Medical Testing

Designs for Life

Nanotechnology

Carbon Capture and Storage

SCIENCE IN PARLIAMENT

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Autumn 2009

The Journal of the Parliamentary and Scientific Committee

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science museum 100

celebrating a century of science

'Now more than ever we need to celebrate our country's achievements in science and we need to foster new generations that understand, appreciate and practise scientific method. Hurrah for the Science Museum!'

Stephen Fry
Actor, writer, comedian, presenter

www.sciencemuseum.org.uk

The Government has listened; the HoC Science and Technology Committee is re-established and meets for the first time in October. It will have the same Chairman and membership as the Innovation, Universities, Science and Skills Committee had, which it replaces, although the Whips will need to do a bit of work to fill the vacancies that exist.

On 23 September I attended the joint 10th Anniversary Celebration of the University of Manchester Incubator Company (UMIC) and 5th Anniversary Celebration of the University of Manchester's Intellectual Property Commercialisation Company (UMIP). However their success is measured this 'portfolio of incubators, based around the Manchester city region, catering for companies in the medical/life science and high technology sectors' has been remarkably successful. Congratulations to all those pioneers who were brave enough to launch the first Manchester bioincubator in 1999, one of the first of its kind.

The requirement for Full Economic Costs (FEC) in research grants in the UK appears to be shifting some industrial research money away from British universities to universities abroad. In any case, what are our Vice-Chancellors doing with this money currently? When the call comes, will they be able to produce it to keep their laboratories and workshops at the cutting edge, which was the reason for requiring FEC in the first place?

As we enter the final straight leading to the General Election the dominant discussion appears to be how each party will address the need for cuts to pay for the debts caused by the 'credit crunch'. Will the science budget remain ring fenced, even if Labour can earn a fourth term? In talks with academics and other professionals in the education and health sectors I get the impression that they are looking for cuts now. For example, the University and College Union tell me that they are engaging in some vigorous discussions with some of our Vice-Chancellors, who are proposing significant 'restructuring' in their universities.

According to the Trans Atlantic Think Tank for Toxicology at John Hopkins University in Baltimore the cost of REACH compliance may be six times previous estimates and use twenty times more animals. It comes as no surprise therefore that animal rights activism is on the rise again. Novartis employees have been targeted recently in France and Switzerland, with renewed demands that the company severs its links with Huntingdon Life Science.

Dr Brian Iddon MP
Chairman,
Editorial Board
Science in Parliament

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.

CONTENTS

BIOETHICS AND DEMENTIA: A CHALLENGE FOR SCIENCE

Professor Albert Weale FBA
Chair of the Nuffield Council on Bioethics and Professor of Government, University of Essex

Chairing the Nuffield Council on Bioethics, a position which I was honoured to take up in January 2008 for five years, is an exciting and unique opportunity for someone like me who works on social values and public policy.

It allows me to debate cutting-edge issues in science and medicine, and to do so with some of the most interesting (and pleasant) people in the UK. Eminent lawyers, scientists, clinicians, journalists and philosophers are brought together. After a thorough process of consultation and deliberation, the Council publishes reports that aim to clarify bioethical issues and influence the development of policy.

THE ETHICS OF DEMENTIA

Most recently, the Council considered the ethical dilemmas raised by dementia. An expert Working Party, ably led by Tony Hope, Professor of Medical Ethics at Oxford, spent almost two years considering the difficult dilemmas that people with dementia, their carers and healthcare professionals have to face on a day-to-day basis. These include:

- deciding when and how to communicate a diagnosis;
- balancing a person's safety with their need for independence and freedom;
- deciding what is in the best interests of the person with dementia, for example when making decisions about their care and treatment;
- recognising that the needs of the person with dementia may sometimes conflict with the needs of others, especially carers;
- tackling discrimination against people with dementia; and
- deciding what priority to give to dementia research.

The Working Party published its report *Dementia: ethical issues* in October 2009. It found that there are many ways in which we can work together as a society to help people with dementia, and their carers, have a better quality of life.

RESEARCH PRIORITIES

One important conclusion was that the amount of funding available for dementia research appears low, given both the number of people with dementia and the effect dementia has on people's lives. Research funding bodies rightly choose to fund research that is important and high quality. However, these criteria alone are not enough to make sure that there is a fair distribution of research funding between the needs of very different parts of the population. We concluded that the major research funders should explain more clearly how and why they divide their research funds between areas of research that have the capacity to benefit very different groups of the population. If necessary, they should take active steps to support and encourage researchers to carry out high-quality research in dementia. More research into the experience of living with dementia and how people with dementia can be supported to live the best possible lives is particularly needed.

RESEARCH PARTICIPATION

People with dementia who understand what is involved in a particular research project decide for themselves whether or not to take part. Those who cannot decide for themselves may be able to take part as long as a number of legal requirements are met. We concluded that more should be done to make it easier for those who have expressed a wish to take part in research to do so. For example, clinical trial networks, which bring together doctors and people with dementia who want to take part in research, should be encouraged; and the possibility of giving welfare attorneys the power to decide if a person with dementia should take part in research should be considered. At present, this is possible in Scotland but not in England or Wales. The Council will be discussing these findings with the major funders of research and others in the coming weeks.

THE FUTURE OF DEMENTIA CARE

The report ties in with current policy discussions. A Green Paper *'Shaping the Future of Care Together'*, published in July, sets out long-term reform proposals on how we as a society provide care for older people. To help them prepare for future debate around adult care, Parliamentarians and other policy makers are invited to discuss the issues raised by caring for people with dementia at the Council's annual 'Bioethics in Parliament' event in the Houses of Parliament. The event, to be held on 10th November 2009, is supported by Evan Harris MP, Brian Iddon MP, Earl Howe and Lord Harries of Pentregarth, and will entail presentations and debate, followed by a drinks reception. For more information contact Catherine Joynson at cjoynson@nuffieldbioethics.org.

Over the next two years the Council will be considering the rise of genetic testing and online medicine; the implications of advances in biofuels; and the donation and use of bodily material such as gametes, blood, tissue and organs in medical treatment and research. At a time when the biosciences present us all with challenges and opportunities, all those on the Council hope that their work will be of public benefit and advance the public understanding of bioethics.

SCIENCE AND ENGINEERING AT THE HEART OF A FUTURE CONSERVATIVE GOVERNMENT

Adam Afriyie MP

The expenses scandal shook Parliament to its core. The fallout has been extensive, and there are now justifiable calls for change.

One area of Parliamentary activity retains its vitality: science. Over the course of the year it has been a pleasure to work with POST (the Parliamentary Office of Science and Technology) to develop a programme of science literacy training for new Conservative MPs.

I was delighted to join with members of the Innovation, Universities, Science and Skills Committee to campaign for a new science and technology committee. And it was enlightening to speak at the recent Parliamentary Links day in support of the annual exchanges between MPs and professional scientists.

These events reminded me that Britain is not just a nation of bankers and borrowers. We also have a proud scientific tradition. That tradition deserves recognition in public life on more than merely historic grounds.

I have hopes that the new Science and Technology Committee will rise to that challenge like its predecessors. In fact, there are at least three reasons why the committee will probably gain influence over the coming months and years.

First, the policy focus is quite rightly shifting away from the failed economic model of the past decade. Attention is quite rightly turning to the role that science and innovation can play in rebalancing our lop-sided economy. Effective scrutiny of government science policy will be essential in the years to come.

Second, with the latest machinery of government changes, science now competes for attention in a bigger department than ever before. With both the Science Minister and the Secretary of State tucked away in the Lords – distant from the usual Commons scrutiny – I will certainly look to the select committees for help in holding ministers to account.

Third, Parliament will continue to rely on its select committees and organisations such as POST to underpin the rigour of scientific debate. In the course of the next Parliament, MPs may be required to tackle a range of tricky issues. This could involve anything from the presence of nano-particles on the high street to the use of genetic information by insurers. So Parliament will need a dedicated, cross-departmental select committee to weigh up the evidence and deliver sound recommendations.

This cross-departmental role is critical. Science is not restricted to just one Whitehall department. Whether it's social science in the Home Office or climate science in DECC, ministers, officials and Parliamentarians all depend on reliable scientific advice.

Science and engineering belong at the heart of government policy, and I am deeply conscious of the contribution they will make to a future Conservative government. That's why I am taking action now to raise the profile of the STEM subjects in the Conservative Party.

At this year's party conference I will be launching the Conservative Friends of Science. The idea has been greeted warmly and enthusiastically, and we're delighted that Simon Singh has agreed to say a few words at the reception. The group will provide a forum for Parliamentarians, party activists, corporate and individual members to debate scientific issues and inform policy. And it will enable members to help promote the STEM subjects alongside the many organisations already active in the field.

Effective policy is based on sound evidence. That's why science and engineering matter. The Conservative Friends of Science will be making a strong case for science and engineering at the heart of Conservative policy-making.

Adam Afriyie is the Conservative MP for Windsor and Shadow Minister for Science and Innovation.

. . . events reminded me that Britain is not just a nation of bankers and borrowers . . .

STRIVING FOR EXCELLENCE

Sir Alan Langlands FRSE
Chief Executive,
Higher Education Funding Council for England

I have taken on the Chief Executive's role at the Higher Education Funding Council for England (HEFCE) at a testing time – universities and colleges face very tough financial conditions and yet they are crucial to delivering the country's twin aims of a vibrant economy and a just society. HEFCE has a key role to play in promoting high quality, cost effective teaching and research to meet the needs of students, the economy and society. This needs sustained investment and of course university funding will be centre stage when the fees review gets under way later this year. In the mean time, it is important to galvanise the intellectual, financial and physical assets in higher education to best effect, striving for excellence in all that we do.

VITAL STATISTICS

HEFCE recurrent funding for 2009-10 is £6.4bn – including £4.7bn for learning and teaching, and research allocations of £1.6bn. We also provide non-recurrent funding of £1.5bn including capital allocations of £1.2bn. Separate arrangements exist in the rest of the UK, vested in the Higher Education Funding Council for Wales, the Scottish Funding Council and the Department for Employment and Learning in Northern Ireland. HEFCE funding has grown by 60% in real terms since 1998-99 and the total number of students in all categories in England has increased from 1.57m in 1998-99 to 1.99m in 2007-08. The higher education participation rate increased by two percentage points to 43.3% between 1999-2000 and 2007-08.

Universities in England are autonomous, self-governing bodies. They derive income from multiple sources and the overall turnover for 2007-08 (the most recent year for which full figures are available) was £19.4bn. HEFCE funding in that year was £7.37bn. HEFCE therefore funds about 37% of the total activity in universities.

This level of investment – coupled to the Government's long-term commitment to science and publicly-funded research, and the introduction of variable fees – has enabled UK universities to maintain their international competitiveness whilst supporting the Government's policy of widening participation in higher education.

There are 17 UK universities in the world's top 100, 14 of which are in England. The UK played host to 284,260 international students in 2007-08 and the UK share of international trade in higher education is stable at 11%, the second-highest country share behind the United States. With 1% of the world's population, the UK achieved 12% of the world's scientific citations, and recent data show that the UK arts and humanities community publishes nearly as many scholarly papers as the US – 33% of the world's output is from the UK versus 37% from the US in the period 2006-2008.

FUTURE CHALLENGES

This strong position achieved in recent years is at risk from intense competition from many other countries, reductions in growth in public spending, threats to university income and fluctuations in the financial and property markets affecting endowment funds and the redevelopment of our campuses. In these times of hard choices, Government, the universities, employers, the Research Councils, HEFCE and a wide range of representative bodies need to work together to build on the international standing of higher education. At the very least this means striking a new balance between public expenditure and student/employer contributions, developing a sustainable system of student support and, even with some further improvements in efficiency, recognising that quality may well have to be protected at the expense of increased volume and new initiatives which fall outside our core mission of higher education and research.

ACTION NOT WORDS

The debate about higher education funding will take its course over the next twelve to twenty-four months but there is plenty to do in the mean time and I envisage that HEFCE, universities, colleges and other partners will work hard to ensure that the quality of

. . . With 1% of the world's population, the UK achieved 12% of the world's scientific citations. . .

teaching continues to be trusted for the future, that we maintain excellence in research and that we work with others for positive economic and social results.

