill afford to put at risk. It thus behoves us to recognise the threats to this insect, to understand the challenges it faces and to help ameliorate its situation whenever we can.

Alarm bells began to ring in 2006 when massive unexplained losses of honey bee colonies of up to 70% were reported from the USA. Colony Collapse Disorder (CCD), by which the syndrome became known, is characterised by hives being left with massively reduced bee numbers without clear cause or reason. So dependent are various sections of US agriculture, eg the almond growers, who pay \$150 million

per annum for pollination services from beekeepers, that research funds were quickly made available by industry and by State and Federal institutions. A host of possible causative agents has been put forward, including mobile phones and climate change, but the smart money is on pest and diseases aggravated by other factors which might include insecticide misuse and, plain and simple, bad weather. The situation is complex and finding out what is wrong in order to put it right is proving difficult and expensive in research terms.

To date it is not thought that CCD as such exists in Europe or the UK, although rising colony loss rates and the presence of the same key disease elements as those in the USA suggest that a similar manifestation is occurring. Winter losses in the UK have risen from the typical 5-10% of earlier years through 20% in 2006-07 to 30% in 2007-08. These levels are unsustainable and the shortfall in last year's honey crop may indicate that we risk reaching critical levels in terms of pollination capacity too.

It is not the first time that devastating honey bee losses have been reported in the UK. The so-called 'Isle of Wight disease' of the early 20th century decimated the UK bee population and there have been recurrent outbreaks of foul-brood disease (beekeeping's foot and mouth disease) over the years. By far the greatest

challenge to bee health to hit these shores in recent memory has been the arrival of the parasitic *Varroa destructor*, first identified in the early 1990s in Devon and which has spread throughout the British Isles. The varroa mite originated in the Far East where it parasitises the Asian honey bee, *Apis cerana*, apparently without great damage. This clever little 'critter' jumped species a hundred years or so ago and spread west across Europe, eventually to arrive here. So adaptable is the varroa mite that it has also developed resistance to the key approved medications available to beekeepers, making its management all the more difficult. The realisation that the varroa mite had itself become infected with viruses which are damaging to honey bees (eg deformed wing virus, Israeli paralysis virus) which it vectors into honey bee colonies, has turned the debilitating varroa mite into a killer. Add to this the emergence of a new form of a fungus-like agent, *Nosema ceranae* which appears to be particularly virulent and one can envisage the toxic cocktail of disease that our honey bees face.

Whilst we are able to identify some of the potential key incriminated elements, we are as yet unable to put our finger on the exact causes of bee colony losses. Further, we need to define these in the context of UK beekeeping and the remedial steps that may be available to us in line with European veterinary medicines legislation. The honey bee is classified as a food producing animal under EU law just like cattle, sheep, pigs, poultry and fish, bringing the full (and disproportionate) weight of the Veterinary Medicines Directive down on this beleaguered insect.

Given the many gaps in our knowledge, there is a clear case for urgent research into honey bee health. The entreaties of beekeepers led by the British Beekeepers' Association (BBKA) fell on deaf ears initially at Defra. With the then Defra Minister, Lord Rooker, accepting the benefits brought by honey bees and the challenges they faced but refusing to contemplate making funds available, the BBKA undertook a campaign to get the Government to reconsider. Never let it be said that the British public is unable to grasp single issues and express its view! Huge media and public support culminated in the presentation of a 142,000 signature petition to Downing Street on 5th November 2008, supported by hundreds of beekeepers in their full kit, with smokers alight, marching down Whitehall. The programme of a parliamentary briefing, an adjournment debate and early day motion had revealed substantial cross party support for the BBKA campaign pushing the Government to fund more bee health research. The BBKA proposed a research programme during the campaign, costed at £8 million over five years, during which time honey bees would deliver more than £825 million in pollination benefit. This programme was formally published in January of this year under the title '*Honey Bee Health Research Concepts*', containing both pure and applied projects plus some desk-based activity to accelerate the availability of new medicines urgently required to confront the challenges being faced by honey bees.

Defra finally reacted, when Hilary Benn announced a £4.3 million package for honey bees, also in January. Of this, £2.3 million was to go into the

. . the cash available will prove to be inadequate to meet all the needs of these important creatures and so key elements will go un-researched. . .

National Bee Unit (NBU). Now part of FERA, the NBU has an important statutory role in controlling notifiable bee diseases fielding a team of Regional and Seasonal Bee Inspectors to help beekeepers identify and manage disease outbreaks. This new money has been predicated towards implementing the bee health strategy, published in March 2009, through building-up a national database of beekeepers, running a disease survey and improved education and training of beekeepers. Only the latter objective would figure high on the BBKA's list of priorities given that education is the key charitable objective of the BBKA, being responsible for the vast majority of beekeeper training. It believes it is best placed to bring benefit through any increased financial support that becomes available.

The remaining £2 million from Defra was destined to support honey bee health research and was joined by a further pledge of £8 million from the BBSRC, NERC, Wellcome Trust and Scottish Office in April. However, the prescription had changed and was now no longer for 'honey bee health' but for research into 'pollinator decline'. And here is the rub as far as beekeepers are concerned. They have identified the key areas of work to be undertaken listing 30 projects

under 12 programmes on honey bee health, only to see the Government put together a hybrid funding group interested in pollinators in general. Worthy, but not on target! The Women's Institute wasn't fooled either, recognising the change in approach of the Government at its June AGM, when it voted overwhelmingly for a campaign to press Government for adequate honey bee health research funding. What the shift in emphasis means in reality is that the honey bee will have to fight its corner against the bumble bee, the hover-fly against the moth and so on. Undoubtedly the cash available will prove to be inadequate to meet all the needs of these important creatures and so key elements will go un-researched. This in turn means that we will reduce the chances of finding the answers to the challenges we face, ultimately risking paying a high price for the failure to provide adequate bee health research funding. The campaign for funding thus continues and it is to be hoped that the imminent formation of an All Party Parliamentary Group on Honey Bees will provide further pressure on Government to come up with the modest funding still needed to ensure that there will indeed still be honey for tea!

For further information visit www.britishbeekeepers.com



THE CARP AND THE RABBIT

Professor Alan Malcolm

The UK has had to deal with very few members of the legislature violently opposed to GM technology in agriculture. (**Everyone** is in favour of it in medicine!)

Although Peter Melchett is Lord Melchett, he hasn't flaunted his peerage since he was a junior minister more than two decades ago. When charged with criminal damage, he was found not guilty. By comparison the Commons' most vociferous spokesperson for the Luddite party, Michael Meacher, seems benign.

As one might expect, things are different across the Channel. On June 7th, one of the new French MEPs was a convicted criminal, found guilty on numerous occasions of being a significant nuisance.

José Bové is now licensed to wreak havoc in Brussels, or as *Le Figaro* put it, "C'est comme le carp et le lapin".

Our hero is a charming and highly intelligent sheep farmer and cheese maker from what is known as La France Profonde – a tiny village called Montredon on the Causse de Larzac in southern Aveyron. The British will recognise it as being only 30km from Norman Foster's mighty Millau Viaduct across the Tarn, helping to link Paris to Barcelona.

His first naughtiness was a decade ago when he confiscated all the items in a supermarket which he believed contained GM material, wrapped them in clingfilm to prevent the genes escaping, and blocked a checkout. The manager and the gendarmerie were not sympathetic. Suspended sentence.

His next little foray was a retaliation against the US's imposition of a 100% import duty on Roquefort cheese! Most of the milk produced by Bové and his neighbours goes to make Roquefort. In fact the US was retaliating against the EU's ban on imports of (GM) hormone treated beef – a legal wrangle which is still not resolved. A comparatively inoffensive gesture was the imposition of a 100% tax on

vociferously about American imperialism. The irony of their driving Ford tractors was overlooked by their audience. The gendarmes stood politely by, preventing the local traffic from interfering with the protest.

The magistrates were not amused and sentenced him to three months in prison. He hated this.

He also managed to fit in visits to Palestine/Israel where he

Maurice Chevalier accent. The unexpected bonus from this was the resurfacing of four miles of road leading to the village – such upgrades to the local highways usually require a significant injection of funds from the EU.

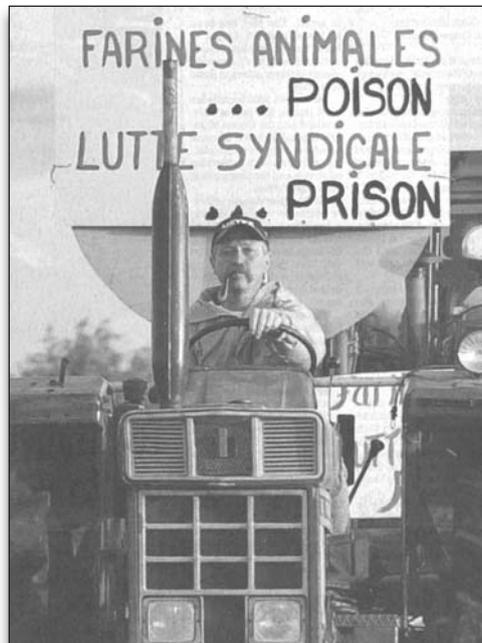
Needless to say, Bové and friends have also dug up (à la Melchett) GM maize crops in south western France. He was very upset that Chirac would not exercise a Presidential pardon in his favour, and a further spell in prison resulted.

His retaliation was to run for President against Sarkozy, finishing a very honourable sixth.

But now at last, the electoral system has given him a political voice which will be heard. He was number one (Tête de Liste) on the Green Party list for South West France. In his home village of Nant, he received 89 votes, a soupçon behind the representative of the UMP (Sarkozy's party), and more than double the number of any other candidate. The turnout was 50%!

He appeared on television later that evening, along with his new partner as MEP, Daniel Cohn Bendit, whom older readers will remember as the leader of student rebellion in 1968. Our very own President of the National Union of Students at that time, Jack Straw, seems to have matured very nicely.

Only problem now remaining is that nobody has yet worked out who will succeed Bové as barbecue chef at the Montredon market on Wednesday evenings. Cometh the hour, cometh the man as we Anglo Saxons say.



Coca Cola at the Montredon farmers' market. This was without noticeable effect on anything since the locals all drink the local pastis.

Much more serious was his advance on the site where a branch of MacDonald's was being developed in Millau. In fact all he (and accomplices) did was to make a nuisance of themselves and rearrange some of the building materials. The "damage" was negligible. His followers then paraded through the streets of Millau, banging dustbin lids and complaining

defied the Israeli army by walking in front of a tank (à la Tiananmen Square, but with a better outcome). DVDs of this foray can be purchased at the Farmers' Market in Montredon.

Next he was off to disrupt the G8 summit in Seattle. By now the world was waking up to the presence of this new Ghandi, and CNN decided to send a film crew to Montredon to interview him. Having spent several years of his childhood in California with his microbiology professor father, he speaks perfect English, albeit embellished with a



HOUSE OF COMMONS SELECT COMMITTEE ON INNOVATION, UNIVERSITIES, SCIENCE AND SKILLS

Under the Standing Orders, the Committee's terms of reference are to examine "the expenditure, administration and policy" of what is now the former Department for Innovation, Universities and Skills (DIUS) and its associated public bodies. This includes the Government Office for Science, headed by the Government Chief Scientific Adviser. On 5th June the Prime Minister announced that DIUS and the Department for Business, Enterprise and Regulatory Reform would merge to form the Department for Business, Innovation and Skills. On 25th June the House of Commons decided to establish a Science and Technology Committee from 1st October 2009. The new Committee will have the same membership and the same Chairman as the Innovation Universities Science and Skills Committee.

The Committee was nominated on 8th November 2007. The current Members of the Committee are:

Dr Roberta Blackman-Woods (Lab, City of Durham), Mr Tim Boswell (Con, Daventry), Mr Ian Cawsey (Lab, Brigg and Goole), Mrs Nadine Dorries (Con, Mid Bedfordshire), Dr Evan Harris (Lib Dem, Oxford West and Abingdon), Dr Brian Iddon (Lab, Bolton South East), Mr Gordon Marsden (Lab, Blackpool South), Dr Bob Spink (UKIP, Castle Point), Ian Stewart (Lab, Eccles), Graham Stringer (Lab, Manchester, Blackley), Dr Desmond Turner (Lab, Brighton Kemptown), Mr Rob Wilson (Con, Reading East) and Mr Phil Willis (Lib Dem, Harrogate and Knaresborough). Mr Phil Willis was elected Chairman of the Committee at its first meeting on 14th November 2007.

ORAL EVIDENCE

The transcripts of these evidence sessions are available on the Committee's website.

Science Question Time

On 18th May 2009 the Committee held Science Question Time with the Minister of State for Science and Innovation, Lord Drayson.