QUALITY AND STANDARDS

The quality and standards achieved in higher education have been in the spotlight over the past year with no shortage of media comment about admissions criteria; the role of the Quality Assurance Agency for higher education; and concerns about a dumbing-down of academic standards. The House of Commons Innovation, Universities, Science and Skills Select Committee and a high level sub-committee of HEFCE have recently reported. The emerging consensus is that there is no evidence of systemic failure in the present arrangements, but that some improvements need to be made.

Action is required to ensure that:

- the QAA has a more public-facing remit, re-assuring the non-expert and adopting a more flexible approach in its audit methodologies
- applicants, students, parents and employers should have ready access to information about programmes of study and what is expected of students who undertake these programmes
- the external examiner system (a key part of the system of self-regulation and peer review at institutional level) should be reviewed and sharpened up

HEFCE and universities will also maintain their commitment to promoting study in science, technology, engineering and mathematics – boosting demand and provision to meet the needs of employers and new industries.

RESEARCH IN HIGHER EDUCATION

The plurality of funding for university-based research, from public and other sources, is a major strength of the UK system. HEFCE funding, provided as one leg of dual support, enables institutions to maintain a dynamic and responsive research base of world-leading quality. This enables ground-breaking basic research, with the potential to drive future innovation and respond quickly to changes in the external environment. Challenges include:

- maintaining the balance between funding for curiosity-driven research and for work targeted on identified national needs and priorities. The leading funders (HEFCE, the UK Research Councils, the NHS and major charities) are committed to working together and engaging with industry to achieve this
- developing the new research excellence framework – the REF – to assess the quality of research outputs, their impact on the economy and society and the vibrancy and professionalism of the research environment. A consultation document on this new approach to assessment has just been published
- continuing to develop the infrastructure and human capital required to support industry collaborations, technology transfer and inward investment

Strong basic research is a cornerstone of Britain's success and, over time, it can make a real difference to our everyday lives. It is valued by industry and by society but it will continue to need long term commitment, time and money. There are no short cuts on the journey from the laboratory to the marketplace.

> . . . higher education has proved to be an asset at national, regional and local level – generating value of £55bn to the economy. . .

WORKING WITH OTHERS

In return for all this public investment higher education has proved to be an asset at national, regional and local level – generating value of £55bn to the economy, and promoting important health and social benefits.

HEFCE, working with BIS encourages close working relationships between higher education and business, public services and the voluntary sector. The higher education innovation fund (HEIF) has been used to establish an institutional infrastructure for commercialisation, innovation and enterprise. Universities and colleges generated £10.3bn in value from users in the period 2001-07; and the return on the HEFCE investment has been evidenced at between £4.9-£7.1 for every £1 of HEIF.

Higher education also plays a fundamental role in delivering the knowledge and skills required in a rapidly changing economy, through the supply of graduates but increasingly through flexible higher education designed around the needs of employers. Universities have shown that they can respond quickly to business needs, leveraging an additional £31m on top of HEFCE investment of £25m to offer rapid support for business and graduates through the Economic Challenge Investment Fund. The fund will benefit 50,000 people and 11,700 businesses. Universities and colleges have also demonstrated an ability to stimulate new markets through programmes which are co-funded by employers. In 2008-09, employers will be funding £7m towards the course costs of 6,000 FTE on top of HEFCE's £17m. We expect this to increase to the target of 35,000 entrants by 2010-11.

AND FINALLY……

Over nearly twenty years I have worked for about half my time in and around Whitehall and half as the Principal and Vice-Chancellor of a University. My task now is to help broker the partnership between Government and universities and colleges to ensure that we make best use of public money and have the high level skills and the research base we need for long-term success. I doubt if life will be dull…….

Sir Alan Langlands was formerly the Principal and Vice Chancellor of the University of Dundee (2000-2009) and Chief Executive of the NHS in England (1994-2000). He also has a particular interest in the scientific basis of health services and he chairs the boards of UK Biobank – a major genetic epidemiology study funded principally by The Wellcome Trust and The Medical Research Council – and the Health Foundation, a UK-wide charity committed to improving the quality of healthcare. He is also a co-opted member of the Office for the Strategic Co-ordination of Health Research.

REGULATING FORENSIC SCIENCE QUALITY STANDARDS

Andrew Rennison MSc
Forensic Science Regulator

What are the challenges I face as the Forensic Science Regulator? This is a common question and one that I regularly ponder on as my role matures and the challenges become clearer; I stepped into the role in February last year and always knew it would take time to unravel all the issues and challenges to be faced in a changing forensic science landscape. My principal task is to set and monitor quality standards for forensic science used in the investigation of crime and prosecution of offenders in England and Wales. From the outset it was clear that any standards had to be UK-wide so we have reached agreements with the Scotland and Northern Ireland authorities to work together such that any standards we develop can and most likely will be adopted in those jurisdictions.

In setting quality standards I want to be sure that organisations have effective quality management systems, that their forensic science practitioners are competent and that the science methods they use are valid and fit for purpose. These three facets do not operate in isolation but are, for the vast majority of forensic science, interdependent and in terms of oversight and assessment benefit from a single process that is designed to assess all three, more on this later.

In England and Wales we now have a commercial supply market with the police operating procurement frameworks leading to contracts with a number of commercial suppliers. We also have the police and other law enforcement bodies providing aspects of forensic science services through their own in-house resources. In Scotland and Northern Ireland all forensic science services are provided by the police and government laboratories. Suffice to say that we have different supply models with a mix of police, state and commercial provision, all of which, in my view, should operate within a single quality standards framework.

The notion of a single quality standards framework for all UK forensic science is, to me, an obvious one. I am pleased to say that in developing such a framework I have received nothing but help and support from the forensic science community and from wider stakeholders such as the Crown Prosecution Service. I have the benefit of continuous and constructive advice from my Forensic Science Advisory Council, the Association of Forensic Science Providers, and the Forensic Science Society as well as expert advice from the many and varied members of the specialist groups I have established to work on different aspects of the standards framework. Naturally there are issues to be debated and different views to consider, which is why consultation is so important. I like to think that I am able to reach all those that want to be consulted and that their views are heard.

But why do we need a new standards framework? Historically, and prior to the commercial market for forensic science, achieving quality and standards at the laboratory level was one of the responsibilities of the Chief Scientist of the Forensic Science Service (FSS). The FSS was a leading member of the European Network of Forensic Science Institutes (ENFSI) set up in 1995 to establish common quality standards for European forensic science laboratories. I applaud the work done by ENFSI and the role the FSS played in setting high standards for state, and now the commercial laboratories, across the UK, all of which are accredited by the United Kingdom Accreditation

. . . The notion of a single quality standards framework for all UK forensic science is, to me, an obvious one. . .

Service (UKAS) against the standards recommended by ENFSI. I also applaud the work undertaken by the Custodian of the National DNA Database to set high standards for the use of DNA technology used to supply DNA profiles to the database. By working closely with UKAS the Custodian improved on the ENFSI standards such that all UK DNA laboratories are accredited and constantly assessed against what I think are world class standards.

However, much of what we term as 'forensic science' is conducted outside of the laboratory environment, for example police crime scene examinations for forensic evidence, and some law enforcement bodies have small in-house forensic laboratories; most police forces have fingerprint development laboratories using process and methods to develop and enhance finger and palm prints. Most of this work does not operate within the same accreditation based standards framework that the larger laboratories do. The police do operate ISO 9001 quality management systems for their fingerprint analysis with some forces extending this to cover all their forensic science work. I am grateful for the on-going support and advice I receive from the police lead on forensic science, Chief Constable Chris Sims, also from the Chief Executive of the National Policing Improvement Agency, Chief Constable Peter Neyroud. Both recognise the need for a standards framework that includes the police. Mr Sims recently wrote to all chief constables to explain my proposed standards framework and received general support but with some requests for further work to understand the impact, in terms of costs and benefits, for the police if they move to adopt the standards. A general and understandable concern is that of the costs associated with assessment by UKAS against the standards leading to accreditation. UKAS are by far the best equipped organisation for this role and save me the expense and logistical problems of establishing a compliance team. Accreditation by UKAS covers in depth and in a single process the three aspects I covered earlier: organisational competence, the individual competence of practitioners and the validity of the science they use.

When I arrived in post we had the Council for the Registration of Forensic Practitioners (CRFP) as a body setting and monitoring competency standards for individual practitioners. Established in 1998, with full government support, CRFP had a role to assess the competence of individual practitioners and to register those that were found to be up to standard in their work. CRFP had, since its inception, failed in its targets to register the majority of forensic practitioners and to become self-financing. CRFP made no assessment of organisational competence or of the validity of the science used by individual practitioners. Their role was reviewed by the Home Office in 2004; Ministers then decided to continue with grant-in-aid but with a very clear stipulation that this was to end by March 2010 as CRFP registered more practitioners and achieved self-financing. When I started in my work CRFP had registered about 3,000 people making up about 35% of the current forensic practitioner population and was unlikely to meet the targets set in 2004; soon after I started they wrote to Ministers seeking further funding at which point I was tasked with reviewing the registration of practitioners. My report following that review recommended a standards model that did not include CRFP; the report is available on my website as are the responses I received following publication[1]. The net result is that the police, whose staff made up the majority of the registered pool, decided to withdraw from CRFP. This in turn led to significant funding problems and the CRFP board were left with no choice but to cease trading (CRFP operated as a company limited by guarantee). In my view, supported by other stakeholders and in advice I gave to Ministers, losing CRFP caused no risks to the criminal justice system.

We are now moving from an *ad hoc* and largely uncoordinated approach to quality and standards to one based on a single coherent framework, in turn with a single compliance assessment mechanism. An example of the lack of co-ordination was the competence assessment of senior scientists within the laboratories that was duplicated through UKAS accreditation and CRFP registration, added to which the junior scientists were covered by accreditation but were not eligible for CRFP registration. I have published the standards I propose to be the basis for this new framework and have received broad support. We are currently considering the excellent and varied responses we received following publication and will have a final version available for publication by the end of this year.

. . . A challenge has been to develop a standards framework that meets the needs of the UK criminal justice systems and to achieve the support of all stakeholders. . .

A challenge has been to develop a standards framework that meets the needs of the UK criminal justice systems and to achieve the support of all stakeholders. There is still fine tuning to be done, but with the continued support I have received so far and with the continued involvement of the broad range of experts and practitioners that we rely on we will have a world leading quality standards framework for forensic science. The UK has a proud reputation for innovation and use of science in the investigation of crime and the prosecution of offenders. The most obvious and best example of this is DNA technology. As the new model for the supply of forensic science services continues to develop we can be assured that a new and up-to-date quality standards framework is also developing.

1 http://police.homeoffice.gov.uk/operational-policing/forensic-science-regulator/

THE GRAND OPENING OF YOUR MIND

Dr Michael Dixon
Director,
Natural History Museum

For more than 200 years, scientists at the Natural History Museum have been exploring and studying the natural world, using our incredible internationally important collection of over 70 million specimens to address the big questions of our time, such as tracing the origins of our solar system or monitoring and assessing the impact of climate change. Until now, most of this work has happened behind the scenes without many people knowing that we are more than a beautiful building with historical specimens on display.

THE SCIENCE OF NATURE

Our science, taxonomy and systematics, underpins all of the natural sciences and is a vital part of the nation's science capability. We also work on more applied science, such as the control of parasitic diseases, sustainable mineral extraction and forensic entomology. We are supporting the development of innovative technologies in emerging areas such as the use of nanoparticles.

Our science is firmly rooted in the collections themselves. We are focused on six main lines of enquiry:

- assembling the Tree of Life
- the relationship between genetic diversity and environment and evolution
- how large-scale geological processes have influenced evolution
- what determines biological diversity
- the relationship between biodiversity and ecosystem functioning
- the interactions between hosts and parasites and their impact on disease.

We have active research programmes that look at providing answers to contemporary issues, for example:

- we study Madagascar's tree ferns to find out how climate change impacts the world's precious rainforests
- we explore the deep sea to understand how environmental changes affect this important ecosystem
- we study mosquitoes to help prevent such diseases as malaria and Dengue fever
- we study nanoparticles to support safe use of this revolutionary technology
- we study comet dust to trace the origins of the solar system
- we are working with the first Indian space mission to reveal the geological history of the Moon.

Next year, the Museum and our science will be centre-stage as we, with support from Defra, will run the 2010 International Year of Biodiversity UK Partnership that aims to promote wider understanding of our impacts on our planet.