CURRENT INQUIRIES

Students and universities

On 30th October 2008 the Committee announced an inquiry into students and universities. The Committee has focused on admissions and widening participation, the balance between teaching and research, degree classification and student support and engagement. Oral evidence sessions started in January 2009 and concluded on 11th May 2009 when the Committee took oral evidence from the former Secretary of State at DIUS, Rt Hon John Denham MP, and the Chief Executive of the Higher Education Funding Council for England. During the course of the inquiry the Committee took evidence from vice-chancellors, academics, students and their representative organisations. The Committee also sought the views of students through an e-consultation which closed on 7th April 2009.

Putting science and engineering at the heart of government policy

On 13th November 2008 the Committee announced an inquiry, putting science and engineering at the heart of government policy. On 24th March 2009 the Committee issued a supplementary call for evidence relating to Lord Drayson's proposals on strategic science funding. Oral evidence sessions started in January 2009 and concluded on 18th May when the Committee took evidence from Rt Hon Lord Drayson, Minister of State for Science and Innovation, and Professor John Beddington, Government Chief Scientific Adviser.

Further Education College Capital Expenditure

On 11th May 2009 the Committee announced two evidence sessions on Further Education College Capital Expenditure, which took evidence from the Learning and Skills Council,

the 157 Group, the Association of Colleges and Rt Hon John Denham MP, former Secretary of State for Innovation, Universities and Skills and Stephen Marston, Director General, Universities and Skills, DIUS.

REPORTS

Pre-appointment hearing with the Chair-elect of the Economic and Social Research Council, Dr Alan Gillespie CBE

On 12th May 2009 the Committee published its Fifth Report of Session 2008-09, *Pre-appointment hearing with the Chair-elect of the Economic and Social Research Council, Dr Alan Gillespie CBE*, HC 505.

Pre-appointment hearing with the Chair-elect of the Biotechnology and Biological Sciences Research Council, Professor Sir Tom Blundell

On 19th May 2009 the Committee published its Sixth Report of Session 2008-09, *Pre-appointment hearing with the Chair-elect of the Biotechnology and Biological Sciences Research Council, Professor Sir Tom Blundell*, HC 506.

The future of science scrutiny following the merger of DIUS and BERR

On 12th June 2009 the Committee published its Fourth Special Report of Session 2008-09, *The future of science scrutiny following the merger of DIUS and BERR*, HC 662.

FURTHER INFORMATION

Further information about the work of the Innovation, Universities, Science and Skills Committee or its current inquiries can be obtained from the Clerk of the Committee, Sarah Davies, the Second Clerk, Glenn McKee, or from the Senior Committee Assistant, Ana Ferreira, on 020 7219 2792/8367/2794 respectively; or by writing to: The Clerk of the Committee, Innovation, Universities, Science and Skills Committee, House of Commons, 7 Millbank, London SW1P 3JA. Inquiries can also be emailed to iusscomm@parliament.uk. Anyone wishing to be included on the Committee's mailing list should contact the staff of the Committee. Anyone wishing to submit evidence to the Committee is strongly recommended to obtain a copy of the guidance note first. Guidance on the submission of evidence can be found at <http://www.parliament.uk/commons/selcom/witguide.htm>. The Committee has a website: www.parliament.uk/iuss where all recent publications, terms of reference for all inquiries and press notices are available.





HOUSE OF COMMONS LIBRARY SCIENCE AND ENVIRONMENT SECTION

Information and copies of papers can be obtained from Michael Crawford at the House of Commons Library on 0207 219 6788 or through http://www.parliament.uk/parliamentary_publications_and_archives/research_papers.cfm

The following is a summary of a paper produced for Members of Parliament.

Marine and Coastal Access Bill

Research Paper 09/56

The Bill covers a broad range of marine issues and would: (1) set up a new Marine Management Organisation (MMO) under which many of the existing, diverse areas of marine

regulation would be centralised; (2) streamline the existing marine licensing system and provide powers to create a joined up marine planning policy; (3) introduce new measures to reform fisheries management; (4) provide a framework for establishing marine conservation zones; and, (5) enable the creation of a route around the English coast.



HOUSE OF LORDS SCIENCE AND TECHNOLOGY SELECT COMMITTEE

The members of the Committee (appointed 11 December 2008) are Lord Broers, Lord Colwyn, Lord Crickhowell, Lord Cunningham of Felling, Lord Haskel, Lord Krebs, Lord May of Oxford, Lord Methuen, Baroness Neuberger, the Earl of Northesk, Lord O'Neill of Clackmannan, the Earl of Selborne, Lord Sutherland of Houndwood (Chairman) and Lord Warner. Lord Jenkin of Roding, Baroness Finlay of Llandaff and Baroness Whitaker have been co-opted to the Select Committee for the purposes of a short follow-up inquiry into pandemic influenza; Baroness Finlay of Llandaff, Baroness O'Neill of Bengarve, Lord Patel (as Chairman of Sub-Committee II), Baroness Perry of Southwark, Lord Taverne and Lord Winston had been co-opted to Sub-Committee II for the purposes of its inquiry into genomic medicine (concluded 20 May 2009); Baroness O'Neill of Bengarve is also co-opted to Sub-Committee I for the purposes of its continuing inquiry into nanotechnologies and food, as has Lord Mitchell.

PANDEMIC INFLUENZA

In December 2005 the Committee published a report on pandemic influenza (Session 2005-06, HL Paper 88). The Committee took the view that the first line of defence against a potential human influenza pandemic was effective surveillance and control of avian influenza, in particular in south east Asia. The Committee recommended more support for generic health services in Asia, where new strains of flu had emerged in recent years, and for Government departments to work together to produce a contingency plan in case of an outbreak of a strain of avian flu that easily transferred to human beings.

On 24th June 2008 the Committee decided to conduct a brief follow-up to its 2005 report. As a result, on 25th November the Committee took evidence from Dawn Primarolo MP, then Minister of State for Public Health at the Department of Health, and also from officials from the Department of Health, the Cabinet Office, the Department for the Environment, Food and Rural Affairs and the Department for International Development. The Minister and officials were invited to answer questions about the United Kingdom's preparedness for flu pandemic and whether the National Health Service was

adequately resourced and prepared for a flu outbreak, and also to give their view on how essential public services would cope with a large-scale loss of staff due to illness caused by pandemic influenza.

The Committee received expert briefing at a seminar in February 2009 and held a further evidence session with Government officials on 17th March. The Committee held a second evidence session with the Minister of State for Public Health, Gillian Merron MP and is likely to publish its report before the end of the current session.

GOVERNMENT CHIEF SCIENTIFIC ADVISER

On 2nd June 2009 Professor John Beddington, the Government Chief Scientific Adviser, gave evidence before the Select Committee about the state of science policy within Government and, more specifically, issues relating to pandemic influenza.

GENOMIC MEDICINE

During the last session (2007-08) the Select Committee appointed a Sub-Committee (Sub-Committee II), chaired by Lord Patel, to hold an inquiry into genomic medicine. The call for evidence was published on 25th February 2008

with a deadline for submissions of 21st April. The Sub-Committee was reappointed at the beginning of the current session (2008-09) and Lord Patel remains as chairman.

The inquiry is examining the policy framework in genomic medicine, the latest research and scientific developments, translation opportunities into the clinic, genomic databases and the use of genetic information in a healthcare setting. The Sub-Committee has held a number of public meetings since April 2008 and has taken evidence from a wide range of witnesses. They have included the Medical Research Council, the Department of Health, the Wellcome Trust, Cancer Research UK, the Royal College of Physicians, the National Institute of Clinical Excellence, representatives of the pharmaceutical industry and representatives of the insurance industry.

In early June 2008 Members visited the National Human Genome Research Institute in Washington DC where they spoke to experts in fields including population genomics, ethics, and translational research. They also met representatives from other organisations including the Food and Drug Administration, Harvard Medical School, and the American Society of Human Genetics. The final evidence session, with Ministers, took place in late January 2009.

The Committee's report was published on 6th July 2009 and is likely to be debated either at the end of the current session or during the early part of session 2009-10.

NANOTECHNOLOGIES AND FOOD

Following a seminar in November 2008 the Select Committee decided to appoint a Sub-Committee (Sub-Committee I), to investigate nanotechnologies and food under the chairmanship of

Lord Krebs. A Call for Evidence was published on 3rd February 2009 with a deadline for submissions of 13th March.

The inquiry covers food products, additives and supplements, food contact materials, food manufacturing processes, animal feed, and pesticides and fertilisers. It will investigate the use of nanotechnologies in the food sector focusing on the state of the science and its use in the food sector, health and safety, the regulatory framework, and public engagement and consumer information.

The Committee held its first public evidence session on 31st March with representatives from Government departments. It has been holding regular evidence sessions since then and will continue to do so until the long recess starting in July. Evidence has been received from a wide variety of witnesses from within the food industry, consumers groups and academia. The Committee also visited Washington DC in late June where members met with US government agencies, including the Food and Drug Administration and the Environmental Protection Agency; NGOs, including the Woodrow Wilson Centre; and industry representatives such as the Grocery Manufacturers Association. It is expected that the Committee's report will be published in late 2009 and will be debated in the House during the forthcoming session, 2009-10.

FURTHER INFORMATION

The written and oral evidence to the Committee's inquiries mentioned above, as well as the Calls for Evidence, can be found on the Committee's website www.parliament.uk/hlscience. Further information about the work of the Committee can be obtained from Christine Salmon Percival, Committee Clerk, salmonc@parliament.uk or 020 7219 6072. The Committee's email address is hlscience@parliament.uk.



PARLIAMENTARY OFFICE OF SCIENCE AND TECHNOLOGY (POST)

RECENT POST PUBLICATIONS

Personalised Medicine

April 2009

POSTnote 329

Risk of disease and response to treatment varies from person to person. This is due to variation in human genetic coding, interactions between one's genes and environment over a lifetime and the unique signature of the immune system. Defining the scope and nature of human biological variation allows the targeting of medical treatments to those most likely to benefit. Such treatments may include drugs or cell therapies tailored to a patient's history, genes and immunology. This POSTnote examines the state of research into human variability, and the prospects, challenges and policy implications of more personalised medical treatment.

Diet and Cancer

April 2009

POSTnote 330

Research shows that the risk of developing some cancers is linked to lifestyle, and scientists estimate that 26% of UK cancers could be prevented by altering diet. This note examines the latest scientific research, advice and recommendations for a diet to lower cancer risk and the consequences for health policy. It also discusses the involvement of the Government, charities, media and the food industry in giving dietary advice.

H1N1 'Swine Flu' Vaccine

May 2009

POSTnote 331

A novel strain of influenza (flu) virus subtype H1N1, originating from Mexico, is currently spreading across the globe. A vaccine against the strain could reduce its global impact but would



take time to develop and manufacture. Different claims have been made about the time it would take to develop and produce a vaccine. This note describes how a pandemic vaccine for UK use would be manufactured, and alternative techniques for vaccine development and manufacture. It was produced in response to requests from Members of Parliament for a POST briefing on the subject for a Commons debate on 'swine flu' on 14th May 2009.

Futures and Foresight

May 2009

POSTnote 332

In 2007 the Commons Public Administration Select Committee (PASC) suggested that Parliament strengthen its capacity to think ahead and engage with outside experts and the wider public. This POSTnote examines the key characteristics of futures work and its current use by governments and parliaments. It covers futures work at national and local levels, and the extent to which it needs to consider social and other trends alongside developments in science and technology.

Regenerative Medicine

May 2009

POSTnote 333

Regenerative medicine aims to restore the function of diseased or damaged tissues or organs by a variety of approaches, from cell-based therapies through tissue engineering to developing new medical devices. This offers potential medical benefits, but also poses regulatory challenges. This POSTnote looks at recent developments in this area and analyses the issues they pose for UK researchers and regulators.

Arctic Changes

June 2009

POSTnote 334

The Arctic is warming faster than lower latitudes. This high north region is important for the UK's future environmental security (climate), energy security and strategic interests. This POSTnote summarises the environmental change already occurring in the Arctic and its potential impact on the global climate, future commercial activities and Arctic governance.

CO₂ Capture, Transport and Storage

June 2009

POSTnote 335

Carbon capture and storage (CCS) involves capturing carbon dioxide (CO₂) emitted from large sources such as fossil fuel power stations, transporting it, and then storing it in secure places deep underground in geological formations. These formations include depleted oil and gas fields, and natural underground reservoirs. This POSTnote details the main CCS technologies and considers their safety and legal issues. This is followed by an overview of global CCS projects as well as a discussion of UK and EU policy.

Crop Protection

June 2009

POSTnote 336

The pesticide approvals process in Europe is changing. Consequently, a number of compounds used to protect European crops from weeds, pests and disease may no longer be available. Proponents believe this will benefit health and the environment; but others fear significant decreases in crop yield and quality. This POSTnote explores the potential implications for UK agriculture and horticulture and examines other crop protection strategies available that complement or compensate for pesticides.

CURRENT WORK

Biological Sciences – Assisted Reproduction, Single Embryo Transfer, Animal Cruelty and Interpersonal Violence, Counterfeit Medicines, New Addiction Treatments, Nutritional Standards in Schools, Deception Detection Technologies and Teaching Children to Read.

Environment and Energy – Security of Energy Supply, Carbon Capture and Sequestration, Future Electricity Transmission, UK Crop Protection, Reducing Emissions from Deforestation and Degradation, Ocean Acidification, Biodiversity and Climate Change and Environmental Limits.

Physical sciences and IT – Digital Preservation, Disruption of the Internet, Noise Pollution and Technology for the Olympics

Science Policy – The Dual-Use Dilemma

CONFERENCES AND SEMINARS

Food Hygiene Standards

On 21st April POST held a seminar in conjunction with the Institute of Food Science & Technology (IFST), chaired by Lord Rea. Professor Hugh Pennington discussed the outcome of his inquiry into the 2005 *E. coli* O157 outbreak in South Wales. This was the second largest in the UK, affecting around 150 people and resulting in the death of one schoolboy. The seminar focused on the lessons learned from that outbreak and considered the food industry's response.

Space Debris

On 23rd April POST collaborated with the Parliamentary Space Committee to organise a panel discussion on Space Debris, chaired by POST Board member, Ian Taylor MP. A recommendation that POST conduct work in this area arose from the discussions at the seminar.

"Counting for Health"

On 6th May POST collaborated with the All-Party Group on Medicine and the Medical Research Council's Biostatistics Group to organise a workshop on interpretation of statistical data related to physical and mental health, and other subject areas.

Regenerative Medicine

On 19th May POST co-operated with the journal *Science*, the Biotechnology and Biological Sciences Research Council and the Medical Research Council to organise a presentation in the Commons Members' Dining Room, hosted by Lord Patel of Dunkeld and opened by Science Minister Lord Drayson. The exhibition featured research by university and other research institutes from around the UK, aimed at treatments for conditions such as stroke, diabetes, cardiac damage, restoring vision and even hair loss. Nearly 160 people attended the event.

"Small World" – the Environmental Nanoscience Initiative

On 25th June POST collaborated with the Natural Environment Research Council to host a morning reception to present the findings of the first phase of the Research Council's Environmental Nanoscience Initiative, and to launch the second phase. The event was hosted by POST Board member Lord Sutherland of Houndwood, chair of the House of Lords Science and Technology Committee.

WORK FOR SELECT COMMITTEES

Commons Committees

Energy and Climate Change Committee: Dr Michael O'Brien produced a written briefing on the Severn Barrage for a short inquiry into the subject.

Environment, Food and Rural Affairs Committee: Dr Jonathan Wentworth produced a written briefing on waste to energy technologies for the committee's inquiry into the DEFRA Waste Strategy for England, 2007.

Transport Committee: Dr Katy Milne, POST fellow, produced a written briefing for the committee on Aviation Noise for its inquiry into the Future of Aviation.

Lords Committees

Science and Technology: Dr Peter Border and fellow Dr Naima Narband produced a written briefing on international regulations for food nanotechnology for the committee's inquiry into Nanotechnologies and Food.

STAFF, FELLOWS AND INTERNS AT POST

Special Commons Energy and Climate Change Committee Fellowship

POST and the Commons Energy and Climate Change Committee have concluded an agreement with the Grantham Institute for Climate Change at Imperial College, London, whereby the Institute will support a fellow dedicated to working with the Committee. It is expected that this will lead to a succession of Grantham Institute staff or doctoral students being based with the committee.

The first such fellow, Dr Greg Offer has been a POST fellow in 2004, prior to joining Imperial College.

Conventional fellows and interns

Alex Guite, Imperial College London, Institute of Physics Fellowship

Rachel Joynes, Royal Veterinary College London, Biotechnology and Biological Sciences Research Council Fellowship

Malin Rivers, St Andrew's University, Natural Environment Research Council Fellowship

Casey Ryan, Edinburgh University, Natural Environment Research Council Fellowship

Tokyo Institute of Technology short term placement

In June POST welcomed Masahiro Matsumoto, Director of Science Communication with the Japan Aerospace Exploration Agency, currently studying science communication at Tokyo Institute of Technology and Leeds University, for a short term placement.

Commonwealth Professional Fellowships

Having received its first fellow in early 2009, POST has been advised by the Commonwealth Scholarship Commission that it has been awarded two fellowships for 2010. These will enable Commonwealth parliamentary staff in Africa to come to Westminster for three month study periods.

INTERNATIONAL ACTIVITIES

POST Presidency of the European Parliamentary Technology Assessment network – Directors' Meeting

On 27th to 29th April POST hosted 16 directors of its European sister organisations, and guests from the European Commission, the Scottish Parliament and from Japan, at the 2009 annual EPTA Directors' Meeting. This was held at the Royal Society of Edinburgh, the Scottish Parliament and at the Scottish Association for Marine Science Marine Laboratory at Dunstaffnage, Oban. Discussions in Edinburgh covered matters such as the European Commission's 7th Framework Programme initiative in 'Science and Society', and the Scottish Parliament's 'Scotland's Futures Forum'. At Dunstaffnage, the Laboratory's director, Professor Laurence Mee, gave a conducted tour of the research facilities. POST is grateful to Professor Mee, and to Dr William Duncan, Chief Executive of the Royal Society of Edinburgh, and Paul Grice, Clerk of the Scottish Parliament, for their hospitality.

POST African Parliaments Programme

In April 2009 Dr Chandrika Nath and Dr Kirsty Newman, programme officer for POST's Africa programme, presented parliamentary staff in Uganda with the results of an expert review of a selection of Ugandan parliamentary briefing papers on science and technology.

In May 2009 Dr Newman organised a training day involving a talk by Ben Goldacre on "Bad Science" in Uganda as part of the APLESA (Association of Parliamentary Libraries of Eastern and Southern Africa) meeting. The day was funded by the International Network for the Availability of Scientific Publications.

Institut des Hautes Études pour la Science et la Technologie (IHEST)

On 14th May POST's Director, Professor David Cope, was invited to Metz, France, to address the final seminar held for the fifty+ participants in IHEST's 2009 fellowship programme. This is a year-long initiative set up by President Sarkozy to encourage high level private sector, academic and research institute staff to examine issues in the field of 'Science and Society'.



Parliamentary science office directors from around Europe at the Scottish Association for Marine Science Laboratory, Dunstaffnage, Argyll, during the 2009 Annual Meeting of the European Parliamentary Technology Assessment network.



SELECTED DEBATES AND PARLIAMENTARY QUESTIONS AND ANSWERS

Following is a selection of Debates and Questions and Answers from the House of Commons and House of Lords.

Full digests of all Debates, Questions and Answers on topics of scientific interest from 20th April to 21st May 2009 from both Houses of Parliament can be found on the website:

www.scienceinparliament.org.uk

Please log in using the members' and subscribers' password (available from the Committee Secretariat) and go to Publications: Digests

HEALTH

Health: Contaminated Blood Products

Debate in the House of Lords on Thursday 23 April

Lord Morris of Manchester: Already disabled by a rare, life-long blood disorder requiring continuous medical treatment, haemophilia patients have twice been infected *en masse* by contaminated blood and blood products used in their NHS treatment. Of a patient group of barely 5,000, 95 per cent were infected with hepatitis C and one in four with HIV, involving for the haemophilia community a loss of life more grievous in proportion to the numbers of people at risk than the Black Death. Thus, of the 1,243 haemophilia patients infected by their NHS treatment with HIV, only 361 – 29 per cent – are still alive; and the much higher number of deaths among hepatitis C-infected patients is still increasing.

I am president of the Haemophilia Society, and the architect of the independent public inquiry headed by Lord Archer of Sandwell. I am most grateful to him and his colleagues – Dr Norman Jones, emeritus consultant physician at St Thomas's Hospital, and Judith Willetts, chief executive of the British Society for Immunology. Their report is one of integrity and humane concern for arguably the most needful minority in Britain today. I acknowledge, too, the help of Lord Turnberg who, as immediate past president of the Royal College of Physicians, served the inquiry with such skill and dedication. When I announced the setting up of the inquiry two years ago, 1,757 haemophilia patients had already died from being infected by their NHS treatment with HIV and/or hepatitis C. The death toll has since risen by over 200 and many more are left terminally ill by what Lord Winston, vice-president of the Haemophilia Society, describes as the worst ever treatment disaster in the history of the NHS.

Baroness Thornton: The Government take the report of Lord Archer very seriously, and I was struck by its reasoned and passionate tone. The Government are giving careful consideration to all the recommendations. However, in light of this, it would be premature of me to address today the recommendations in any detail while the Secretary of State for Health was still considering

the implications. I would have loved to be able to give further enlightenment on the Government's view of the detail but I am not in a position to do so.

I should say that we fully acknowledge the pain and suffering – physical, psychological and economic – that has afflicted so many people and which has permeated the lives of the friends and families of those affected. Many Members of past Governments have expressed their regret for what happened. Perhaps I may say on behalf of this Government how sorry we are for what happened. We acknowledge that these serious infections, which were acquired as a result of NHS treatment some two or more decades ago, have struck a particularly cruel blow to patients suffering from haemophilia and other bleeding disorders, who saw treatment with clotting factor concentrates as giving hope of a much improved and possibly near normal life.

HEALTH FOOD PRODUCTS (CHANNEL ISLANDS)

Debate in Westminster Hall on Tuesday 5 May

Brian Iddon (Bolton South East): I am grateful for this opportunity to raise my concerns about food supplements and herbal remedies being marketed in this country by companies based in the Channel Islands. My attention has been focused on this issue by the Health Food Manufacturers Association.

Most, if not all, health food businesses based in the Channel Islands market at UK consumers food supplements and herbal remedies that either contain illegal ingredients or are marketed using claims that would be illegal if those products were placed directly on to the UK market – sometimes both, and are described in catalogues that market vitamins, minerals, food supplements and herbal remedies, but while such marketing is tightly regulated in the UK, such regulation does not cover operators based in the Channel Islands. That is particularly worrying because many people in the UK assume that our consumer protection laws also cover the Crown dependencies, but that is not the case.

Some of the products marketed by Channel Island operators contain ingredients that are



considered illegal in the UK, including ingredients such as DHEA, or dehydroepiandrosterone, a steroid, which is a class C drug in this country. Another ingredient is melatonin, which is categorised as a medicine here. Another aspect of the problem is that some products are marketed with illegal medicinal claims relating to cancer, cardiovascular disease, dementia and diabetes. It has also been claimed that probiotics “significantly decrease a risk of cancer”, or that the product *Chelogarde* “reduces heart disease by up to 50%”.

Such medicinal claims are extremely dangerous, as they can discourage people from seeking proper medical advice, and so put their health at serious risk. In the UK, we have strict regulation to prevent that, and no medicinal claims may be made for products that do not hold a marketing authorisation under the Medicines Act 1968. The European Union has recently introduced a raft of directives and regulations, which apply to foods in general, that are designed to protect consumers. They include the food supplements directive and the regulation on the use of nutrition and health claims for foods, the short title of which – the nutrition and health claims regulation – is more widely used. The Government are also in the process of implementing the traditional herbal medicinal products directive, which is intended to further protect consumers. The UK has implemented, or is in the process of implementing, all that legislation, with which responsible UK operators have to comply.

Our Medicines and Healthcare products Regulatory Agency, the MHRA, and our trading standards officers, have powers to take steps against UK operators that contravene those regulations and directives, but they do not have jurisdiction in the Channel Islands. The Channel Islands do not have similar legislation, and so companies in Guernsey and Jersey, in particular, are able to abuse the situation and market vitamins, minerals, food supplements and herbal remedies, which may contain illegal ingredients, to UK consumers using illegal claims. The turnover of Channel Island businesses that deal with such products has risen from zero to an estimated £100 million today, and the business is still growing. Meanwhile, the turnover in the UK sector has stagnated in comparison.

The problem is further exacerbated by the inequities of the low-value consignment relief, or LVCR, regime, which allows companies based in the Channel Islands to avoid paying VAT on deliveries in which the contents are valued at less than £18. That not only poses a serious threat to UK consumers, but gravely undermines the responsible UK suppliers and health food businesses that continue to make considerable investments to comply with the law.