THE DARWIN CENTRE

Today we are facing a large-scale biodiversity crisis and potential environmental catastrophe. It has never been more important to understand our planet and to engage as many people as possible with appreciating and protecting the natural world. This is why we opened our state-of-the-art Darwin Centre on 14 September, named after Charles Darwin to mark his bicentenary and celebrate his work that continues by the Museum as we look from the origin to the future of species.

Darwin Centre is a hub of world-class scientific research, allowing visitors to marvel at the amazing diversity of life on our planet, to view our science in action, understand the extent and research use of our collections and to explore the natural world for themselves.

The visitor experience in this new London landmark will begin in the spacious atrium, where people can orientate themselves while admiring the views into the wildlife garden and the enormous cocoon towering above. The climate change wall

is an interactive collage of screens displaying films, specimens and images to allow users to explore the reality of climate change in their lives. Visitors can also collect a free NaturePlus card, which uses new barcoding technology to enable them to save video clips, images and weblinks throughout their journey through the Darwin Centre and access them on line back home or in the classroom.

THE COCOON

At the heart of the new Darwin Centre is a 65-metre-long, eight-storey-high cocoon that safeguards many of the Museum's treasures, including from our Entomology and Botany collections – 17 million insects and 3 million plant specimens. More than 200 scientists will be working in the Cocoon and the adjoining multidisciplinary facilities, carrying out their research in the molecular and imaging labs or specimen preparation areas. Through viewing decks, video and intercom, visitors will be able to see and interact with some of our staff – opening up the hidden world of scientific research. There is no other museum in the world that brings the public and scientists together in this way or on this scale.

THE ATTENBOROUGH STUDIO

Based on the research and collections of the Museum and the legacy of Sir David Attenborough's filmmaking, the new Attenborough Studio will combine scientific expertise, public dialogue, film and interactive media in a venue specially built to create a truly accessible environment. Pioneering technology will allow visitors to engage in real time link-ups with Museum researchers around the world, or influence projected 3D images in our interactive film *Who do you think you are?* A free, daily programme of screenings, discussions and events will include films specially created by the BBC Natural History Unit to celebrate wildlife filmmaking.

THE ANGELA MARMONT CENTRE FOR UK BIODIVERSITY

Housed on the lower ground floor of the Darwin Centre, the Angela Marmont Centre for UK Biodiversity will become the leading national venue for the collaborative study of UK natural history. The Museum receives around 30,000 public enquiries each year and visitors will be encouraged to bring their finds to the new centre, where dedicated staff will guide them through the reference material and collections. Much of the Museum's UK collections will be available for amateur naturalists to study, including 4,200 drawers of butterflies and 6,200 drawers of flowers. This access will offer new opportunities for the UK's many wildlife groups and societies and will nurture, inspire and excite naturalists of all ages.

THE FUTURE

Excellence in applied science depends on support for pure science, like taxonomy and systematics. We believe that with an informed and engaged public, science can fully play its crucial role in boosting competitiveness, enhancing our quality of life and ensuring a sustainable future. In a time when humanity is facing massive environmental challenges, like climate change, we and our peer institutions have an even more important role to play in assisting the generation of and distribution of vital knowledge.

Since free admission was reintroduced in 2001, we have welcomed over 25 million visitors to the Museum and expect that with the opening of the Darwin Centre we will receive a record 4 million visitors this year.

The Darwin Centre is a bold statement about our ambitions and a demonstration of our ability to deliver large, complex projects. It is also an excellent example of using public funding to leverage wider support for public benefit.

We would like to express thanks for the invaluable support and contributions we have received from many organisations and individuals, including: the Department for Culture, Media and Sport, the Heritage Lottery Fund, the Wellcome Trust, the Weston Foundation, the Cadogan family, Professor and Mrs Anthony Marmont, GlaxoSmithKline, and the Rufford Maurice Laing Foundation.

The Darwin Centre will change perceptions of what museums of natural history can be and I hope you are able to visit us in the near future, so you can personally explore this magnificent addition to the Museum.

KEW'S MILLENNIUM SEED BANK: A VITAL RESOURCE FOR AN UNCERTAIN WORLD

Simon Linington

A week is a long time in politics. But seeds can span even human generations with ease, a feature that gives us a vital opportunity to prepare now for the 'perfect storm' of environmental problems predicted by the Government Chief Scientist.

For most plants, on which all life depends, seeds provide a means of surviving this storm. By 'banking' them now, future generations will be able to draw on the widest range of plant diversity and fashion plant-based solutions to problems of human well-being thrown up by a dramatically changing world. In this, its 250th anniversary year, the Royal Botanic Gardens, Kew has successfully conserved seed from 10% of the world's flowering plant species. The Millennium Seed Bank Project, which is led by Kew and international in its scope, has achieved this significant milestone on time and within budget. It is a conservation initiative of which the UK should be very proud. While a tremendous start has been made, a great deal more needs to be done if we are to make a real impact on the erosion of plant diversity. A new ten year project that builds on the current one is planned. It needs modest financial support and, to achieve this, it needs to build on the political support received to date.

Seed banking is a simple and robust technology. For seeds of most species, drying greatly increases longevity. This drying is often carried out in a low humidity room at cool temperatures. Additional cooling of the dried and hermetically-sealed seeds further increases storage life, though there are diminishing returns as the temperature drops. Many banks such as Kew's Millennium Seed Bank have cold storage rooms running at domestic deep freezer temperatures; others use cryo-storage in liquid nitrogen. But just how long can these seeds live under bank conditions? By extrapolating from experiments that speed up seed ageing, there is good evidence that many of the MSB collections will still be germinated two hundred years from now. Added to this, we have even germinated seeds that were collected in the Napoleonic era and stored under much more adverse conditions than those offered in the state-of-the-art MSB, though admittedly, few of them germinated. These 200-year-old seeds found their way to us after a remarkable journey. They were in the possession of a Dutch merchant on passage out from the South African Cape in

Dr Paul Smith, Head of the Millennium Seed Bank, sharing his seed knowledge with the partners

1803 who was 'relieved' of them by British privateers. The seeds passed via the Admiralty to the Tower of London and eventually into the current National Archives where they were recently discovered and sent to us to attempt germination. Their germination is an exceptionally rare event for seeds of such antiquity.

Storing seeds for two centuries will enable us to bridge a phenomenal period of technological, sociological and environmental change, the conclusion of which is difficult to imagine. Over the last two hundred years, there have been huge improvements in human wellbeing as a result of greater access to plant diversity, in which Kew has played its part. An early Nineteenth Century Briton would be staggered at the variety of fruit, vegetables and plant-based drugs available in Britain today. Furthermore, the fact that we take these benefits so much for granted would perhaps have shocked someone with an existence more obviously bound to plants, much as it is still in large parts of the Developing World. Of course, things may go full circle. With human population racing towards seven billion, finite agricultural land and increasing water shortages, food insecurity is likely to spread. We may quickly retreat two hundred years in this respect. Therefore, we will need to be able to call on every botanical reserve available to create new crops and to put new genes into existing crops. Rightly or wrongly, we are already returning to plants as a renewable source of fuel. Commodity shortages would certainly reawaken latent awareness of the human

survival value of many plants and could drive an unprecedented wave of conservation and innovation. But by that time we may have already depleted the botanical resources that can help us adapt. Plant diversity is being eroded by habitat loss due to urbanisation and agriculture. Climate change may exacerbate this erosion and has led to the prediction that up to two thirds of all plant species may stand on the abyss of extinction by the end of this century. We cannot rely on conserving plants where they grow. Therefore, off site *(ex situ)* conservation is necessary. Of the techniques available, only seed banks allow us to conserve billions of genetically different individuals for hundreds of years and relatively cheaply.

Long-term seed banks were first established for crop diversity in the middle of the last century. Work by Kew and in Spain in the 1960s showed that this technique could be applied to a much wider array of wild species and, in 1974 Kew created a seed bank for wild species at its Wakehurst Place garden in West Sussex. From the early 1980s the bank focused on plants from the world's dry lands which had received little attention from conservationists and yet which supported nearly a fifth of the world's people, providing everything from local foods and medicines to building materials and fencing. In the early 1990s a challenge was made by Kew's Trustees to expand sufficiently the work to make a significant impact on the problem of genetic erosion and species loss. The result was a plan for the seed collection of 24,000 species in ten years. Kew had recently established a strong fund-raising foundation and, fortuitously, the UK was preparing to celebrate the Millennium. In December 1995 the Millennium Seed Bank Project was launched with a grant of close to £30 million from the Millennium Commission. The matching funding for this landmark project came from the Wellcome Trust, Orange plc, Kew itself, the public and many others. A fine new facility, the Wellcome Trust Millennium Building, was built at Wakehurst Place with a large underground storage vault, processing and research laboratories, public interpretation designed to show the conservation process unfolding, and residential accommodation for visiting scientists. It was opened by HRH The Prince of Wales on 20 November 2000. Simultaneously, Kew worked with the voluntary sector to collect samples of most of the UK's seed-bearing species; a world first for a national flora that encouraged other countries to follow suit.

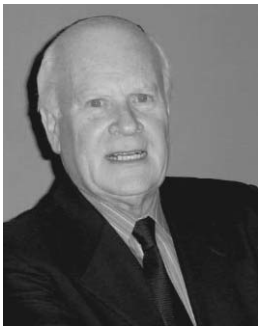
In addition to the priceless seeds conserved and the thousands of samples distributed for unique research and habitat restoration, perhaps the greatest legacy of this unique project has been the international co-operation engendered. In some countries partnerships have been catalysed between institutes that have never worked together before. The partnership now comprises 128 institutes in 54 countries. Furthermore, there is now collaboration that is independent of Kew – a sure sign that the network is established. In 16 of these countries a major collaboration has been established with botanical, forestry and conservation agencies based on legally-binding agreements that clarify the expectations of both parties and cover collecting, capacity building and research. These agreements helped exemplify the implementation of the 1992 Convention on Biological Diversity (CBD). The seed collecting work, mainly in dry vegetation, has brought together each nation's conservation priorities in a way that has helped deliver the project's species target. At the heart of targeting have been endangered, endemic (for which countries have a unique responsibility) and locally economic species. The capacity-building activities have centred on training both here and abroad, and assistance with the design and equipping of partner seed banks. The latter encourages *ex situ* conservation in the country where the plants grow; consequently, Kew's storage role is one of safety duplication. Underpinning this project is an unparalleled seed research programme that seeks to improve the effectiveness of storage and our ability to recover the full genetic potential of the collections by breaking seed dormancy. This can be a major problem with seeds of wild species and there is still much to be learnt. Such new data will not only benefit seed banks but horticulture, agriculture and habitat restoration.

The safeguarding of so many plant species by the partnership is both a major achievement and responsibility. But there is so much left to be done. Kew is now galvanising support for a successor project that will start in January. In order to keep the seed banking operation lean and focused, a challenging target has been set of bringing the species stored up to 25% of the world's flora by 2020. Obviously, difficulty of locating and collecting new species increases with the law of diminishing returns. Additionally, and in line with Kew's Breathing Planet Programme, the new project will focus on using the collections sustainably including on the repair of damaged habitats. Demonstrating new uses of species drives the financial imperative to conserve. We have a unique chance to do something about the gathering storm. There is still significant plant genetic diversity left in the wild but it won't be there for long. We have the drive, expertise (Kew alone has over 500 person years of seed banking experience), the technology and partners to make a huge impact. With a price tag of £77 million, fund-raising is proving difficult in this time of financial stringency. However, it is money that must be found if the world is to have the tools to thrive in an uncertain future. It would be a fitting tribute to this country's foresight if the people of the 23rd century looked back to this moment as the one when their botanical legacy was secured.

A scientist putting the collected seeds into the vault at the Millennium Seed Bank

BREAST CANCER SCREENING

SHOULD ROUTINE SCREENING BY MAMMOGRAPHY BE REPLACED BY A MORE SELECTIVE SERVICE OF RISK ASSESSMENT/RISK MANAGEMENT?



Michael Baum
Professor of Surgery Emeritus and visiting Professor of Medical Humanities, University College London

INTRODUCTION

The majority of lay people could be forgiven for believing that one of the mainstays in the fight against cancer is "early detection". In the vanguard of this campaign, the NHS screening programme for breast cancer (NHSBSP) by mammography has been lauded as a triumph. If nothing else the introduction of this programme has improved the service for the diagnosis and treatment of all women with breast cancer of any age and any stage. However we cannot remain complacent and continue uncritically with a service based on a limited number of trials that are more than 20 years out of date. Our understanding of breast cancer has moved on since then and as a result our attitude to screening is worthy of a fresh look.