The Minister of State Department of Health (Phil Hope): The Food Standards Agency is the Government organisation responsible for the legislation that governs health food products – namely the food supplements directive and the nutritional health claims regulations. The Food Standards Agency has received representations from the UK supplements industry in relation to their concern that large volumes of food supplements, which would be regarded as illegal in the UK, are being sold to UK consumers by companies based in Jersey and Guernsey. Those concerns relate particularly to the use of medicinal claims for unlicensed supplements. My hon Friend wanted reassurance that we are aware

both of our responsibilities and of the need for action on this matter. I give him that assurance today, and I hope that we will be able to take forward the action that he requires at the earliest opportunity.

Hospitals: Furniture

Question and Written Answer on Wednesday 6 May

Mr Dai Davies (Blaenau Gwent): To ask the Secretary of State for Health what work his Department has undertaken with (a) the Design Council and (b) the National Health Service on the development of new furniture design for hospitals to reduce the incidence of healthcare acquired infections in hospitals.

Ann Keen: In autumn 2007, the Department held workshops with around 500 national health service doctors, nurses and cleaning staff at which ideas were gathered about what kinds of technology might be used to further help combat health care associated infections more effectively. From the 150 ideas generated, 10 were prioritised as showing the most promise and these have been subject to design and development programmes since that time. Among the 10 prioritised ideas are two items of furniture—a waste bin/locker and a new style commode. Working prototypes are currently subject to clinical trials at University College London Hospital.

Additionally, the Department commissioned the Design Council to deliver a competition in which designers joined forces with manufacturers to develop working prototypes of furniture for the bedside environment (patient chair, bedside storage and overbed table), a porter’s chair and a commode. The Design Council also worked with the Royal College of Art’s Helen Hamlyn Centre to design innovations in a further five areas, one of which was a new style ‘intelligent’ patient bed mattress. These prototypes have now been launched and will be showcased over the next three weeks at seven NHS hospitals and then at a number of health care conferences through until the autumn.

Penicillin

Debate in the House of Commons on Monday 11 May

Des Browne (Kilmarnock & Loudoun): It is 80 years and one day precisely since Alexander Fleming’s research paper “On the antibacterial action of cultures of a *Penicillium*” was submitted for publication in *The British Journal of Experimental Pathology*. Thus was born the age of antibiotics, although it was to be many years before the first practical application in treatment of bacterial infection in humans, or indeed many years before the coining of the word “antibiotics”. The history tells us much about the nature of scientific discovery, the development of treatments and some of the outside factors that can influence the direction of research, development and human benefit, both positively and negatively.

On 6 August 1881, Alexander Fleming was born at Lochfield farm, near Darvel, the youngest of eight children. He received his first schooling at Loudoun Moor school, went to the village school in Darvel at the age of 10, then two years later continued his education at Kilmarnock academy. On 24 April this year, standing in the garden of the isolated Lochfield farm, now restored by Phillip and Heather Scott, surveying the landscape that the young Fleming had crossed daily just to get to the place of his early education, I



sensed the determination to learn that must have driven him on.

When Fleming was 14 he joined an elder brother in London, where after two more years of education he commenced work as a clerk in a shipping company. Four years later, a legacy enabled him to enter St Mary's hospital medical school, Paddington, where he excelled in his studies and in numerous sports. He qualified in 1908 and, attracted by research work, entered the laboratories of Sir Almroth Wright at St Mary's, working on the nature of immunity and the treatment of bacterial infection.

In 1909 the German chemist-physician Paul Ehrlich developed a chemical treatment for syphilis. He had tried hundreds of compounds, and the 666th worked. It was named salvarsan, which means "that which saves by arsenic". The only previous treatments for the disease had been so toxic as often to kill the patient. Ehrlich brought news of his treatment to London, where Fleming became one of very few physicians to administer salvarsan. He did so with the new and difficult technique of intravenous injection. He soon developed such a busy practice that he got the nickname "Private 606".

During the first world war, Fleming served in the Royal Army Medical Corps, working in a laboratory in France to study the treatment of infected war wounds. In 1921, back at St Mary's, he discovered lysozyme. Like Fleming's discovery of penicillin, his discovery of lysozyme was the result of shrewd observation and the investigation of an unplanned event: he had a cold and observed that the drips from his nose caused lysis of bacteria where they were mixed on the culture plate. He long considered the discovery of lysozyme more important than that of penicillin.

In September 1928 Fleming discovered penicillin when he returned from a six-week holiday and observed the classic clearing or lysis of the bacterial colonies around the contaminating mould, later identified as *penicillium notatum*. The irony is that modern "good laboratory practice" would probably have dictated that the old culture plates would have been disposed of long since and not left lying around for the mould to grow. The discovery was made and Fleming is reported to have remarked of his observation, "That's funny."

Fleming provided samples of the mould to other laboratories, including the Sir William Dunn school of pathology at Oxford. There in 1939, Howard Florey, professor of pathology, and Ernst Chain, a biochemist and refugee from Nazi Germany, began their studies with the purely academic aims of discovering the chemical nature of penicillin and its mode of action. However, they quickly became aware of its clinical potential, and the onset of the second world war brought treatment of infected wounds back into high profile. By 1943 Fleming was able to use penicillin successfully to treat a girl with streptococcal meningitis; the rapid cure of an almost moribund patient led him to bring penicillin to the notice of the Government. That led to the setting up of the Penicillin Committee and the production of penicillin on an industrial scale, especially in the United States.

Fleming was elected a Fellow of the Royal Society in 1943, knighted in 1944, and shared the 1945 Nobel prize in physiology or medicine with Florey and Chain. In 1945, Fleming was elected the first president of the new Society for General Microbiology,

which was formed to provide a common meeting ground for those interested in the study of microbes of all types – bacteria, fungi and viruses and others.

The Minister of State Department of Health (Dawn Primarolo): The events of 80 years ago are hugely significant, as my right hon Friend demonstrated. They marked the start of a revolution in health care that no one at the time, least of all Sir Alexander Fleming, predicted. The story of penicillin's discovery is a remarkable one: an object lesson for all of us to be ready for the unexpected and to act with courage, determination and vision in seeing through the ideas that we believe in – even in the face of setbacks and disappointments. Indeed, there were some for Fleming. It took a decade for penicillin to reach the people capable of purifying it and doing the research that demonstrated, in record-breaking time, that it could cure deadly infections. That breakthrough ushered in the antibiotic era. Pneumonia, syphilis, gonorrhoea, diphtheria, scarlet fever and many wound and childbirth infections that killed indiscriminately suddenly became treatable. Millions of lives have been saved, including millions in the second world war.

AGRICULTURE

Bees

Debate in the House of Lords on Thursday 21 May

Lord Moynihan: My Lords, the honey bee is under threat. There is no single cause, but uniquely in the insect world, we can have a direct impact on their survival since for generations we have harvested honey from these remarkable creatures and managed their welfare in hives. The Government have made progress towards funding the necessary research to enable beekeeping to be modified so that the dramatic plight of the loss of bees and colonies can be arrested. A month ago the Government announced that £10 million would be spent on research for pollinators, bees, butterflies and other insects. The objective of this announcement was driven by a determination to arrest the decline in UK populations of all these insects.

Along with the British Beekeepers' Association I welcome the announcement, but I am concerned about three key issues. First, can the Minister provide assurance that the £10 million will not be watered down with myriad small and unco-ordinated research grants covering a wide range of the thousands of insects which, to varying degrees, can be termed pollinators? It is clear to those of us interested in the subject that research into the honey bee must take priority and the lion's share of the funding. Even then, it is doubtful that the decline in bee populations will be managed without a further increase in funding. Secondly, can the Minister ensure that the funding committee which will oversee the research acts quickly and co-ordinates effectively? Thirdly, can the Minister assure the House that the funding committee will be constituted of experts, with at least one member of it as an expert in the honey bee?

Lord Davies of Oldham: I should emphasise that there are 44,000 beekeepers in the United Kingdom and only 300 professional bee farmers. It is easy enough to relate to the professionals but much more difficult to deal with the enormous

number of beekeepers who have only one or two hives and are difficult to communicate with and often lack essential knowledge. The regulations are just not working because they are not controlling varroa, and there is absolutely no point in insisting on retaining them if they are not producing an effect. There are only 70 bee inspectors and they are crucial to the work that we are doing to deal with the current problems. The National Bee Unit and its inspectors are a crucial part of Defra's work. They receive funding from both Defra and the Welsh Assembly Government.

The National Bee Unit is a serious unit, on which we rely a great deal as one of the weapons that we are deploying to tackle the issues that we face. The main activities are inspection and enforcement. The bee inspectors are out in the field, controlling notifiable pests and diseases. The unit is responsible for research and development. It has a crucial role in advising beekeepers, which is a significant task. The unit contributes to the evidence-based policy development, including identifying risks to bee health from current and emerging threats. The National Bee Unit is critical to this challenging issue.

On top of the current £1.3 million a year that is allocated, the National Bee Unit will receive an additional £2.3 million over two years, which will be used for the following three priorities. The first is to get a more accurate picture of the numbers and distribution of beekeepers and a robust assessment of the health of their colonies. Its second priority is to increase learning opportunities because, by definition, if we have an extraordinarily enthusiastic but nevertheless amateur industry on the whole, it is very important to support, educate and encourage beekeepers in good husbandry. The third priority is that we have our databases up to date. They are a key source of free advice, training and information for beekeepers in this interesting but diverse industry. Of the £10 million to be devoted to research, Defra has contributed £2.5 million. This is a joint initiative from the Biotechnology and Biological Sciences Research Council, the Natural Environment Research Council, the Wellcome Trust, the Scottish Government and, of course, Defra itself. The timetable for research is such that we expect invitations to be issued in late June.

CLIMATE CHANGE

Climate Change

Debate in House of Lords on Thursday 21 May

Lord Dixon-Smith: We know that the global population is heading for 9 billion people by 2050, from 6 billion today. Supplying the resources to support that increase will strain our ingenuity as well as our present standard of living. One effect will almost certainly be that agricultural land will be focused almost entirely on food production and will not be available to produce energy. Here in the United Kingdom our own population is heading for 80 million by 2050. These increasing numbers mean that meeting their energy demands will be likely to negate much of the gain that we hope to achieve through better fuel economy in what we are doing today.

The decision of the Committee on Climate Change (CCC) to raise the target for greenhouse gas emission reduction to 80 per cent by 2050 will require a much more focused approach than we

have at present. It is worth noting that if we simply use carbon dioxide as the measurement, because greenhouse gases were not in the basket at that time, then we passed the level which we are now required to meet in about the middle of the 19th century, when our population was less than 25 million.

Some industries that are fundamental to modern society have no alternative but to use fossil fuel. The metal smelting industries use fossil fuel to reduce ores to base metals. The cement industry requires a similar process with similar emissions. Aviation, because of the problem of energy density, might well be included within this category of essential industry. Agriculture emits around 8 per cent of the United Kingdom's greenhouse gases because of the livestock sector. That is food, so we can do nothing about it. These essential industries will take up the major part of the 20 per cent that is left for greenhouse gas emissions after 2050. In any event, any residual free capacity at that point will be too small to support any major industrial output. If that presumption is correct, everything else will have to change and become zero emissions-based.

We should not overestimate the problem. Any establishment which runs exclusively on electric power is already a zero-emissions establishment. The electricity generating industry emits huge quantities of greenhouse gases at present and is not as energy-efficient as it could be. However, if we can source our electricity without greenhouse gas emissions, a major problem is solved.

The Government's decision on carbon capture and storage is welcome, although the process is not 100 per cent efficient in capturing carbon. Nuclear power is a well known, proven technology. Wind power is another proven technology and the Government have taken action to promote it. Hydroelectricity in this country is already near its capacity, but we could use turbine technology to extract more power from the rivers. Estuarial barrages are a proven technology. They are very expensive, but the high cost is offset in many ways by their very long service life. Tidal stream and wave technologies are very much at the prototype stage and have high potential. Domestic and other waste can be digested into methane to generate electricity with a fertiliser residue, and microgeneration in all its forms will unquestionably make a considerable contribution.

Solar power is an almost unlimited resource. The latest prototype solar power-generating stations can capture enough heat during the day that they can then release it at night and continue generating for 24 hours a day. We could transmit large quantities of electricity, probably as direct current, where the transmission losses are less.

A more difficult issue is land-based transport. Railways are no problem. They are already almost completely powered by electricity, and it would not be difficult to ensure that they were totally electrically driven. Road transport is not so straightforward, and we are very road transport-dependent. However, it is interesting that the technology required to make road transport emissions-free already exists and has done for some time. We simply need the willpower to develop it. The Government have made a welcome move on battery cars, which unquestionably have a place in the outcome that we are looking for.

Honda has fuel cell cars going on lease to customers in



California, where it seems likely that they intend to make one road a hydrogen highway with sufficient infrastructure. At the moment it looks as though the cost will be frighteningly high. All our experience, however, shows that as new technologies develop, the costs come down with further experience, development and mass production.