THE ILLUSIONS AND DELUSIONS OF "EARLY DETECTION"

Let us start by considering two separate but related issues; firstly biases of screening that give a false impression of benefit and secondly the over-detection of cancer "look-alikes" that if left undetected might never threaten a patient's life. The *survival* from cancer is measured from the time of detection until recurrence and death. If a frame shift in the chronology of the disease due to screening occurs, then survival is automatically extended even if the ultimate outcome is the same; this is called lead-time bias. Next, bearing in mind that the interval between screens is anything from one to three years, it is inevitable that the fast growing tumours with a bad prognosis will appear during the intervals whilst the slow growing tumours with a good prognosis will sit around until found by mammography; this is called length bias. There is also another subtle bias that can be described as the "self selection" bias. In that women who accept invitations for screening might be demographically different to those who ignore the invitation. The only way to account for these biases is to consider all the clinical trials of screening versus no screening and look for the pooled results described in terms of *mortality* ie the number of women dying in the screened group compared with those dying in the control group rather than case survival. The results are then described as relative risk reduction (RRR) or hazard ratios (HR). There is in fact a modest advantage to screening looked upon in those terms, (RRR 15% or HR 0.85) as described in the recent publication in the BMJ; "Breast screening: the facts—or maybe not" by Peter C Gøtzsche and his colleagues from the influential and *independent*, Nordic Cochrane Centre.[1]

In this paper they describe a synthesis of all the papers that describe both the benefits and harms of screening using absolute benefits (ie number needed to screen) rather than RRR, that makes it easier for women to comprehend and conclude as follows. If 2000 women are screened regularly for 10 years, one will benefit from the screening, as she will avoid dying from breast cancer. (The independent United States Preventive Services Task Force derived a similar number in 2004.[2]) However even the figures 1:2,000 might be an over-estimate. Remember these data were derived from the trials that were mostly started in the 1970s and reported in the late 1980s. Since then improvements in treatment, such as the adoption of tamoxifen and adjuvant chemotherapy, have narrowed the window of opportunity and we have witnessed a drop in mortality of 30%-40% both in the age group that are invited for screening (>50) as well as for the younger woman. So perhaps the correct number might be 1:3,000. (See table 1).

Absolute value screening 10,000 women for 10 years assuming two estimates of relative risk reduction and assuming that unscreened symptomatic women receive the best of modern therapy.

Whatever the number, that one woman who benefits from a decade of screening has a life of infinite worth and if screening were as non-toxic as wearing a seat belt there would be no case to answer. However there is a downside and that is the problem of the over-diagnosis of "pseudo-cancers". [3, 4, 5,] It is deduced by the Cochrane report that for every life saved 10 healthy women will, as a consequence, become cancer patients and will be treated unnecessarily. These women will have either a part of their breast

TABLE 1

10,000 women aged 50 screened for 10 years	25% Relative risk reduction[6] (HR 0.75)	15% Relative risk reduction[1] (HR 0.85)
Cancer incidence (2 per 1,000/year)	200	200
Cancer deaths without screening at median follow up 5 years[9]	20	20
Cancer deaths with screening (20 X HR)	15	17
Absolute benefit	5	3

or the whole breast removed, and they will often receive radiotherapy and sometimes chemotherapy.

AN EXPLANATION FOR, AND THE NATURE OF, THE OVER-DIAGNOSED CANCERS

Screening for breast cancer is now adopted as an unequivocal good by most of the members of the EU. Invitations for screening promote this activity by being economical with the truth.[6] One of the uncomfortable truths concerns the over-diagnosis of both in-situ and invasive breast cancers in screening populations.[3,4,5] Over-diagnosis of breast cancer doesn't mean false positive rates but the detection and treatment of cancers that left undetected would never threaten a woman's life and with which she would live, in blissful unawareness, until she died naturally of old age. We had always assumed that there was an over-diagnosis of duct carcinoma in-situ (DCIS), some of which had the potential of progressing to an invasive and life-threatening phenotype. However, there is now clear evidence that anything between 10% and 50% of invasive cancers detected and treated radically as a result of screening, would never threaten life.[1, 3,4,5] As a result the overall mastectomy rate rises after any country implements screening in contrast to the message in the NHSBSP leaflet, "breast cancer the facts" that implies that screening saves breasts. It doesn't. I would therefore like to argue that some of these screen detected "cancers" if left unperturbed, would not progress to a disease with lethal potential. In other words there are latent conditions, which under certain conditions might progress, remain stable or even regress. Other biological processes behave in a similar way. Wound healing starts with the knife and ends when it needs to, although rarely wound healing carries on too long and leaves an ugly keloid scar. Virchow, the father of modern pathology, himself once described cancer as the wound that never heals. Prolonged latency followed by catastrophe should not be all that surprising.

IS THERE A REASONABLE WAY OF MODERNISING THE NHS SCREENING PROGRAMME THAT ENHANCES THE BENEFIT AND REDUCES THE HARM?

Since 1997 when I resigned from the NHSBS committee I have publicly expressed my concerns on the issue of informed choice for women invited for screening. I take no particular pleasure in the fact that NHS has at last accepted the point and agreed to rewrite the letters of invitation.

My concern is that they will repeat the mistakes of the past if we leave this task to those with a conflict of interest. Furthermore it's not for me to prejudge what level of benefit and what level of harm might influence the average woman to accept the invitation. For this reason I think there are two related areas of research. First, the development of an information pack that includes decision aids. This could be used in a person preference study where well women might be offered sliding scales of benefits and harms to find the point at which screening is judged acceptable. These data might then inform the next area of research on more efficient ways of using scarce resources in the NHS such as risk assessment/risk management.

The beauty of a risk assessment/risk management approach is that it provides a platform for the management of all women in an attempt to reduce all causes of mortality as well as mortality from breast cancer where mammographic screening is only one component of an integrated programme. The first step is to set up a facility nationwide for risk assessment using one of the modern computer programmes. Women would then be *offered*, not *compelled* to accept this service. Initially a practice nurse could administer this questionnaire but it would be quite easy to transfer this to a web- based programme for the computer literate members of the community. From the read-out an initial triage could be agreed. Those at the most extreme end of the risk spectrum could be invited to a clinical genetics consultation. At the other extreme those with a low risk might be reassured and given lifestyle advise on diet, alcohol, tobacco and exercise that might not only impact on the risk of breast cancer but also on the more important risks of cardio-vascular disease.[7] Those in between could then be invited to a special clinic for the second step. At this clinic women of say 45 or older would be invited to have a mammogram. Those with radiological abnormality at this stage would be investigated in the accepted way. In addition those who were pre-menopausal might be offered prevention with tamoxifen and those who were post-menopausal could be offered entry into the IBIS II trial, a study comparing tamoxifen with arimidex for the chemo-prophylaxis of breast cancer. A recent paper in JNCI supports the validity of this approach.[8]

CONCLUSION

To carry on regardless is no longer acceptable, neither is political spin the answer. Women are now getting smarter. However the changes I have in mind are not nihilistic but constructive. The NHSBSP has indirectly lead to the provision of the best specialist services for the diagnosis and treatment of symptomatic breast cancer in the world, riding on the back of the screening units. The centralisation of care has lead to the rapid recruitment into RCTs for the treatment of cancer that is the major contributor to the dramatic fall in breast cancer mortality in the UK over the last two decades. If we can now add to this the prevention of the disease and a risk adjusted screening programme then everyone is a winner.

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MEDICAL TESTING

Professor Karol Sikora
Medical Director,
CancerPartnersUK;
Dean, University of Buckingham
Medical School

HEALTH AND SOCIETY

There are several trends in the way in which people of all cultures are dealing with health. We now live in a global village crammed full of information – national boundaries are no hindrance to the power of the internet. The ongoing revolution in mobile phones without reliance on a creaking telecommunications infrastructure means that people in some of the world's remotest places can connect to remarkable health information websites. In an increasingly politically centrist Europe there is tremendous interest in being seen to do something to improve the speed and accuracy of medical diagnosis. The policies of most political parties are becoming extremely difficult to differentiate, and therefore doing something to improve health and the clarity of diagnosis is a natural vote winner.

The integrity of conventional religious structures and families is declining due to greater mobility, divorce, single parenthood and the break-up of traditional caring patterns for older people. This means that when a life-threatening illness strikes, patients have fewer psychological crutches to lean on today than in the more structured society of 20 years ago. Better psychosocial care is therefore needed alongside the technology-based service doctors are traditionally trained to provide. Offering patients more informed choice may well cause uncertainty and psychological confusion. Speeding up the pathway to achieve the correct diagnosis helps to reduce much of the uncertainty in many illnesses.

RISK ASSESSMENT AND PREVENTION

The public perception of cancer risk is heavily swayed by interesting but negligible risk factors. These are fanned by good media stories and the desire to find scapegoats for our unhealthy lifestyle. Cellphones, radiation from power lines, plastic films for food packaging and stress figure large in public surveys on causes of cancer, even though their risks are so low as to be nearly impossible to measure. Public education is the key to the future.

Over the next 20 years, novel programmes of individual risk assessment will be established. From the newly sequenced human genome we will learn about the complex interplay of our genes and the environment. Tailored prevention programmes will be available. New screening technology coupled with drugs and vaccines that prevent disease will come into routine use. All this requires novel approaches to diagnostics.

Cancer preventive drugs and hormones are already available for certain high-risk situations: tamoxifen for breast cancer and the COX-2 inhibitors for familial polyposis, which if untreated will inevitably lead to colon cancer. These drugs were developed and marketed for indications other than cancer prevention. The identification of effective biomarkers of cancer risk is essential if novel drug discovery programmes are to be created. The ability to prevent cancer will dramatically increase the number of people who will need to attend clinics regularly.

THE NEW DIAGNOSTICS

Diseases present with a myriad of symptoms depending on the site, size, severity and pattern of their development. Doctors are trained to analyse symptoms and then after clinical examination to utilise a series of medical tests to make a firm diagnosis. Although some symptoms alarm patients more than others there is tremendous variability in the speed at which any illness can be precisely diagnosed. With cancer a lump can be biopsied, but many deep-seated tumours present late, long after they have already spread. Most patients have actually been harbouring the cancer for several years before it becomes apparent. In psychiatry there is much more diagnostic difficulty as there is a huge spectrum of abnormalities with many blurred boundaries. Schizophrenia, bipolar disorders and severe depression may all be present in the same patient and there are no effective diagnostics other than the psychiatrist's skills.

The two drivers for improvement in medical diagnosis are imaging and biomarkers. The last decade has seen a massive rise in the use

. . . doing something to improve health and the clarity of diagnosis is a natural vote winner. . .

of computed tomography (CT) and magnetic resonance imaging (MRI) scans to outline in beautiful detail the anatomy of disease and surrounding normal structures. Positron emission tomography, in which a molecule is labelled with a radioactive marker, allows us to examine the living biochemistry of the body. The future of imaging will be the coupling of high-definition structural information to real-time functional change. This will allow the precise effects of drug or other treatment to be monitored in three dimensions. It is also likely that the telecom revolution will produce new devices for examining the function of interior compartments of the body without causing distress to the patient.

Biomarkers are biochemical changes produced by the presence of disease. They may be synthesised directly by a cancer, for example prostate specific antigen (PSA), or represent a complex change in an organ system, for example abnormal liver function tests caused by hepatitis. As we understand more about the molecular abnormalities that lead to disease through the science of genomics and proteomics, novel biomarkers will be identified. These will not only enable us to diagnose cancer at an earlier stage but also to predict the likely natural history of an illness in an individual. This information will become essential for planning optimal care. It is likely that a cancer screening kit for the four major cancers (lung, breast, colorectal and prostate) will be on sale within the next decade in pharmacies, fitness centres and health food shops, so increasing consumerism. There will be a rise in cancer screening and prevention clinics in the private sector, almost certainly attached to the 'cancer hotels' of the future.

> . . . The two drivers for improvement in medical diagnosis are imaging and biomarkers. . .

THE $1,000 GENOME

The cost of sequencing an entire human genome is currently around $100,000. This figure is likely to reduce dramatically over the next five years with many predicting a price tag of below $1,000. Looking further forward it is likely that continuous monitoring for potentially dangerous mutations will be possible. Up-market car engines have systems to measure performance against baseline, sending a signal to the driver if a problem arises. Implanted devices to identify genomic change and signal abnormalities to a home computer may well allow the detection of disease long before any symptoms. Such pre-patients will require appropriate counselling and intervention probably with newly developed drugs. It will be essential to carry out careful outcome research on such new diagnostic and screening techniques to validate their benefits.

THE FUTURE OF DIAGNOSTICS

- New diagnostic tests are introduced by enthusiasts and enter routine practice
- Specific diagnostics will accompany new therapies
- Pathologists will move away from morphological diagnostics into molecular assays
- There will remain a global shortage of pathologists
- Imaging and pathology will merge into a single discipline
- Computer based decision support systems will enhance clinical judgement
- Future patients will interact with such systems from home

IN DISCUSSION THE FOLLOWING POINTS WERE MADE:

In response to a question regarding the inherent dangers attributable to the increasing extent of radiation of the human body arising from CT scans the reply indicated that too much mindless imaging is going on. Imaging using ionising radiation should only be used as a last resort, but now it is the first resort. Why bother to conduct examinations when you have CT scans? However one in ten CT scans reveal abnormalities and these should only be undertaken therefore where a problem arises and should not form part of a routine screening programme. Over-diagnosis also occurs as a result in a population where tumours are common but we live with them as they do not need treatment. This is the core to the argument that everyone in this room has something in their body that under the microscope looks like cancer. This is the inevitable consequence of living to a mature age, although realisation of the implications are difficult for many to accept. The public who have fear of but a lack of the relevant scientific knowledge about cancer, receive confusing mixed messages from the experts who do not speak with one voice. The public also generally lack understanding of risk, especially the implications of false positives and false negatives arising from testing, for example. This gives rise to the demand to "do something" in response which has huge implications for the NHS resulting in ever-expanding costs which results in unsustainable budgetary growth, and something has to give. £55 million a year is the cost of screening all women, much of it futile, and a cost saving of £25 million could be achieved for use in treating their preventable death from other more threatening diseases. An example of heart disease was treated by a statin on the basis of a test algorithm that saved the NHS money. Point of care testing undertaken by police with electronic tools for monitoring alcohol are a good example which could be extended to genetic testing to determine whether genes are switched on or off. However anything other than the length and quality of life is a surrogate and the unnecessary use of testing fails to address this issue.

Are we spending enough NHS/Research Council money on non-invasive testing? The main financial resources underpinning novel testing methods are located in the biopharmaceutical industry rather than in government funded sources primarily concerned with delivery of clinical treatment. The NHS is very good at collecting data but the will appears to be lacking, for reasons unknown, to apply sufficient time and resources to interpret the outcomes and apply the results to medical testing and clinical care in order to maximise the available knowledge and potential benefits. Screening using cervical cytology, for example, is "intermediate technology" that is inherently subject to human error, and which has now been replaced by tests that provide yes/no answers unaffected by human error. We must learn from these experiences and develop improved methods, but unfortunately those involved with intermediate technologies won't let go! We need better testing, not more testing. Translational research on patients rather than more animal research is the way forward to drive new diagnostics. The pharmaceutical industry realises that drugs increasingly require tailoring to the individual patient, as a result both industry and the NHS are gradually moving to a new paradigm.

CONNECTING TECHNOLOGY: CATALYSING INNOVATION

Alec Reader
Director NanoKTN

Mike Fisher
Bio-Nano/Nano-Medicine Theme Manager NanoKTN

Nanotechnology is used in the development and manufacture of products in a number of different areas, including medicine, materials, electronics, coatings and energy saving technology, all with positive effects such as decreasing drug side-effects and improving sports equipment performance.

Nanotechnology has been used to increase benefits and improve processes for many years, indeed, long before many people realise. For example, in 400 AD, the Romans unknowingly used nano-particles in the process of glass blowing to produce the Lycurgus Cup that, due to the gold and silver nano-particles contained in the glass, give the cup unusual optical properties. Similarly, medieval stained glass relies on the same size-dependent light scattering properties of metal nanoparticles.

MORE RECENT DEVELOPMENTS AND BENEFICIAL APPLICATIONS IN THE PUBLIC DOMAIN

Earlier this year, Applied Nanodetectors Ltd (AND) released the prototype of a mobile phone that can detect various diseases from the user's breath. The handset manufactured by Nokia Corp, Finland, uses AND's chip that integrates sensors to detect various gases such as CO_2, NOX and ammonia (NH_3). The sensor is capable of detecting the density of each gas by matching results with the characteristics of various diseases. With the ability to detect asthma, diabetes, lung cancer and alcohol concentration, this device can automatically inform the user or their doctor of early detection of an illness.

As well as the medical and pharmaceutical professions, energy and natural resource producers are using nanotechnology to lower costs and improve safety and services to the public.

A direct coal liquefaction plant in China is converting 12,800 tonnes of coal per day into 50,000 barrels of gasoline and diesel by using a carbon nanotube catalyst of traditional vanadium/magnesium oxide complexes. The project in China worth $2 billion has positive impacts for the environment, as well as economically, with a promise to lower the costs and need for imported oil.

The filtration of water through a process of nano-filtration is another nano-process that has positive effects economically. The Generale des Eaux's Mery-sur-Oise plant in France has already adopted nanopore polymer membrane filtration and produces 140,000 m^3 per day of drinking water from the River Oise. Although power consumption is greater, it avoids the use of costly water treatment chemicals.

CASE STUDIES

Sphere Medical

Sphere Medical in Cambridge has combined nano and microtechnologies to develop a tiny diagnostic chip that analyses blood in real-time and gives doctors access to information about critically ill patients. The microanalyser gives immediate access to data, where previously a lab test was required. The technology is based around a microchip, only four millimeters square that hosts up to ten nano sensors, capable of reading a variety of patient information. The Application Specific Integrated Circuit (ASIC)'s functionality allows it to monitor temperature, self check and configure and store individual sensor control settings.

Endomagnetics

Endomagnetics in London has produced a hand-held magnetic probe that can be used in conjunction with a magnetic dye to locate quickly and easily the sentinel lymph node for biopsy in breast cancer patients. The detection of the sentinel lymph node is one of the most important actions in the identification and treatment of breast cancer and the nanotechnology device eliminates the use of radioisotopes, thereby avoiding exposure of patients and surgeons to radioactivity. As well as this the costs of treatment are greatly reduced.

These are just a few of the exciting and beneficial developments happening in the field of nanotechnology right now. Whilst Japan and America are clear market leaders when it comes to the number of patents submitted per country, the number submitted from the UK is now growing.

BIO & PHARMACEUTICAL SECTOR ADOPTION

A number of commentators over the past few years have speculated that nanotechnology is the wave of the future in biotech and pharma. However,

there is a large disparity between these predictions and actions of the very companies that are in a position to make them come true.

Nanotechnology appears to be following the classic bell-shaped adoption curve for any technology. When a new technology appears, there is initial excitement created, which hypes its promise to be the next great answer to all our problems.

Usually the hype is caused by the fact that the technology and its applications aren't actually understood and so the imagination allows one to think of numerous areas where it could add value, resulting in overstatement of its promise. This is then followed by disillusionment as people see the hype not matching the reality. Finally, full adoption is achieved as the technology proves itself in the market. The authors believe that nanotechnology has passed through the low point of the trough and that we are now seeing real products being developed, which will fuel further investment. It is at this point where the UK companies should invest in the technology to ensure we ride the wave and benefit from the technology.

In the current market climate, companies need to get their products to market quickly to allow as much market exclusivity time as possible – not to recoup their investment, as this is a sunk cost, but to recoup the cost of developing future drugs, the cost of which is becoming ever more expensive.

Given these issues, companies won't adopt new technology, however brilliant the science is, unless they know that the technology has a clear and fast route to approval. This is particularly poignant in drug formulation and other rate-limiting activities that occur post-patent filing. Once a patent is filed, the clock is ticking on the product's life. If a product is going to be a $1billion a year blockbuster, lost revenues will be at least $2.7 million for every day a product is held from the market. This produces a catch 22 scenario; no-one will take the risk to demonstrate a new technology, especially if it is competing with existing and proven methods, so no-one will see a clear adoption path and use it.

FUTURE OF NANOTECHNOLOGY

The future of nanotechnology has been at the centre of many discussions in recent years. Ideas have gone from the far-fetched and elaborate to more realistic patents with beneficial and revolutionary effects.

Recently, scientists have constructed functioning vascular systems that are capable of supplying nutrients and oxygen to tissue, a crucial step towards being able to build functioning organs. Tissue engineering methods have successfully produced skin and cartilage within laboratories as well as one-layer systems of kidney and liver cells that have been successfully implanted in rats.

Nano-particles are being developed to detect physiological changes within the body and can release drugs at certain times depending on these changes.

There are still many areas where nanotechnology can be predicted to provide signifcant benefits. Some will come to fruition, some won't. The important thing is that we should explore these ideas so that we do benefit from technological advancement.

DO WE NEED TO WORRY?

As with all new technologies, we don't know everything about a product until it has been developed, characterised and extensively tested. There are significant efforts in the UK and globally to study any possible dangers of nanomaterials as they are produced and there are also strong safety systems in place, ensuring any threats are detected and countered.

Given the number of benefits nanotechnology can bring to the UK and the positive socio-economic effects it can have on the country, the only matter it seems that we should really be worried about, is nanotechnology advancing elsewhere while the UK is left behind.

CONCLUSION

The field of bionanotechnology is clearly moving forward rapidly and there is no doubt that it will enhance our understanding of biology and how biological systems work. Nanotechnology is being used to help resolve some of the pharma and biotech industries' significant problems.

In the future, nanotechnology will enhance the drug discovery process, through miniaturisation, automation, speed and reliability of assays. It will also enable greater selection of the right drug for the right patient and mean that the tests to support this decision process can be done immediately in the doctor's clinic.

Nanotechnology has a lot to offer the pharmaceuticals industry and if it follows previous technology examples such as biotechnology, the successful early adopters will reap the rewards. It still has a number of hurdles to leap, such as a clear regulatory pathway and a demonstration of value above and beyond current technologies, before it can become mainstream, but there are significant efforts by industry and governments to help it to jump the technology adoption gap quickly.

As with most technologies, nanotechnology will develop over time. It is still in its first phase of development and industry leaders believe major growth will occur between 2015 and 2035, providing the UK public, academia and research facilities support it now. A balance needs to be struck to ensure that the science moves forward, but does so carefully with public support. If the UK wants to remain a leading knowledge economy it cannot afford not to be at the forefront of nanotechnology.

SUPPORT BY THE NanoKTN

The Nanotechnology Knowledge Transfer Network (NanoKTN), one of the UK's primary knowledge-based networks for Micro and Nanotechnologies, was set up by the Technology Strategy Board, to promote and facilitate knowledge exchange, support the growth of UK capabilities, raise nanotechnology awareness and provide thought-leadership and input to UK policy strategy.

The NanoKTN has a number of different focus groups working across a number of different areas, designed to act as a three way communication channel between industry, academia and the funding authorities. Focus groups are available to all NanoKTN members and further information can be found at www.nanoktn.com

Membership of the NanoKTN is free. For further information on the UK MNT community and the NanoKTN, please visit www.nanoktn.com or email enquiries@nanoktn.com

USING NANOTECHNOLOGY FOR BETTER BIOLOGY-TECHNOLOGY INTERFACES

Stéphanie P. Lacour
University Research Fellow of the Royal Society,
Nanoscience Centre,
University of Cambridge

Nanotechnology is in essence a multidisciplinary endeavour, which has already had an impact in most branches of technology ranging from the communication, robotics, and optelectronic industries to biology and medicine. Nanotechnology refers to the engineering and manipulation of materials and structures at the atomic and molecular level, typically ranging from 0.1nm to 100nm. Without doubt, one of the greatest assets of nanotechnology is in combining nanomaterials and related tools with biomedical technology. Accurate and early-on diagnosis, localised and selective treatments, biomimetic and functional repair are the holy grail of medicine. In addition nanotechnology offers the capability to bring the quest at hand.