We cannot afford to wait until 2030 to find that the existing, rather hit-and-miss proposals, which are all done with the best of intentions, will not actually meet the target that has now been set. The critical date is 2050. If we are a bit slow at the start it does not really matter, but we must be absolutely sure that we can get there.

Lord Hunt of Kings Heath, Department of Energy and Climate Change & Department for Environment, Food and Rural Affairs: I agree with Lord Dixon-Smith about the need for a more focused approach to the 2050 targets. In July, we will publish our strategy document on how to take forward our policies on climate change and energy and this is a serious, realisable but ambitious approach. We believe that the climate is already changing. The atmosphere is warming up because of the greenhouse effect, and the rate of change will accelerate rapidly unless we take decisive action. I agree with the noble Earl, Lord Cathcart, and say to the noble Lord, Lord Reay, that, frankly, I would rather sail on HMS "Stern" than sink into the rising sea with HMS "Lawson". Lord Tanlaw asked me whether the Department of Energy and Climate Change and the direction of government policy had led to a big increase in staff; he seemed to think that it might have. He will know that my department is only six months old. Its size is roughly equivalent to the size of the energy group within BERR and the former climate change group in Defra. I must say that the discipline on public finance within government is very tough at the moment, having been responsible for overseeing budgetary matters in the Department of Energy and Climate Change in the past few weeks. The new department has been faced by some mega-issues about both climate change and energy.

The IPCC's most recent and fourth assessment report was written by 619 named scientists and reviewed by another 622, and that objectivity is ensured by the broad and open review process and shared responsibility for the report. No one Government, organisation or individual has sole responsibility for any part. The IPCC is very careful to keep science separated from the political negotiations that take place at UN climate change convention meetings. The scientists in the working groups write their reports, which are then extensively reviewed and edited in draft before government review and final acceptance. IPCC assessment reports are not written or changed by Governments.

I should say that the seven members of the CCC include three scientists and an engineer – Lord May, Professor Jim Skea, Sir Brian Hoskins and Professor Julia King – all of the very highest calibre. I have been impressed by the quality and rigour of their advice to the Government. All of this is in the context of seeking international agreement in Copenhagen so that we can take action to ensure that we see the kind of progress in reducing greenhouse gas emissions that is necessary.

It is clear that the Chinese Government are extremely interested in carbon capture and storage technology, which is why our decision is so important; not just for what we can achieve in this

country, but for the opportunity for the export of technological and, we hope, other know-how in this area.

There was a very important announcement on coal. We think that this has huge potential for up to four new projects to demonstrate carbon capture and storage. It is quite clear, if one looks at the amount of coal that is used globally, that we need a great deal of international effort and co-operation. In the UK, we are in a very good position to influence that because of the announcement that we have made.

Renewables come with a cost. However, we must remember what Lord Stern said on the economics of climate change that, essentially, the sooner we get on with taking the actions that are required, the cheaper it will be in the long run.

SECURITY

Telecommunications: Security

Question and Written Answer on Tuesday 21 April

Mark Pritchard (The Wrekin): To ask the Minister of State, Department for Business, Enterprise and Regulatory Reform if he will have discussions with Ministerial colleagues on the resilience of the IT and telecommunications components of critical national infrastructure.

Mr McFadden: Regular discussion takes place on IT resilience (including that of critical national infrastructure) between the Departments concerned at ministerial and official level as appropriate. Additionally, Government continue to work closely with the telecommunications sector and the regulator to ensure a high level of resilience – especially of UK critical national infrastructure – including through EC-RRG (the Electronic Communications-Resilience and Response Group – a joint industry Government forum), as well as through the Centre for the Protection of National Infrastructure (CPNI), which provides dedicated advice to reduce the vulnerability of national infrastructure.

Much information regarding resilience is commercially sensitive and inappropriate for public discussion. However, where possible information is published here:

www.cpni.gov.uk
and www.cabinetoffice.gov.uk/ukresilience.aspx

Civil Liberties: Electronic Surveillance

Debate in the House of Lords on Thursday 23 April

Lord Craig of Radley: Twelve years ago I chaired a Science and Technology Select Committee inquiry into the use of digital images as evidence, in which we drew attention to civil liberties implications. My debate is to call attention to any effect on civil liberties of electronic surveillance today. There are four points on which I shall dwell. What are civil liberties? What does surveillance imply? What might evolve in the future – and what will be the effect for individual members of the public? For me, civil liberties are freedoms which are, or should be, guaranteed to individuals. These range from rights to free speech, fair trial, property ownership, to free association, privacy and, most importantly, freedom from the abuse of power by those who have the means

and methods of dictating and of enforcing it. The concept of our civil liberties stretches back to the Magna Carta and, arguably, pre-1066 to the Anglo-Saxon witas. In more recent times, in the face of national danger and survival, the exercise of power by government to curtail or direct individuals has been accepted as a necessary restraint on civil liberties. But terrorism, however ghastly its manifestations, should never be equated with a threat to national survival. Curtailing civil rights is playing the game by terrorists' rules. We owe it not only to ourselves but to future generations to do our utmost to uphold and safeguard our civil rights. Creeping irreversible curtailment is the danger today.

A decade or so ago, as the capabilities of information technologies expanded, we referred to the information age and the information society. Individuals were expected and encouraged to feast on the new capabilities to inform and manage their lives and aspirations. Browsers opened a vast new world of information and knowledge. The Science and Technology Committee, of which I was a member in the mid-1990s, completed a study called *The Information Society; Agenda for Action*. There was no question mark in that title. Ours was the first Select Committee report from either House to be published electronically.

We saw the information society based on an information superhighway as one of the most important technological developments of the century. Directly or indirectly, the digital and communications revolution would affect us all. So it has, and at astonishing speed. In the past decade, information society – no question mark – has morphed into surveillance society – question mark. For some the question mark is no longer apposite. In 2004, the Information Commissioner was warning that the UK must not sleepwalk into a surveillance society. There have been further advances in data collection and usage since.

Lord West of Spithead The Parliamentary Under-Secretary of State, Home Office: My Lords, the debate seeks to consider the profound question of the role of the state in protecting individual freedom, including privacy and civil liberties, while ensuring protection from those who would seek to do us harm. A number of speakers raised that issue, which is the nub of the matter. While there will always be people on either side of the debate claiming

that things have gone too far in one direction or another, the role of government is to protect and balance both types of freedom. In an era of rapid technological change it is right that we constantly satisfy ourselves that we have that balance correct. That balance is maintained by a strong legislative framework, namely, the Data Protection Act and the Human Rights Act. As Article 8 of the European Convention on Human Rights, as set out in the Human Rights Act, stipulates: "Everyone has the right to respect for his private and family life, his home and his correspondence. There shall be no interference by a public authority with the exercise of this right except such as is in accordance with the law and is necessary in a democratic society in the interests of national security, public safety or the economic well-being of the country, for the prevention of disorder or crime, for the protection of health or morals, or for the protection of the rights and freedoms of others". It is the very fact that privacy is a qualified right – one that needs to be balanced against collective interests such as national security and prevention of crime – that creates the debate.

The technology of the 21st century has completely reshaped the way we live our lives. Each day all of us give out a huge amount of personal information about our finances, travel arrangements, phone calls, internet use and purchases. We all recognise the benefits this brings us as individuals. The use of personal data is essential to protecting the public and to delivering efficient, effective and joined-up public services. It is required to tackle severe threats including serious crime and terrorism, to protect the public from crime more generally and anti-social behaviour, and to help people get access to the benefits and new opportunities to which they are entitled. We want to create services that improve people's lives and are simple and easy for them to use.

PROGRESS OF LEGISLATION BEFORE PARLIAMENT

A comprehensive list of Public Bills before Parliament, giving up-to-date information on their progress through Parliament, is published regularly when Parliament is sitting in the Weekly Information Bulletin, which can be found at:

<http://www.publications.parliament.uk/pa/cm/cmweb.htm>

PARLIAMENTARY AND SCIENTIFIC COMMITTEE NEWS

NEW MEMBERS

We are delighted to welcome the following organisations which have recently joined the Committee:

British Institute of Radiology represented by Dr Stuart Green and Dr Stephen Davies

The British and Irish Association of Zoos and Aquariums represented by Dr Miranda Stevenson

Chemical Industries Association represented by Fiona Ferguson

HON TREASURER

In addition to his role as Hon Secretary of the Committee, Mr Robert Goodwill MP has agreed and been co-opted to serve as Hon Treasurer in place of Dr Ian Gibson who retired from Parliament in June.



EURO-NEWS

Commentary on science and technology within the European Parliament and the Commission

EU SEEKS COMMON STRATEGY ON SWINE FLU VACCINE

EU Health Commissioner Androulla Vassiliou called (9th June 2009) for a common European strategy on producing and using a swine flu vaccine, emphasising the need to focus on those most vulnerable.

"I think it is very important member states reach agreement on the modalities of production, availability and distribution of the vaccine," she told reporters as she arrived for a meeting of EU health ministers in Luxembourg. "We need to have a vaccine by the autumn, and if there is not enough vaccine for everyone then we need to decide on priority groups to be vaccinated first, such as the elderly and the handicapped, and emergency services workers", she added. "We won't have enormous quantities of the vaccine available from day one."

Swine flu has now spread to 73 countries with 25,288 people known to have been infected since the disease was first uncovered in April. In a note distributed to EU health ministers, the Commission admitted that if there were major differences between EU nations about who the priority groups were, then citizens may engage in "vaccine tourism/shopping in other member states". The number of deaths has risen to 139 according to the latest WHO tally of confirmed influenza A(H1N1) cases. Under WHO guidelines, one key criteria for a move to the highest phase six alert was established by community spread in a country outside the region where the disease was initially reported, in this case, outside the Americas. Many European nations have confirmed cases of the flu but so far most of the fatalities from the disease have been recorded in Mexico, and all the rest in the Americas.

German Health Minister Ulla Schmidt, attending the meeting in Luxembourg, echoed that there should be joint European analysis of the dangers of swine flu and "the means to protect citizens". Among the decisions to be made are: which vaccine should be used, how much vaccine should be produced, who should receive it, what stocks should be kept and how to help out poorer nations. Schmidt said European level discussions were important, "otherwise we risk leaving the playing field to the pharmaceutical industry." The EU Commission recognised that seven European nations already had advance purchase agreements with vaccine makers, and negotiations were ongoing in nine other countries. Last month the WHO said it had sent three "seed viruses" to drug companies for use in making a vaccine against the new strain of influenza. WHO interim Assistant Director General Keiji Fukuda said the pharmaceutical industry should be ready to produce a preventive vaccine by the end of June or early July. However, experts are still considering whether to give the go-ahead with production as this may reduce or halt the manufacture of vaccines for seasonal flu. Other issues still to be ironed out include whether one or two doses would be needed to obtain immunity and the cost of development, production, distribution and application of the eventual vaccine.

COMMISSION TO LAUNCH EUROPEAN RESEARCH COUNCIL REVIEW

EU Science and Research Commissioner, Janez Potočnik is to establish a high-level panel of experts to review the work of the European Research Council (ERC).

Potočnik met experts from the EU and US, who are expected to be appointed to the review group by the Commission within days. They will review the progress made by the ERC since its establishment in 2007 and provide advice on its future direction. Since the ERC's inception, the Council has considered some 11,000 grant applications and allocated over €850 million to 575 successful applicants. The panel is expected to meet between February and July, and will draw up a report over the summer to enable the European Commission to offer an initial response in the autumn. Commissioner Potočnik described the review of the ERC's structure as an important step in its development. "I am pleased to entrust it to such an eminent group and thank them for their commitment to this important work. The Commission is committed to an absolutely independent review, so as to ensure a robust and authoritative analysis of the ERC," he said.

All the members of the review group have held senior positions in national government, research institutes or prestigious European academic establishments. The panel will be chaired by Vaira Vīķe-Freiberga, a former president of Latvia and a former professor of psychology at the University of Montreal. She is also vice-president of a reflection group on the long-term future of the European Union.

The group's other members are:

- Yves Mény (rapporteur), President of the European University Institute;
- Fiorella Kostoris Padoa Schioppa, professor of economics at Rome's 'La Sapienza' university, and a former president of Italy's Institute for Studies and Economic Analyses (ISAE);
- Lars-Hendrik Röller, President of the European School of Management and Technology in Berlin and a professor of economics at Humboldt University, also in Berlin;
- Lord David Sainsbury (vice-chair), a former under-secretary of state at the UK Department of Trade and Industry, where he was responsible for science and innovation, and current head of the Gatsby Charitable Foundation;
- Elias Zerhouni, a former director of National Institute of Health, USA (until Oct 2008), and previously executive vice-dean of John Hopkins University School of Medicine, Baltimore, USA.