The human body is complex, multiscale machinery; limbs and organs are macroscopic (>1cm) elements; cells are microscopic (10-100μm wide) structures; and human biology happens at the nanometer scale. DNA strands are about 2.5nm wide; proteins may be tens of nm long; viruses are a few hundreds of nanometers in diameter. Nanomaterials are man-made, engineered materials, which have size scales comparable to their biological counterparts, and may be manipulated both at the nano- to macroscale. With matching geometry, nanomaterials and nanostructures offer a route towards enhanced biocompatibility and interaction between engineered and biological systems.

A few examples of recent studies using nanotechnology in medical sciences are highlighted in figure 1. Nano-tools such as atomic force microscopy allow for the study of the biological and physical properties of structures such as amyloid fibrils (which most likely play a role in neurodegenerative diseases). Micro- and nanofabrication tools eg electron beam lithography provide new design approaches to develop faster computing circuitry and engineer 3-dimensional biosensing devices. Furthermore, nanomaterials offer not only improvements in current medical diagnosis and therapeutic techniques but also may provide new solutions for physiological repair.

IMPROVED DIAGNOSIS

Cancer is often detected using imaging techniques such as Magnetic Resonance Imaging (MRI). Contrast agents may be preliminary injected intravenously to the patient to enhance the appearance of specific tissues such as blood vessels or tumours. The technique is usually non or minimally invasive for the patients. Nanoparticle based contrast agents such as. quantum dots – nm size diameter spheres made of semiconductor material, colloidal metal or magnetic particles have shown great promise for high resolution and sensitivity imaging of cancers. For example, superparamagnetic iron oxide nanoparticles have been successfully used to visualise cancerous cells in the liver.

Other imaging techniques eg Computed Tomography (CT)

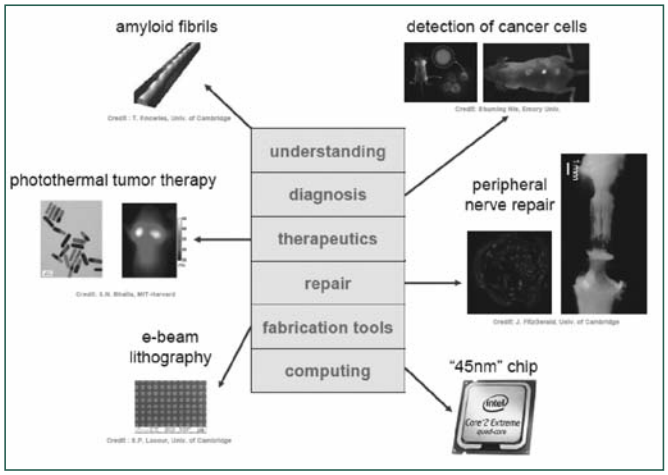


Figure 1. Nanotechnology provides unique materials and tools to explore, diagnose, treat and repair biological systems.

and ultrasound scanning also benefit from nanoparticle contrast agents. For instance, gold nanoparticles provide enhanced imaging in CT scans compared to standard iodine contrast medium.

As nanoscientists design and engineer the nanoparticles, there is a vast library of available materials for disease specific enhanced imaging. Equipped with smart nanoparticle contrast agents, optical imaging techniques have most certainly the potential for early cancer detection. Furthermore, as nanoparticle contrast agents have a better optical stability than conventional organic dye contrast agents, recording of "live" biological events may become available, and therefore provide unique information about inflammatory development, angiogenesis and thus disease progress.

TARGETED THERAPEUTICS

Drug delivery is one of the most advanced applications of nanotechnology in medicine. In this case, nanoparticles are designed not only to bind to specific cells in the body but also to deliver one or more bioactive molecules to those cells. The nanoparticles are taken up by the cells due to their small size. The activation of the nanoparticle, ie the release of the drug, may be spontaneous or triggered by pH change, near-infrared light, enzymatic response inside the cells, etc.

Whilst successful, targeted therapeutics is not without challenges. Numerous mechanisms may prevent the nanoparticles from reaching their target in high enough concentration to treat efficiently the malignant cells. The circulation in the body of the nanoparticles, their elimination and eventual accumulation in specific organs are additional concerns. Further improvements of nanoparticles' geometry, architecture and biochemical properties are currently part of active research.

FUNCTIONAL REPAIR

Unlike the salamander, humans don't have the ability to self-repair and regrow injured or missing biological tissues. Nanotechnology may not change that statement but offers promising alternatives based on tissue engineering, smart prosthetics and regenerative medicine.

For example, scaffolds for tissue repair have been developed for decades. They include matrices for bone, cartilage, teeth, skin, cardiac and vascular tissues, and the nervous system. But none of the current implants offer long-term endurance and true functional recovery. One recent route of investigation is the biomechanical interface between the cells and the "man-made" surfaces. This is being explored with nano-tools such as atomic microscopy which allows for the study of the physical properties of cells and their response to the mechanical compliance of the surrounding medium. Data shows that cells differentiate surface elasticity and topography, and therefore proliferate preferentially on certain ranges of compliance. Based on these findings, the design and fabrication of scaffolds and prosthetic implants are being revisited and will hopefully provide improved biocompatibility.

CONCLUDING REMARKS

For the first time, scientists have the ability to select, manipulate and/or interact with cells and biological structures at the molecular and cellular levels. Still there is a lot of uncertainty associated with this. The good news is that the scientific community, governments and the public are not only aware of the high-end promises of nanotechnology but have already stepped aside to anticipate potential health, environmental and societal risks associated with by-products of nanotechnology. Worldwide studies are conducted to evaluate and quantify potential hazards associated with nanotechnology and its derivatives. This is a lengthy and non trivial process given the wide range of engineered nanomaterials and nanostructures, and the plethora of exposure modes.

Although comprehensive data are not yet available, strict guidelines must be drawn up and applied regarding the handling, the modes of exposure, and the disposal of nanomaterials. Moreover, given the pace at which nanotechnology develops, such protocols must be revisited and updated regularly, every few months or yearly, in order to incorporate new research and practice findings, and offer the most up-to-date code of behaviour.

Science and innovation are always associated with potential risks, but those related to nanotechnology are anticipated and thus should be controlled.

Professor Vicki Stone of Napier University, who attended the meeting, continues the debate in an article on pages 38 and 39.

DURING DISCUSSION THE FOLLOWING POINTS WERE MADE:

The setting up of the Human Genetics Advisory Council was an example of ways one can use to try to allay public fears. A question whether regulation is needed and whether it should be developed locally or worldwide was raised. REACH already exists to regulate chemicals on a Europe-wide basis but only deals with substances that occur in volumes exceeding one tonne. However nanoscale products are usually produced on a much smaller scale that do not fall under REACH. Nanoscale products which are embedded are safer whereas freestanding nanoscale products are different as they have potential for release into the environment. Nanotechnology is an enabling technology concerning a limited size range of particles which extend across the range from biology to quantum physics. For example, solar cell efficiency can be increased from 8-10% by the use of nanostructure in the cell, resulting in transfer of this technology to industrial production in the near future. Energy storage in super capacitors is another area of current interest. Turbine blade performance can be greatly improved by surface treating the blade with nano-structured diamond. Nanomembranes also provide opportunities to clean up water supplies and reduce, for example, the amount of medication in water supplies contaminated by waste from upstream sources.

The KTNs are a very useful way of getting knowledge out of universities and into industry. Rationalisation, which is the responsibility of the Technology Strategy Board, will not affect the NanoKTN.

Regeneration of the spinal cord is an area of current work also undertaken by the Regenerative Medicine Network which is about to embark on clinical trials. Gene therapy is another area of current interest requiring care especially when inserting a new heritable gene capable of transfer to subsequent generations. Clearly nanotechnology is a topic of global importance with great potential to bring benefits to humankind provided the necessary precautions are taken.

AN ENERGY POLICY FOR BRITAIN: CONSERVATIVE THINKING

Charles Hendry MP
Shadow Minister for Energy

The current liberalised market was the brainchild of Nigel Lawson who, in 1982, gave a speech in which he said: "energy is a traded good…the job of government is to remove distortions in the market place". The competitive market ensured diverse and sustainable supplies at competitive prices for decades.

But what was good for 1982 certainly no longer applies today.

For much of the last 25 years the UK has been awash with its own oil and gas supplies. It is easy to have a hands-off policy when you know the lights will stay on, but when you have to appeal to corporate boards in France and Germany, persuading them that Britain is the right place to invest, it can't just be left to the market.

In addition, it is clear the current framework has been assiduous at sweating assets and developing CCGT plants. We are now in a position where, in the words of Wulf Bernotat of E.On: "You have old nuclear plants, old coal, expensive gas, a need to invest in renewables to reach unrealistic targets, and a slow [planning] process. Doesn't that sound like a problem to you?"

And now, to the twin old challenges of affordable and secure supplies, we must add the need for low carbon and renewable energy, as tackling climate change moves to centre stage. The challenge for Government now is to ensure diversity of supply, a reduction in carbon emissions and affordability for customers.

The current market structure will not deliver all of these aims. It is for this reason that there must now be greater Government engagement in energy policy to remove all barriers to investment and achieve our goals – a theme which will be developed in more detail in a Conservative energy policy paper to be published in the autumn.

An important aspect of retaining diversity of supply and reducing carbon emissions is to develop carbon capture and storage. We have already said there should be no new coal without CCS attached. To this end we have proposed at least three large-scale demonstration projects, each of the order of 600MW, using either pre-combustion, post-combustion or oxy-fuel combustion technology to be built using the receipts from EU ETS certificates. Government will be required to invest significant amounts in the infrastructure and so all of the additional costs associated with the carbon capture and storage technology will be covered by the Government in these demo projects. There is also a natural role for Government in installing oversized pipelines from plants in clusters and then having generators pay for access to that grid.

We welcome the degree to which the Government has moved to accept our policies which give a new life to coal as part of the UK's energy mix. We were disappointed however that the Government did not take this opportunity to match our pledge for an Emissions Performance Standard of around 500g of CO_2 per kwh to begin with and then gradually decreasing over time.

In order to ensure that funding is available for this project and others, the carbon price must remain predictable and relatively strong. The Climate Change Levy as it currently stands is a straight tax on business. We have proposed reforming it so as to make it a genuine tax on carbon which we envisage will become the floor price for carbon. This must be implemented carefully and at the right level so as not to adversely affect the competitiveness of British business.

Despite demand destruction resulting from the recession, it is clear that we are facing an energy gap. The Large Combustion Plant Directive means that 8GW of coal-fired plant must come offline by the end of 2015. In reality these power stations are running down their 20,000 remaining hours at a rate which means they could start to come offline as early as 2013. This in turn means that they are now making decisions about whether to replace parts and undertaking selective maintenance so that they do not waste money on plant which will be coming out of service in a few years' time. It is clear to us too that the Directive will have a particular impact on the UK, because we have an ageing coal-fleet which would cost more to 'opt in'.

Without energy security we won't have affordable energy or meet our climate change

objectives. Energy security is therefore a priority and one of our major concerns is our growing reliance on gas. Under the current market structure the UK is moving towards 60-70% of its electricity being generated from gas, as old coal and nuclear plants come offline and are replaced by gas plants only. Around 80% of this gas will need to be imported as our indigenous supplies on the UK continental shelf dwindle.

Most countries which rely on imported gas have invested in gas storage facilities to prevent any shock ruptures to supply or price spikes. Indeed, in the recent difficulties between Russia and Ukraine, Germany was able to meet its needs and export to neighbouring countries experiencing difficulties because of the investment it has made in gas storage. But whereas France and Germany have around 100 days' worth of storage capacity, the UK has just 14. Labour's failure to secure investment in new storage has put our energy security sorely at risk.

The barriers to development are huge and many of the projects currently planned are simply aspirational or have already been rejected by the Secretary of State. In order to push on with gas storage we need a body which will look at the obstacles and remove them, in much the same way the Office for Nuclear Development has done in nuclear. The OND has been very effective in pushing away the barriers and now the UK looks to be the most exciting place in the world for new nuclear.

The gas inter-connectors are also key to energy security. In January, Britain imported 26mcm of gas per day through one pipeline, but at the same time, the Bacton inter-connector was pumping out 25mcm per day. Whilst this is a shining example of how well the market is working, it is clearly less good for our energy security. The UK's gas storage had decreased to just a few days' worth in January during the Ukraine-Russia dispute. As another example of where a greater level of engagement in the market is needed, it has been suggested that those burning the gas could be required to keep a minimum level of gas during the winter months or whether there should be a trigger point at which we cease to export any gas through the pipelines.