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The Food and Environment Research Agency
Institute of Biology
LGC
Newcastle University
PHARMAQ Ltd
Society for General Microbiology
UFAW

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STFC

Information Services

AIRTO
CABI

IT, Internet, Telecommunications, Computing and Electronics

EPSRC
Institution of Civil Engineers
Institution of Engineering and
Technology
National Physical Laboratory
Newcastle University
STFC

Intellectual Property

ABPI
The Chartered Institute of Patent
Attorneys
C-Tech Innovation
Lilly
NESTA
Newcastle University

Large-Scale Research Facilities

C-Tech Innovation
The Food and Environment Research
Agency
London Metropolitan Polymer Centre
National Physical Laboratory
Natural History Museum
STFC

Lasers

National Physical Laboratory
STFC

Manufacturing

ABPI
AMSI
EPSRC
Institution of Chemical Engineers
London Metropolitan Polymer Centre
National Physical Laboratory
Semta

Materials

C-Tech Innovation
Institution of Chemical Engineers
London Metropolitan Polymer Centre
National Physical Laboratory
Royal Society of Chemistry
STFC

Medical and Biomedical Research

ABPI
Academy of Medical Sciences
Biochemical Society
British Pharmacological Society
British Society for Antimicrobial
Chemotherapy
CABI
HFEA
Institute of Biology
Lilly
Medical Research Council
Merck Sharp & Dohme
Newcastle University
Plymouth Marine Sciences Partnership
UFAW

Motor Vehicles

London Metropolitan Polymer Centre
Semta

Oceanography

AMSI
National Physical Laboratory
Natural Environment Research Council

Plymouth Marine Sciences Partnership

Oil

C-Tech Innovation
Institution of Chemical Engineers
LGC

Particle Physics

STFC

Patents

The Chartered Institute of Patent
Attorneys
NESTA

Pharmaceuticals

ABPI
British Pharmacological Society
British Society for Antimicrobial
Chemotherapy
C-Tech Innovation
Institute of Biology
Institution of Chemical Engineers
LGC
Lilly
Merck Sharp & Dohme
PHARMAQ Ltd
Royal Society of Chemistry
Semta

Physical Sciences

Cavendish Laboratory
C-Tech Innovation
EPSRC
London Metropolitan Polymer Centre
National Physical Laboratory

Physics

Cavendish Laboratory
C-Tech Innovation
Institute of Physics
National Physical Laboratory
STFC

Pollution and Waste

ABPI
AMSI
C-Tech Innovation
Institution of Chemical Engineers
Institution of Civil Engineers
London Metropolitan Polymer Centre
National Physical Laboratory
Natural Environment Research Council
Newcastle University
Plymouth Marine Sciences Partnership

Psychology

British Psychological Society

Public Policy

Biosciences Federation
The British Ecological Society
British Nutrition Foundation
British Society for Antimicrobial
Chemotherapy
Economic and Social Research
Council
The Engineering and Technology
Board
The Food and Environment Research
Agency
HFEA
Institute of Biology
Institution of Civil Engineers
Institution of Chemical Engineers
NESTA
Prospect

Public Understanding of Science

Academy of Medical Sciences
Biochemical Society
Biosciences Federation

The British Ecological Society
British Nutrition Foundation
British Science Association
British Society for Antimicrobial
Chemotherapy
Clifton Scientific Trust
EPSRC
The Engineering and Technology
Board
The Food and Environment Research
Agency
HFEA
Institute of Biology
Institute of Physics
Institution of Chemical Engineers
Institution of Engineering and
Technology
Medical Research Council
Natural History Museum
NESTA
Newcastle University
Plymouth Marine Sciences Partnership
Prospect
Research Councils UK
Royal Academy of Engineering
Royal Institution
The Royal Society
Royal Society of Chemistry
STFC

Quality Management

LGC
National Physical Laboratory

Radiation Hazards

Health Protection Agency
LGC

Retail

Marks and Spencer

Science Policy

ABPI
Academy of Medical Sciences
Biochemical Society
Biosciences Federation
The British Ecological Society
British Nutrition Foundation
British Pharmacological Society
British Science Association
CABI
Clifton Scientific Trust
Economic and Social Research
Council
EPSRC
The Engineering and Technology
Board
The Food and Environment Research
Agency
HFEA
Institute of Biology
Institute of Physics
Institution of Chemical Engineers
Institution of Civil Engineers
LGC
Lilly
Medical Research Council
NESTA
National Physical Laboratory
Plymouth Marine Sciences Partnership
Prospect
Research Councils UK
Royal Academy of Engineering
Royal Institution
The Royal Society
Royal Society of Chemistry
Semta
STFC
UFAW

Sensors and Transducers

AMSI
C-Tech Innovation
STFC

SSSIs

Kew Gardens
Natural England

Statistics

EPSRC
The Engineering and Technology
Board
Royal Statistical Society

Surface Science

C-Tech Innovation
STFC

Sustainability

Biosciences Federation
The British Ecological Society
CABI
C-Tech Innovation
EPSRC
The Food and Environment Research
Agency
Institute of Biology
Institution of Chemical Engineers
Institution of Civil Engineers
London Metropolitan Polymer Centre
Natural England
Newcastle University
Plymouth Marine Sciences Partnership

Technology Transfer

CABI
C-Tech Innovation
The Food and Environment Research
Agency
LGC
London Metropolitan Polymer Centre
NESTA
National Physical Laboratory
Research Councils UK
Royal Society of Chemistry
STFC

Tropical Medicine

Health Protection Agency
Natural History Museum
Society for General Microbiology

Viruses

ABPI
Health Protection Agency
Society for General Microbiology

Water

AMSI
C-Tech Innovation
Institute of Biology
Institution of Chemical Engineers
Institution of Civil Engineers
LGC
Plymouth Marine Sciences Partnership
Royal Society of Chemistry
Society for General Microbiology

Wildlife

Biosciences Federation
The British Ecological Society
The Food and Environment Research
Agency
Institute of Biology
Natural England
Natural History Museum
UFAW

Research Councils UK

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Each year the Research Councils invest around £3 billion in research covering the full spectrum of academic disciplines from the medical and biological sciences to astronomy, physics, chemistry and engineering, social sciences, economics, environmental sciences and the arts and humanities.

Research Councils UK is the strategic partnerships of the seven Research Councils. It aims to:

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



Arts and Humanities Research Council



Arts & Humanities
Research Council

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Website: www.ahrc.ac.uk

Each year the AHRC provides approximately £100 million from the Government to support research and postgraduate study in the arts and humanities, from archaeology and English literature to dance and design. Awards are made after a rigorous peer review process, to ensure that only applications of the highest quality are funded. The quality and range of research supported by this investment of public funds not only provides social and cultural benefits but also contributes to the economic success of the UK.

Biotechnology and Biological Sciences Research Council (BBSRC)



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BBSRC is the UK's principal public funder of research and research training across the biosciences. It supports five research institutes and a number of specialist centres; including six systems biology centres, as well as research in universities across the UK. BBSRC's research underpins advances in a wide range of bio-based industries, and contributes knowledge to policy areas which include: food security, climate change, diet and health and healthy ageing.

Economic and Social Research Council



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The ESRC is the UK's leading research and training agency addressing economic and social concerns. We pursue excellence in social science research; work to increase the impact of our research on policy and practice; and provide trained social scientists who meet the needs of users and beneficiaries, thereby contributing to the economic competitiveness of the United Kingdom, the effectiveness of public services and policy, and quality of life. The ESRC is independent, established by Royal Charter in 1965, and funded mainly by government.

EPSRC

Engineering and Physical Sciences
Research Council

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EPSRC is the main government agency for funding research and training in engineering and physical sciences, investing around £740 million a year in a broad range of subjects – from mathematics to materials science, and information technology to structural engineering.

EPSRC's investment in high quality basic, strategic and applied research and training promotes future economic and societal impact in the UK.

Medical Research Council



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Website: www.mrc.ac.uk

The Medical Research Council (MRC) is funded by the UK taxpayer. We are independent of Government, but work closely with the Health Departments, the National Health Service and industry to ensure that the research we support takes account of the public's needs as well as being of excellent scientific quality. As a result, MRC-funded research has led to some of the most significant discoveries in medical science and benefited millions of people, both in the UK and worldwide.

Natural Environment Research Council



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Website: www.nerc.ac.uk

The UK's Natural Environment Research Council funds and carries out impartial scientific research in the sciences of the environment. NERC trains the next generation of independent environmental scientists.

NERC funds research in universities and in a network of its own centres, which include:

British Antarctic Survey, British Geological Survey, Centre for Ecology and Hydrology, National Oceanography Centre and Proudman Oceanographic Laboratory

Science & Technology Facilities Council



Science & Technology
Facilities Council

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Public Affairs Manager
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Harwell Science & Innovation Campus
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Formed by Royal Charter in 2007, the Science and Technology Facilities Council is one of Europe's largest multidisciplinary research organisations supporting scientists and engineers world-wide. The Council operates world-class, large-scale research facilities and provides strategic advice to the UK Government on their development. It also manages international research projects in support of a broad cross-section of the UK research community. The Council also directs, co-ordinates and funds research, education and training.



Association of the British Pharmaceutical Industry



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The ABPI is the voice of the innovative pharmaceutical industry, working with Government, regulators and other stakeholders to promote a receptive environment for a strong and progressive industry in the UK, one capable of providing the best medicines to patients.

The ABPI's mission is to represent the pharmaceutical industry operating in the UK in a way that:

- assures patient access to the best available medicine;
- creates a favourable political and economic environment;
- encourages innovative research and development;
- affords fair commercial returns

Association of Marine Scientific Industries



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Association of Marine Scientific Industries
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The Association of Marine Scientific Industries (AMSI) is a constituent association of the Society of Maritime Industries (SMI) representing companies in the marine science and technology sector, otherwise known as the oceanology sector.

The marine science sector has an increasingly important role to play both in the UK and globally, particularly in relation to the environment, security and defence, resource exploitation, and leisure. AMSI represents manufacturers, researchers, and system suppliers providing a co-ordinated voice and enabling members to project their views and capabilities to a wide audience.

The Academy of Medical Sciences



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The Academy of Medical Sciences promotes advances in medical science and campaigns to ensure these are converted into healthcare benefits for society. The Academy's Fellows are the United Kingdom's leading medical scientists and scholars from hospitals, academia, industry and the public service. The Academy provides independent, authoritative advice on public policy issues in medical science and healthcare.

AIRTO



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Research & Technology Organisations Limited
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Chipping Campden,
Gloucestershire GL55 6LD.
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Fax: 01386 842010
E-mail: airto@campden.co.uk
Website: www.airto.co.uk

AIRTO represents the UK's independent research and technology sector - member organisations employ a combined staff of over 20,000 scientists and engineers with a turnover exceeding £2 billion. Work carried out by members includes research, consultancy, training and global information monitoring. AIRTO promotes their work by building closer links between members and industry, academia, UK government agencies and the European Union.

Biochemical Society



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The Biochemical Society exists to promote and support the Molecular and Cellular Biosciences. We have nearly 6000 members in the UK and abroad, mostly research bioscientists in Universities or in Industry. The Society is also a major scientific publisher. In addition, we promote Science Policy debate and provide resources, for teachers and pupils, to support the bioscience curriculum in schools. Our membership supports our mission by organizing scientific meetings, sustaining our publications through authorship and peer review and by supporting our educational and policy initiatives.

BIOSCIENCES FEDERATION

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The Biosciences Federation is a single authority representing the UK's biological expertise. The BSF directly represents 54 bioscience organisations, and contributes to the development of policy and strategy in biology-based research - including funding and the interface with other disciplines - and in school and university teaching by providing independent opinion to government.

British Science Association



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Our vision is a society in which people are able to access science, engage with it and feel a sense of ownership about its direction. In such a society science advances with, and because of, the involvement and active support of the public.

Established in 1831, the British Science Association is a registered charity which organises major initiatives across the UK, including National Science and Engineering Week, the British Science Festival, programmes of regional and local events and the CREST programme for young people in schools and colleges. We provide opportunities for all ages to discuss, investigate, explore and challenge science.

The British Ecological Society



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Tel: 020 8877 0740 Fax: 020 8871 9779
Website: www.BritishEcologicalSociety.org
Ecology into Policy Blog
<http://ecologyandpolicy.blogspot.com/>

The British Ecological Society's mission is to advance ecology and make it count. The Society has 4,000 members worldwide. The BES publishes four internationally renowned scientific journals and organises the largest scientific meeting for ecologists in Europe. Through its grants, the BES also supports ecologists in developing countries and the provision of fieldwork in Schools. The BES informs and advises Parliament and Government on ecological issues and welcomes requests for assistance from parliamentarians.

British Nutrition Foundation



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Websites: www.nutrition.org.uk
www.foodfactoflife.org.uk

The British Nutrition Foundation is a scientific and educational charity which promotes the well-being of society through the impartial interpretation and effective dissemination of scientifically based knowledge and advice on the relationship between diet, physical activity and health.