The issue of planning is clearly of enormous importance to the huge infrastructure projects we have to undertake in the energy sector in the coming years. Whilst we agree with the Government that applications need to be processed more swiftly, we believe that they have gone too far away from the democratic legitimacy brought by the final decision being made by an elected representative. To this end we have proposed that the Infrastructure Planning Commission be abolished and its back-office capacity be subsumed by the Planning Inspectorate. The Planning Inspectorate will then make their recommendations to the Secretary of State rather than have a final decision made by a quango with no recourse to public opinion. One of the concerns often made is that recommendations are often left on the Minister's desk for several months and we are seized of the need to keep that period short. There does not need to be a distinction between democratic accountability and prompt decisions.

The uncertainty which arises from a new procedure will also be unwelcome in the industry and so our commitment is to put in place transitional arrangements which cause no delays or uncertainties. And there will be no return to the current section 36 approval process once we are in the process of abolishing the IPC.

To ensure our security of supply we will require energy from a diversity of sources. Nuclear will be part of that mix so long as it is economically viable and does not require subsidy. We recognise that this stability of public policy is crucial to investor confidence and we will do nothing to upset it. Adequate resources for the Nuclear Installations Inspectorate must be maintained to keep the roadmap spelt out by the Office for Nuclear Development on track for completion in 2018.

There is scope for extending the life of some of our non-Magnox nuclear plants but this should be seen as a bonus rather than relied upon to provide our energy security: if a fault develops, it could cause a shut-down of all of the plants leaving us potentially short of supply at a critical moment.

On renewables, it is clear that the targets set for 2020 are extremely ambitious, all the more so because of the Government's lack of a roadmap. If we are to achieve 15% of our energy from renewables, it is patently in our interest that we have a roadmap with dates setting out exactly what we need to achieve and by when. Without a plan, a target means little.

The Government has clearly focused on wind to the detriment of all other renewables because it sees it as the only technology which can help it to achieve its arbitrary targets. We should avoid picking technologies which will help us to achieve a political solution when better and more effective technologies might provide a better technical solution.

The UK has 11,000 miles of coastline and already the world's first tidal power turbine in Strangford Lough in County Down. We have a Marine Renewables Deployment Fund worth £50m of which only a portion of the £8m set aside for environmental work has been used and none of the £42m in the deployment of marine technologies. If the terms of the fund aren't working, they need to be changed. Likewise the £50m fund for British renewables companies set aside by the Export Credit Guarantee Fund to underwrite the debt during export which remains unused because it is unable to give terms more favourable than a commercial bank. We should be removing obstacles to marine development and the long anticipated but still unseen Office for Renewable Energy Development should be hurried along.

In January David Cameron launched the *Low Carbon Economy* paper in which we set out proposals for a set of Marine Energy Parks similar to the European Marine Energy Centre in Orkney. It is anticipated that local authorities, businesses and educational institutions clustered by the coast will come together to build Marine Energy Parks to develop technologies here in this country. It is perverse that British companies such as Pelamis have found the support structure in the UK so unhelpful that they have instead taken their technology to Portugal where the regime is more benign.

We want to make Britain the most exciting place to do business in the energy world and with these policies we hope to do so.

CCS – MAKING IT WORK

Dr Andy Read
Clean Coal Business Development Manager, E.ON UK

GAME OVER WITHOUT CCS

The question I was given as the basis of my presentation to the Committee was "CCS – will it work?" I would argue that it is not a question of whether carbon capture and storage (CCS) will work – I am in no doubt about the technology – instead we need to focus on *how* we make it work, because when it comes to tackling climate change, no CCS means it's game over.

It is important to recognise that the UK produces only about 2% of global emissions – China and the USA are the world's largest emitters and China alone is building 70GW of coal-generated power per year. That is the equivalent of the UK's entire capacity. The Royal Society, Sir Nicholas Stern and the Climate Change Committee have all said that CCS is essential on a global basis because coal will continue to be burned.

In the UK we face our own set of challenges – one third of our current generation capacity is set to close by 2020, the Climate Change Committee sees electricity being largely decarbonised by 2030 and the EU has committed to producing 20% of its energy from renewable sources by 2020.

However, there is no silver bullet. We have to ensure we have a diverse energy supply that delivers reliable, low-carbon power. Wind is a key source of renewable energy but studies suggest that as much as 90% back-up generation capacity will be required for when the wind doesn't blow. Nuclear is low-carbon and secure but inflexible. This means we also need fossil plant to provide flexible, back-up base load power – this means gas and coal and it has to mean CCS.

The Secretary of State, Ed Miliband, has said there is "no alternative to CCS if we are serious about fighting climate change and retaining a diverse mix of energy sources for our economy" and the Conservative Party has also recognised the importance of CCS. What we now need to do is take the technology forward on a larger scale.

THE TECHNOLOGY IS PROVEN

The capture technology is already working on a smaller scale. In Japan there are industrial CCS plants operating commercially on a fifth of the scale proposed for the first UK demonstration. The only reason it hasn't been scaled up is because there is currently no commercial driver. Pipelines are already being used for the transportation of carbon, most notably in the United States. It is a myth to say the technology isn't proven.

There are also several myths around how secure the store is – it is sometimes claimed that the CO_2 might leak significantly. In fact the CO_2 captured will be sequestered (locked away) permanently. The storage sites identified will be geologically sound and many will have held gas or oil for millions of years. Over time, the CO_2 will dissolve in water already trapped in the rocks. This makes it heavier than water without CO_2, so unlike natural gas and oil, the buoyancy that drives leakage will gradually disappear. CO_2 also slowly reacts with some rocks to create a carbonate (solid). Where this happens, leakage would become impossible. We have identified a number of suitable North Sea CO_2 sinks for storage including the Hewett gas field, where we are already working with the current owners

E.ON AND CCS

It is a common misconception that we are seeking to expand coal in the UK as we are in fact closing two of our three coal-fired power stations, and only seek to build one new plant. The existing coal-fired power station at Kingsnorth in Kent is due to close by the end of 2015 and, as a replacement, we have proposed a new power station that would be 20% more efficient and would meet all the modern standards on emissions.

If the new Kingsnorth power station was built it would enable CCS in the UK, either as demonstration or as commercial roll-out. It's important to be clear – E.ON would expect to fit full CCS to a new power station at Kingsnorth within the first decade of its operation.

. . . Pipelines are already being used for the transportation of carbon, most notably in the United States. . .

OUR VISION FOR A THAMES CCS CLUSTER

Our vision for the Kingsnorth project is for it to act as a gateway to CCS development in the UK, enabling the development of a 'CCS Cluster' for the south east of England. We believe the south east is the right location for the first such cluster in the UK. London and the south east have the highest level of energy demand in the UK – London and the Thames demand equals that of Yorkshire and Humber and Scotland combined. We expect this to continue, particularly as we look to the electrification of transport. It would also make a significant contribution to the economic development of the area.

BARRIERS TO INVESTMENT REMAIN

However, barriers to investment remain and we will not build Kingsnorth unless we have a business case. Utilities need secure funding in order to develop large scale CCS. The carbon price is too low and too uncertain at the moment to support investment without further support – particularly as the early large-scale CCS demonstrations will have higher costs. In turn we believe mandating CCS on coal without financial support would simply drive a switch to gas – there would be no incentive to invest in this new technology.

The need for incentives has been recognised by the Government, the Conservatives and the European Union. The UK Government is running a CCS demonstration competition and is proposing further demonstrations before 2020, which we welcome. Our Kingsnorth project is entered into the existing competition for a 300MW post-combustion demonstration. The main benefit of post-combustion technology is that it can be retrofitted to existing power stations. Although the capture element is likely to be more expensive for post-combustion, the base power station is cheaper so it is comparable economically to pre-combustion technology such as integrated gasification combined cycle (IGCC) plants.

The EU will launch its 'flagship' demonstration programme next year and an €180M grant as part of the European Economic Recovery Programme is available to one UK project, to be allocated at the end of this year. We have also entered this competition and have submitted plans to procure an oversized pipeline for the transportation of CO_2 which we believe is the right long term solution. It would promote the development of a Thames Cluster, effectively 'future proofing' a CCS transportation system around the Thames and Medway estuaries (ie it avoids the need to fit new pipelines for future projects). At 36 inches (diameter) the pipeline would have the capacity to transport 24m tonnes of captured CO_2 to storage sites under the North Sea, equivalent to all the carbon captured from 3GW of coal and 4GW of gas-fired plant. It would mean the development of infrastructure that would be highly attractive to other industries and would also have a significant impact on carbon emissions, as well as potentially acting as an example for the rest of the world on low carbon energy.

The Conservative Party is also committed to supporting CCS projects in the UK and we welcome the broad agreement on this between the main political parties.

WE NEED A BUSINESS CASE BEFORE WE CAN INVEST

However, utilities still need a business case for new coal with CCS. Too much risk will deter investment. This concern around investment is not aided by the other uncertainties in the energy market. Market reform may be needed but uncertainty around the future structure may also delay investment.

The UK has a great opportunity to lead the way on CCS. If it went ahead we believe a new power station at Kingsnorth with CCS would be a fantastic project. It would provide global leadership on CCS, with demonstration and later full CCS roll-out on a commercial, modern coal plant. It would help to support security of supply and fuel diversity for the UK and would promote the development of a Thames CCS Cluster to enable the de-carbonisation of power in the South East of England.

DURING DISCUSSION THE FOLLOWING POINTS WERE RAISED:

Carbon price is not the only driver to the delivery of Carbon Capture and Storage (CCS) as the application of different technologies will vary in cost although a basic cost of £30/tonne for carbon may be about right. In the case of retrofitting, this will not always apply and in some cases will not act as an effective driver. Direct Government support is more important than the actual price since in the UK the coal burning power generation facilities are much older than in the rest of the EU where retrofitting may be more applicable, as those facilities will have a much longer overall lifespan than those in the UK. Prototype CCS demonstration power plants are also more expensive to build than subsequent copies

Powerfuel plc owns and operates the Hatfield Colliery in South Yorkshire through its subsidiary, Powerfuel Mining Ltd. The Hatfield colliery has access to approximately 100 million tonnes of British coal. Powerfuel is probably best known, however, for its plans to build and operate the first commercial, large scale, coal fired power station with Carbon Capture and Storage (CCS) in Europe through another subsidiary, Powerfuel Power Limited. The Hatfield IGCC (Integrated Gasification Combined Cycle) project will be situated adjacent to the colliery, will have a gross output of 900MW and will capture around 90% of the carbon produced. The Hatfield IGCC project, which uses an innovative 21st century "pre-combustion" technology for carbon capture, was however excluded from the UK Government competition to build a demonstration CCS plant, which was launched in November 2007. The competition, which was designed to demonstrate internationally the UK lead in this technology was very poorly specified as it was restricted exclusively to "post-combustion" 20thC technology.

However, on 20th March 2009 the EU Presidency approved €1.05 billion of financing for certain specified CCS projects as part of the European Economic Recovery Plan. It is the intention of the EU to make this financing available in 2009 and 2010 and the financing will be executed following the order of the projects' maturity. The €1.05 billion includes €180 million for four named UK based projects; the three remaining projects in the UK's CCS demonstration competition and the Hatfield IGCC project.

Other countries considered potential beneficiaries of UK technological development, such as China, for example (who sent a high level delegation to the UK which was hosted by the P&SC to investigate the application of CCS in the UK) have recently overtaken the UK Government in the development of CCS technology. Both pre-combustion and post-combustion technologies may operate effectively if there is a funding stream available to support them, without which nothing can happen. The urgent priority now is much closer to home to ensure the necessary work is undertaken as soon as possible to provide energy security in the short term due to the imminent closure of much of the UKs existing and outdated coal burning and nuclear power generation facilities, unless it is the Government's intention to become increasingly dependent on Russia for essential power supplies in the short term.

ERGONOMICS AT 60 – A CELEBRATION

Reg Sell

A past president of The Ergonomics Society and Life Member Parliamentary and Scientific Committee

INTRODUCTION

2009 represents a significant landmark for ergonomics as a science and as a profession, and also for the Ergonomics Society. We are celebrating 60 years of the Society by reviewing our past achievements and anticipating future challenges.