Central to all our work is the distillation and dissemination of evidence-based nutrition science.





BRITISH PHARMACOLOGICAL SOCIETY

Today's science, tomorrow's medicines

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Website: www.bps.ac.uk

The British Pharmacological Society has now been supporting pharmacology and pharmacologists for over 75 years. Our 2,000+ members, from academia, industry and clinical practice, are trained to study drug action from the laboratory bench to the patient's bedside. Our aim is to improve the quality of life by developing new medicines to treat and prevent the diseases and conditions that affect millions of people and animals. Inquiries about drugs and how they work are welcome.



The British Psychological Society

The British Psychological Society

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Parliamentary Officer
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The British Psychological Society is an organisation of over 45,000 members governed by Royal Charter. It maintains the Register of Chartered Psychologists, publishes books, 10 primary science Journals and organises conferences. Requests for information about psychology and psychologists from parliamentarians are welcome.

British Society for Antimicrobial Chemotherapy

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Executive Director
British Society for Antimicrobial Chemotherapy
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53 Regent Place
Birmingham B1 3NJ
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W: www.bsac.org.uk

Founded in 1971, and with 800 members worldwide, the Society exists to facilitate the acquisition and dissemination of knowledge in the field of antimicrobial chemotherapy. The BSAC publishes the *Journal of Antimicrobial Chemotherapy* (JAC), internationally renowned for its scientific excellence, undertakes a range of educational activities, awards grants for research and has active relationships with its peer groups and government.

CABI



www.cabi.org

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Website: www.cabi.org

CABI is an international not for profit organization, specialising in scientific publishing, research and communication. Our mission is to improve peoples' lives worldwide by finding sustainable solutions to agricultural and environmental issues. Activities range from assisting national policy makers and informing worldwide research to supporting income poor farmers. We also house and manage the UK's National Collection of Fungus Cultures which we are exploring for potential new drugs, enzymes and nutraceuticals.

Cavendish Laboratory



The Administrative Secretary, The Cavendish Laboratory,
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http://www.phy.cam.ac.uk

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

Its world-class research is focused in a number of experimental and theoretical diverse fields.

Astrophysics: Millimetre astronomy, optical interferometry observations & instrumentation. Astrophysics, geometric algebra, maximum entropy, neutral networks.

High Energy Physics: LHC experiments. Detector development. Particle physics theory.

Condensed Matter Physics: Semiconductor physics, quantum effect devices, nanolithography. Superconductivity, magnetic thin films. Optoelectronics, conducting polymers. Biological Soft Systems. Polymers and Colloids. Surface physics, fracture, wear & erosion. Amorphous solids. Electron microscopy. Electronic structure theory & computation. Structural phase transitions, fractals, quantum Monte Carlo calculations Biological Physics. Quantum optics.

Chartered Institute of Patent Attorneys



Contact: Michael Ralph -
Secretary & Registrar
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CIPA's members practise in intellectual property, especially patents, trade marks, designs, and copyright, either in private partnerships or industrial companies. CIPA maintains the statutory Register. It advises government and international circles on policy issues and provides information services, promoting the benefits to UK industry of obtaining IP protection, and to overseas industry of using British attorneys to obtain international protection.

Clifton Scientific Trust



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Science for Citizenship and Employability,
Science for Life, Science for Real

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

- for young people of all ages and abilities
- experiencing science as a creative, questioning, human activity
- bringing school science added meaning and motivation, from primary to post-16
- locally, nationally, internationally (currently between Britain and Japan)

Clifton Scientific Trust Ltd is registered charity 1086933

C-Tech Innovation Limited



C-Tech Innovation
...advantage through technology

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Tel: +44 (0) 151 347 2900
Fax: +44 (0) 151 347 2901
E-mail: paul.radage@ctechinnovation.com
Website: www.ctechinnovation.com

Independent Innovation Management and Technology Development organisation providing a range of innovation support services. Activities include research and development, multidisciplinary business and technology consultancy and the commercialisation of innovative ideas, products, processes and intellectual property. We also provide more general innovation consulting services including project and programme management, due diligence, market and technical assessments, advice on the exploitation of intellectual property and innovation and creativity training.

The Engineering and Technology Board



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Website: www.etechb.co.uk

The Engineering and Technology Board (ETB) is an independent organisation that promotes the vital role of engineers, engineering and technology in our society. The ETB 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.



The Food and Environment Research Agency



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Website: www.defra.gov.uk/fera

The Food and Environment Research Agency's overarching purpose is to support and develop a sustainable food chain, a healthy natural environment, and to protect the global community from biological and chemical risks.

Our role within that is to provide robust evidence, rigorous analysis and professional advice to Government, international organisations and the private sector.

Health Protection Agency



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The Health Protection Agency is an independent UK organisation that protects the public from threats to their health from infectious diseases and environmental hazards.

The HPA identifies and responds to health hazards and emergencies caused by infectious disease, hazardous chemicals, poisons or radiation.

It gives advice to the public, provides data and information to government, and advises people working in healthcare. It also makes sure the nation is ready for future threats to health that could happen naturally, accidentally or deliberately.

Human Fertilisation and Embryology Authority



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The HFEA is a non-departmental Government body that regulates and inspects all UK clinics providing IVF, donor insemination or the storage of eggs, sperm or embryos. The HFEA also licenses and monitors all human embryo research being conducted in the UK.

Institute of Biology



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The biological sciences have truly come of age, and the Institute of Biology is the professional body to represent biology and biologists to all. A source of independent advice to Government, a supporter of education, a measure of excellence and a disseminator of information - the Institute of Biology is the Voice of British Biology.

IOP Institute of Physics

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The Institute of Physics is a scientific charity devoted to increasing the practice, understanding and application of physics. It has a worldwide membership of more than 36,000 and is a leading communicator of physics-related science to all audiences, from specialists through to government and the general public. Its publishing company, IOP Publishing, is a world leader in scientific publishing and the electronic dissemination of physics.



IPEM Institute of Physics and Engineering in Medicine

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IPEM is a registered, incorporated charity for the advancement, in the public interest, of physics and engineering applied to medicine and biology. It accredits medical physicists, clinical engineers and clinical technologists through its membership register, organises training and CPD for them, and provides opportunities for the dissemination of knowledge through publications and scientific meetings. IPEM is licensed by the Science Council to award CSci and by the Engineering Council (UK) to award CEng, IEng and EngTech.

IChemE

Institution of Chemical Engineers

IChemE is the hub for chemical, biochemical and process engineering professionals worldwide. We are the heart of the process community, promoting competence and a commitment to sustainable development, advancing the discipline for the benefit of society and supporting the professional development of over 29,000 members.

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Institution of Civil Engineers ice

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ICE aims to be a leading voice in infrastructure issues. With over 80,000 members, ICE acts as a knowledge exchange for all aspects of civil engineering. As a Learned Society, the Institution provides expertise, in the form of reports, evidence and comment, on a wide range of subjects including infrastructure, energy generation and supply, climate change and sustainable development.

Institution of Engineering and Technology



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The Institution of Engineering and Technology was formed in 2006 by the Institution of Electrical Engineers and the Institution of Incorporated Engineers. The IET has more than 150,000 members worldwide who work in a range of industries. The Institution aims to lead in the advancement of engineering and technology by facilitating the exchange of knowledge and ideas at a local and global level and promoting best practice.



KEW GARDENS



The mission of Kew is to inspire and deliver science-based plant conservation worldwide, enhancing the quality of life. Kew is developing its breathing planet programme with seven key activities:

- creating global access to essential information
- identifying species and regions most at risk
- helping implement global conservation programmes
- extending the Millennium Seed Bank's global partnership
- establishing a global network for restoration ecology
- identifying and growing locally appropriate species in a changing climate
- using botanic gardens as shop-front opportunities to inform and inspire

Contact: Prof Simon J. Owens

Tel: 020 8332 5106

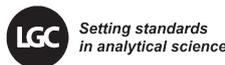
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Website: www.kew.org

Two stunning gardens-devoted to building and sharing knowledge

LGC



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Website: www.lgc.co.uk

LGC is an international science-based company and market leader in the provision of analytical, forensic and diagnostic services and reference standards to customers in the public and private sectors.

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

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Lilly and Company Limited



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Lilly UK is the UK affiliate of major American pharmaceutical manufacturer, Eli Lilly and Company of Indianapolis. This affiliate is one of the UK's top pharmaceutical companies with significant investment in science and technology including a neuroscience research and development centre and bulk biotechnology manufacturing operations.

Lilly medicines treat schizophrenia, diabetes, cancer, osteoporosis, attention deficit hyperactivity disorder, erectile dysfunction, severe sepsis, depression, bipolar disorder, heart disease and many other diseases.

London Metropolitan Polymer Centre



Sir John Cass Department of Art, Media & Design

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Website: www.polymers.org.uk

The London Metropolitan Polymer Centre provides training, consultancy and applied research to the UK polymer (plastics & rubber) industry. Recently, LMPC has merged with the Sir John Cass Department of Art, Media & Design (JCAMD) to provide a broad perspective of materials science and technology for the manufacturing and creative industries. JCAMD contains Met Works, a unique new Digital Manufacturing Centre, providing new technology for rapid prototyping and manufacture. The new department will offer short courses in polymer innovation, print technology and silversmithing & jewellery.

Marks & Spencer Plc

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Merck Sharp & Dohme Limited (MSD) is the UK subsidiary of Merck & Co., Inc., of Whitehouse Station, New Jersey, USA, a leading research-based pharmaceutical company that discovers, develops, manufactures and markets a wide range of innovative pharmaceutical products to improve human health. Our mission is to provide society with superior products and services by developing innovations and solutions that improve the quality of life.

The National Endowment for Science, Technology and the Arts



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NESTA's aim is to transform the UK's capacity for innovation. We work across the human, financial and the policy dimensions of innovation. We invest in early stage companies, inform innovation policy and encourage a culture that helps innovation to flourish. The unique nature of our endowed funds means that we can take a longer term view, and develop ambitious models to stimulate and support innovation that others can replicate or adapt. NESTA works across disciplines, bringing together people and ideas from science, technology and the creative industries.

National Physical Laboratory



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

Natural England



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Natural England has the responsibility to enhance biodiversity, landscape and wildlife in rural, urban, coastal and marine areas; promote access, recreation and public well-being, and contribute to the way natural resources are managed so that they can be enjoyed now and by future generations.



Natural History Museum



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The Natural History Museum is the UK's premier institute for knowledge on the diversity of the natural world, conducting scientific research of global impact and renown. We maintain and develop the collections we care for and use them to promote the discovery, understanding, responsible use and enjoyment of the world around us.



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Newcastle University is confirmed by external review as having world-leading or internationally excellent researchers in all 38 subject areas spanning medicine, the sciences, engineering, humanities and the arts.

The University has an active technology transfer programme forming five spin-out companies per annum. The University is committed to excellence with a purpose, interdisciplinary research and external engagement.

The Nutrition Society



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Founded in 1941, The Nutrition Society is the premier scientific and professional body dedicated to advance the scientific study of nutrition and its application to the maintenance of human and animal health.

Highly regarded by the scientific community, the Society is the largest learned society for nutrition in Europe. Membership is worldwide and is open to those with a genuine interest in the science of human or animal nutrition.

Principal activities include:

1. Publishing internationally renowned scientific learned journals
2. Promoting the education and training of nutritionists
3. Promoting the highest standards of professional competence and practice in nutrition
4. Disseminating scientific information through its publications and programme of scientific meetings

PHARMAQ

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Veterinary pharmaceuticals specialising in aquatic veterinary products. Fish vaccines, anaesthetics, antibiotics and other products.



Plymouth Marine Sciences Partnership

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The Plymouth Marine Sciences Partnership comprises seven leading marine science and technology institutions, representing one of the largest regional clusters of expertise in marine sciences, education, engineering and technology in Europe. The mission of PMSP is to deliver world-class marine research and teaching, to advance knowledge, technology and understanding of the seas.

Prospect



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Prospect is an independent, thriving and forward-looking trade union with 102,000 members. We represent scientists, technologists and other professions in the civil service, research councils and private sector.

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



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Founded in 1976, The Royal Academy of Engineering promotes the engineering and technological welfare of the country. Our activities – led by the UK's most eminent engineers – develop the links between engineering, technology, and the quality of life. As a national academy, we provide impartial advice to Government; work to secure the next generation of engineers; and provide a voice for Britain's engineering community.

The Royal Institution



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www.rigb.org

The core activities of the Royal Institution centre around four main themes: science research, education, communication and heritage. It has a major Public Events Programme designed to connect people to the world of science, as well as a UK-wide Young People's Programme of science and mathematics enrichment activities. Internationally recognised research programmes in bio- and nanomagnetism take place in the Davy Faraday Research Laboratory. The building has recently undergone a £22 million refurbishment, and now features an extended museum, new social spaces and upgraded facilities in the historic lecture theatre.

The Royal Society



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Website: www.royalsociety.org

The Royal Society is the UK academy of science comprising 1400 outstanding individuals representing the sciences, engineering and medicine. As we prepare for our 350th anniversary in 2010, our strategic priorities for our work at national and international levels are to:

- Invest in future scientific leaders and in innovation
- Influence policymaking with the best scientific advice
- Invigorate science and mathematics education
- Increase access to the best science internationally
- Inspire an interest in the joy, wonder and excitement of scientific discovery.



RSC | Advancing the Chemical Sciences The Royal Society of Chemistry

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Website: <http://www.rsc.org>
<http://www.chemsoc.org>

The Royal Society of Chemistry is a learned, professional and scientific body of over 46,000 members with a duty under its Royal Charter "to serve the public interest". It is active in the areas of education and qualifications, science policy, publishing, Europe, information and internet services, media relations, public understanding of science, advice and assistance to Parliament and Government.

The Royal Statistical Society



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The Royal Statistical Society is a leading source of independent advice, comment and discussion on statistical issues. It promotes public understanding of statistics and acts as an advocate for the interests of statisticians and users of statistics. The Society actively contributes to government consultations, Royal Commissions, parliamentary select committee inquiries, and to the legislative process. In 2009, the RSS celebrates 175 years since its foundation 1834.



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Semta - working with employers to improve performance through skills

Semta is the employer-led Sector Skills Council for Science, Engineering and Manufacturing Technologies. Semta supports UK businesses in achieving global competitiveness through investment in skills.

Every business depends on the skills of its workforce to drive productivity, growth and success. Semta works with companies in its sector to understand skills needs and provide solutions to meet those needs.

society for general Microbiology

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SGM is the largest microbiological society in Europe. The Society publishes four journals of international standing, and organises regular scientific meetings.

SGM also promotes education and careers in microbiology, and it is committed to represent microbiology to government, the media and the public.

An information service on microbiological issues concerning aspects of medicine, agriculture, food safety, biotechnology and the environment is available on request.

Society of Cosmetic Scientists



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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.

Universities Federation for Animal Welfare



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Registered in England Charity No: 207996

UFAW is an internationally-recognized independent scientific and educational animal welfare charity. It works to improve animal lives by:

- supporting animal welfare research.
- educating and raising awareness of welfare issues in the UK and overseas.
- producing the leading journal Animal Welfare and other high-quality publications on animal care and welfare.
- providing expert advice to government departments and other concerned bodies.



SCIENCE DIARY

THE PARLIAMENTARY AND SCIENTIFIC COMMITTEE

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lloyda@pandsctte.demon.co.uk
www.scienceinparliament.org.uk

Below are dates for events in the autumn and early 2010 with provisional subject headings; further information will be sent as soon as it is available.

Thursday 15 October 70th Anniversary Lunch

Guest of Honour: Professor John Beddington CMG FRS
Chief Scientific Adviser to HM Government
Cholmondeley Room and House of Lords Terrace

Tuesday 10 November 17.30 Environmental Change

Discussion Meeting

Tuesday 15 December 17.30 Science Policy

Discussion Meeting

Tuesday 19 January 2010 17.30 Brain Research

Discussion Meeting

THE ROYAL INSTITUTION

The Royal Institution has now re-opened following its £22 million refurbishment, including the new Time & Space restaurant, bar and café. All events take place at the Royal Institution unless otherwise stated. See www.rigb.org or telephone 020 7409 2992 for full details and to book tickets.

Monday 20 July 19.00 July café scientifique

Monday 27 July 19.00 Quiz night

Tuesday 28 July 19.00 Decoding the heavens

Dr Jo Marchant

Thursday 17 September 19.00pm Is free will an illusion? – you decide!

Prof Patrick Haggard and Prof Al Mele

Monday 21 September 19.00 September café scientifique

Thursday 8 October 19.00 What on Earth evolved? 100 species that changed the World

Christopher Lloyd

Thursday 15 October 19.00 Adam Hart-Davies

Monday 26 October 19.00 Quiz night

Thursday 29 October 19.00 Darwin, Fitzroy and the voyage of the Beagle: the untold story

Juliet Lacey, Lord Julian Hunt, Prof Armand Leroi, Baroness Susan Greenfield.

THE ROYAL SOCIETY

The Royal Society runs a series of events, both evening lectures and two day discussion meetings, on topics covering the whole breadth of science, engineering and technology. All the events are free to attend and open to all.

Highlights in the next few months include:

Monday 28 and Tuesday 29 September (all day) The spin on electronics

Tuesday 20 October 18.30 The first 4 million years of human evolution

By Professor Chris Stringer FRS

Details of all of these plus our forthcoming events programme can be found at royalsociety.org All Royal Society lectures are available from the Royal Society website. The collection includes over 200 lectures with speakers including David Attenborough, Ottoline Leyser and James Lovelock.

THE ROYAL ACADEMY OF ENGINEERING

3 Carlton House Terrace,
London SW1Y 5DG

www.raeng.org.uk/events or
events@raeng.org.uk

020 7766 0600

THE ROYAL SOCIETY OF CHEMISTRY

For details please contact Dr Stephen Benn
benns@rsc.org or phone 0207 440 3381

ROYAL SOCIETY OF EDINBURGH

22-26 George Street, Edinburgh EH2 2PQ.
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events@royalsoced.org.uk
www.royalsoced.org.uk

All events require registration and, unless otherwise indicated, take place at the RSE.

Monday 7 September 18.00 Making Eyes: lessons from failed miracles

Henry Dryerre Prize Lecture
Professor Veronica Van Heyningen FRS FRSE

Thursday 8 October 18.00 The technology-policy challenges to address climate changes and biodiversity loss

Professor Bob Watson, Chief Scientific Adviser's Secretariat, Department for Environment, Food and Rural Affairs (DEFRA)
Environmental Choices Lecture
Supported by the Institute of Physics, the Royal Meteorological Society and Scottish Natural Heritage

BRITISH SCIENCE ASSOCIATION

Saturday 5 – Thursday 10 September British Science Festival

The British Science Festival (formerly the BA Festival of Science) is one of Europe's largest science festivals, taking place in a different UK location each September. This year the Festival is hosted by the University of Surrey in Guildford with events taking place across Surrey.

The Festival will be joining in the national celebrations of Darwin200 marking 200 years since the birth of Charles Darwin by exploring his scientific ideas and the impacts they made. 2009 is also the International Year of Astronomy and there will be an exciting and inspiring programme for families, adults and school children.

Please visit

www.britishtscienceassociation.org/web/BritishScienceFestival for more information, including an online programme of events.

ROYAL PHARMACEUTICAL SOCIETY OF GREAT BRITAIN

Contact: events@rpsgb.org
www.rpsgb.org/events

Monday 7 – Wednesday 9 September Science@BPC 2009

At Manchester Central, Manchester
www.bpc2009.org

Thursday 24 September

Recent developments in wound management: intelligent biomaterials to novel antimicrobials

In partnership with the Academy of Pharmaceutical Sciences
At the RPSGB, London

Monday 12 – Tuesday 13 October

FIP Quality International 2009 - Managing quality across the drug supply chain: from product inception to patient utilization

In partnership with the International Pharmaceutical Federation (FIP)
At the RPSGB, London

THE ERGONOMICS SOCIETY

Exhibition

Wednesday 18 November 2009 to
Sunday 14 March 2010
Daily 10.00 – 17.15

Ergonomics: Real Design

To celebrate 60 years of ergonomics, there will be a special exhibition focusing on ergonomics/human factors. It will show how ergonomics is improving our lives at home and at work, with case studies ranging from mobile phones and TV remote controls, to the control room design at CERN, which operates the Large Hadron Collider.

At The Design Museum, 28 Shad Thames, London SE1 2YD

FRAME (Fund for the Replacement of Animals in Medical Experiments)

Tuesday 8 – Thursday 10 September
Human Alternatives to Animal Studies

Symposium to mark the 40th Anniversary of the establishment of FRAME
At Jubilee Campus, University of Nottingham

For more details and to download a booking form log on to www.FRAME.org.uk



OFFICERS OF THE PARLIAMENTARY & SCIENTIFIC COMMITTEE

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COUNTDOWN TO 2010

THE ROYAL SOCIETY INVITES YOU TO 'SEE FURTHER'

The Royal Society will celebrate its 350th Anniversary in 2010 with a year-long series of events, exhibitions, and publications to increase both the public's involvement in and the profile of science.

This programme will begin on 30 November 2009 (known in the Society as Anniversary Day from the date of its founding) and will run until November 2010, 350 years after the Society was formed. It is intended that the programme will have a legacy in terms of ongoing engagement with new audiences developed during the year.

At the heart of celebrations, we will create a Summer of Science in central London. Working in partnership with the Southbank Centre, the event will be open to everyone, and will give visitors the opportunity to meet the scientists and engineers at the forefront of the UK's research activities and explore their work. There will be an accompanying programme of events, including partnerships with museums and galleries to celebrate arts and science and to reposition science firmly as a cultural activity. A programme of discussion meetings will be held during 2010 in new or rapidly changing research fields and there will also be a programme of science policy public forums, the inaugural of which will be held during the Summer of Science festival.

Throughout 2010 we will work in partnership with over 70 cultural institutions nationwide on a programme of events and activities to involve the public, to broaden our anniversary celebrations beyond our London base and to bring science to a new audience.

The BBC has committed to making 2010 a Year of Science. This is likely to be reflected across television, radio and web broadcasting. Our long history of scientific publishing will also form an important element of 2010 celebrations and we will publish special issues or special contributions in our own journals. We are working with Harper Press to publish a book edited by the award-winning author Bill Bryson in the spring of 2010. It will offer a unique look at scientific issues from the past 350 years with chapters by leading scientists and well-known authors including Margaret Atwood, Richard Dawkins and Martin Rees.

Our Library and Archives have long been a focus for the rich history of scientific progress in Britain and beyond. In 2010 this will be formalised with the creation of the *Royal Society Centre for the History of Science*. Visitors to the Royal Society will be able to walk through 350 years of scientific progress in Britain. As well as celebrating the achievements of Fellows from the 17th century to the present, the exhibition will put into context the history of the Society which was founded by men who were curious about the natural world and wanted to 'See Further'.

We have a longstanding commitment to inspiring young minds by supporting activities that bring together the best of science and education for the future of young people. Our long-running Partnership Grants Scheme will give more UK students the opportunity to experience science first hand in 2010. An Associate Schools Scheme will be set up in 2010, providing schools from across London with unprecedented access to our facilities.

During 2010 we will publish the fourth in our series of 'state of the nation' education policy reports, which will focus on transition from secondary education to undergraduate first degree studies in science and mathematics.

We will be involved in an ambitious series of international activities. The flagship event is the InterAcademy General Assembly in January 2010, which the Royal Society is hosting and co-organising. We also plan to co-host a science meeting with Canada, focusing on research that underpins one or more of the G8 Presidency themes in 2010.



In 2010 the Royal Society will celebrate its 350th Anniversary. Newton believed that by standing on the shoulders of giants he had 'seen further' than others. We have chosen 'See Further' as the theme for 2010 because it encapsulates what the Royal Society is all about – Fellows of the Royal Society see further into the complexities of the universe by using a way of thinking called science.

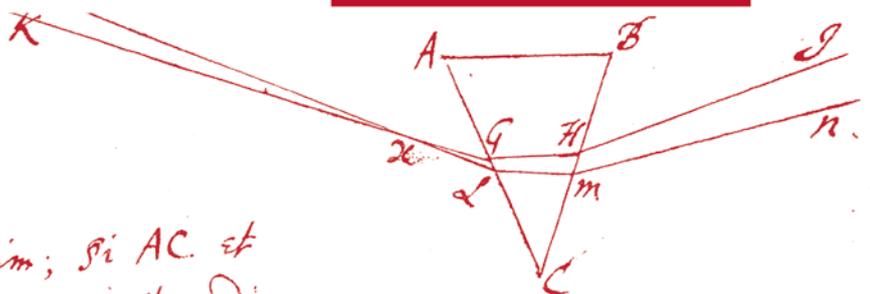
We have now launched a new website to bring you the latest news from our 350th Anniversary programme. Find out more at: seefurther.org

EXCELLENCE IN SCIENCE



*actionis ad
matis esse
ad latus*

*rima supposuerim; si AC. et
in aequalia, similis int radioru
ad AB basem Prismatis incline*



THE ROYAL SOCIETY 'Hq

CPH Quors stiam 'refractionis in g' et m aequalis