Ergonomics is about designing solutions to problems that are optimised for the people involved. Ergonomics can help people perform better and help them make less mistakes and safeguard their health, whether it is in a factory environment, a control room, a transport system or a hospital. The challenge for the modern ergonomist is to encapsulate within one organisation what our founding fathers discovered during their wartime collaboration – that they could achieve together what could not have been achieved by any one discipline. Their post-war meeting in 1949 which marked the formation of The Ergonomics Research Society was our first landmark. The subject is now well established – the next landmark will be when it becomes second nature for anyone to call for ergonomics input.

A DEFINITION OF ERGONOMICS

The International Ergonomics Association gives the following definition: "Ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimise human well-being and overall system performance." We can all practise ergonomics. What makes ergonomics different from its constituent disciplines is that it is the interactions which we seek to understand and context is everything; from medical equipment and transport through consumer products and office equipment to submarines, aircraft and power stations. Ergonomics improves the way we work, the way we play, the way we live resulting in improvements in products, workplaces and homes that make our lives easier, safer and better. Organisations can be transformed if they apply ergonomic principles to the way their employees work.

IN THE BEGINNING – A BRIEF HISTORICAL SUMMARY

Ergonomics has a long and fascinating history and its origins tell us a lot about ourselves and the changes to our working lives. Although the modification of industrial processes to make them more efficient, the improvement of working conditions and the removal of health and safety hazards, have been going on for as long as the industrial process itself, the applied science of ergonomics stands out for its fresh approach and the combination of techniques it involves. The growth of industry during the last 200 years, whilst it has made human beings increasingly dependent on the machine, has helped them achieve a higher standard of living and given them an increasing measure of control over their environment; it has also, however, brought hardships and suffering to workers. From the time when the first textile factories were built, industrial structures and machines have tended to be conceived with an eye to the process rather than the person who operates it.

Developments and scientific investigation were slow to evolve and efforts to combine the man-machine complex more successfully were mainly directed to improved productivity. The need to pay equal attention to the human factor in industry developed very gradually.

It took two world wars to stimulate positive action. It was not until the First World War that attempts were made to investigate human performance in industry and scientific investigations were made into the relationship of working conditions to health. For instance, concern about fatigue in munitions factories in the United Kingdom led to the establishment of the Industrial Fatigue Research Board, and physiologists and psychologists conducted investigations into the effect of working conditions on health and efficiency. These pioneering studies had relatively little impact on industry in the 1920s and '30s and progress was slow, possibly because a surplus of labour removed the demand for economy in labour.

The Second World War gave impetus to the study of human performance, because the extreme demands that were placed upon responsible personnel led to difficulties in the control and operation of radar, anti-aircraft tracking systems, high speed aircraft and other intricate military equipment. The complexity of these devices, the need for effective design of operations plotting rooms and for the development of suitable clothing for extreme weather conditions, the establishment of design criteria to satisfy the human requirements of tank drivers for protection, visibility and efficiency, and similar problems all emphasised that technical developments had reached the stage at which the capacities of the operator rather than the potentialities of his equipment were setting limits to the performance of men and machines working together. If further progress was to be made it was therefore necessary that these human limits should be studied and that equipment should be designed in relation to them.

In the 1950s technological developments in industry, often associated with the concept of automation, resulted in the construction of machines which threatened to make excessive demands on their human operators; some of these turned out to be too complex for a man to control effectively. In consequence, ergonomists have increasingly been called on to make their findings available as a guide to design engineers. It was thus that 'human engineering', or ergonomics, first came into prominence.

ERGONOMICS TAKES THE VOTE

Although the UK Ergonomics Society was the first such organisation of its kind in the world its formation was followed by the International Ergonomics Association and the French, Dutch and Australian societies in the 1960s. However, the name for the UK society was hotly debated. There was an overwhelming majority initially in favour of including the word 'Research' in the name. This points clearly to the thinking of those who founded the Society: that it was an association of people working in the field of research. The creation of an applied science of ergonomics was not envisaged at that time. It was the emergence of the idea that an ergonomist can be an individual applying research results rather than being engaged on research which caused so much heart-burning over subsequent years and led to the change of name to The Ergonomics Society.

There was a good deal of criticism of the term 'ergonomics'. It was thought to be ugly, apt to be confused with economics, and incomprehensible. Sometimes similar criticisms are heard today and, in part, have resulted in present moves to change the name of the Society to The Institute of Ergonomics and Human Factors. The formulation of the rules made the objectives of the new society reasonably clear. At that time, the intention was to conform to the pattern of a learned society with the emphasis on both scientific meetings where research results could be presented and discussed. and at the same time, an emphasis on communicating results to industry. These are still the aims of the Society today.

SOME EXAMPLES

Control rooms

Ergonomists have been involved in the design of control rooms for power stations, chemical plant, steel works, air traffic control, emergency services, railway operation and for many other situations.

Transport

Ever since World War Two ergonomics has had a strong role in all aspects of transport air, sea, road and rail. The Society has recently set up a Special Interest Group on motorcycling.

Sports Ergonomics

An ergonomics perspective is crucial in securing the safety and enhancing the performance of participants in sports. Sports ergonomics is concerned with optimising the relationship between the individual, the task, the equipment, and the sport and training environment. Success at all levels of competition is more likely to be realised when this harmony is achieved; at the elite level ergonomics factors often determine the outcome.

Physical aspects

Ergonomists have had great success in this area and the EU has produced directives on manual handling and work with computers.

Military equipment

There have been requirements for ergonomic factors to be considered in the design of all kinds of military equipment.

APPLYING ERGONOMICS

The work of ergonomists has directly or indirectly led to improvements in the way we live and has had a major influence on us all, often with little or no realisation on our part, and can make us healthier, safer, more productive and make life more pleasurable. Listed below is a selection of the headlines generated by this work in the past:

- A systems approach to design gains popularity in many domains such as safety and healthcare ergonomics.
- Ergonomists were involved in the development of a hospital bed, which later became a British Standard for the NHS.
- Reaction times, speed and efficiency of older persons were studied, and later their job satisfaction and problems adjusting to new working environments.
- A systems approach within the military is applied to the design of ships' operations rooms, vehicle environments aircraft cockpits and fleet information systems.
- In the home, ergonomists are involved in the development of domestic appliances including electric drills, electric carving knives, record players and hairdryers.
- Trials of alternative layouts led to the control room design for the ESSO refuelling depot at Heathrow Airport.
- The relationship between circadian rhythms and physiological changes has been investigated in relation to shift work patterns, design of rotating shift systems and individual selection.
- Analysis of accident patterns within the steel industry allowed for accident avoidance and reduced absence.
- The Flixborough chemical plant disaster changed the emphasis on safety to the causes of accidents and disasters, which led to the development of health and safety legislation.
- Studies consider the effect of in-car radio, mobile phone use and other concurrent tasks on driving, and the implications of fatigue during prolonged driving on the impairment of skill.

RECENT DEVELOPMENTS

Over the last decade or so there has been a big increase in the application of ergonomics to railway operation following the Ladbroke Grove accident and the associated inquiry.

Health care is another area where there has been an increase due to the recognition of the huge number of design-induced errors in hospitals resulting in many people suffering health problems.

There is an increasing interest in the socio-technical approach where it is the total organisation which is studied.

There is continuing consideration of the role of the human being in relation to the technology. How far should we go towards complete automation whether it be driving a car or controlling air or rail traffic?

THE FUTURE

All too often, in the past, the importance of ergonomics has only been appreciated after disasters such as the Ladbroke Grove railway accident, the many aircraft crashes due to bad cockpit design and the failures of many large scale IT systems to meet their full potential due to difficulties with their user/machines interface

Hopefully, in the future, we will consider the user at the start of designing any system or piece of equipment. We will cease to blame the worker for a design-induced error or put in health improvements only after the damage has been done. Perhaps ergonomics and its potential benefits for mankind will deserve increased attention by Parliamentarians in the future?

The anniversary is being celebrated by an exhibition at The Design Museum from 18 November to 14 March 2010

For a definitive chronology of the Society, see the Ergonomics Society website at www.ergonomics.org.uk > About the Society > History.

POSTCARD FROM AUSTRALIA: INFRASTRUCTURE AUSTRALIA

Robert Freer

Robert Freer has recently visited Australia to collect information about the long-term planning of their national infrastructure. The visit was partly supported by the QUEST fund of the Institution of Civil Engineers.

Water is an important commodity in Australia. I arrived in Sydney at the end of a week of steady rainfall and the fact that the reservoirs were then 60% full was a sufficiently important matter for an announcement by the Premier of New South Wales State to allow an easing of restrictions on the watering of gardens. Even Lake Eyre in South Australia had water in it, which does not happen very often.

But for the rest of the world Australia is an important source of minerals, not only gold and silver but also industrial minerals including coal, iron ore, bauxite and uranium. Transporting these minerals to the docks for export to meet world demand requires investment in a modern and robust infrastructure and efficient and well organised shiploading facilities.

The Australian Federal Government has been concerned for some time about the state of the national infrastructure. Its condition has apparently been deteriorating as a consequence of lack of funding and development, creating bottlenecks and backlogs which were thought to be damaging the national economy. Developing the infrastructure of any country requires long-term planning and the Australian Government decided the best way to achieve this was by setting up a panel of experts who are separated from the day to day work of politicians and are able to recommend long term objectives, priorities and funding proposals.

The expert panel is called Infrastructure Australia. It was set up in 2008 and consists of 12 specialists drawn from the public sector and from industry. Their objective is to prepare a long-term plan for the infrastructure which is detached from the electoral cycle so that continuing infrastructure development can go ahead whichever party is in power.

Australia, a country the size of the mainland USA (excluding Alaska), consists of six states (New South Wales, Victoria, Queensland, South Australia, Western Australia and Tasmania) and two territories (the Northern Territory and the Australian Capital Territory). The infrastructure for the whole country is funded by the Federal Government and the individual states are invited to compete for the money available. Some of the projects, especially port and railway developments where there is a potential future income, may lend themselves to possible joint public-private funding.

Infrastructure Australia set out seven main themes where urgent action was required for future development to boost national productivity, enhance the national quality of life and protect the environment, and in August 2008 they invited applications and proposals from the individual States, and also from the general public.

The seven themes were:

- A national broadband network
- A national energy market
- Competitive international gateways (ports and associated land transport developed together)
- Secure water supplies
- A national rail freight network
- Improving city transport
- Essential infrastructure for the indigenous population

Within these themes the criteria used for selecting suitable projects included value for money, sustainability and practicality of completion.

They received over 1,000 proposals (600 from the public) and by December 2008 had whittled the selection down to 94 projects, for each of which the proposers had provided a minimum level of information to allow an assessment against the selection criteria..

From the 94 shortlisted projects the assessment process identified nine projects for construction, many of them for new highways and road works, which met the defined criteria. These projects fitted one of the seven themes, they were of national significance with the prospect of being successfully implemented and of making a positive contribution to the national policy goals. They also showed benefit-cost ratios significantly above 1:1. A further 28 projects were judged to need more development and analysis and were put in a priority pipeline for further consideration.

The Government's new Infrastructure Planning Commission has been set up with a generally similar objective to the Australian model. Long-term planning of the infrastructure needs to be separated from short-term political considerations and to be promoted and developed to suit the national needs, but at the same time ensuring that local interests are recognised and considered.

If this approach is successful then the prolonged public enquiries which have in the past bedevilled and delayed projects such as Sizewell B nuclear power station will hopefully not occur again.

CHINA - SCIENCE AND INNOVATION

Dr David Bacon
Director, China Science and Innovation, Science and Innovation Counsellor

China is on a path to becoming the world's second largest economy and its impact on innovation and markets matters to UK innovators and researchers. It is already our largest market for goods outside the US and EU and the UK is its largest cumulative European investor. Major companies, such as GSK, BP, Unilever, AstraZeneca, Vodafone and Rolls Royce, already invest substantially in technology and research.

China has set independent innovation as a top national priority. Rebuilding the nation's innovation infrastructure from a base of mass, low cost manufacturing will be challenging. If the UK collaborates in this process it can facilitate future partnership in innovation and trade.

China is a highly important science partner. It quadrupled its output of research papers in a decade and has overtaken the UK as world Number 2. In citation performance, its world share is already over 10% in physical sciences and above 12% in engineering, in 2007 outranking France and Japan in the number of top three places in major research fields[1].

China is a key partner in science and innovation to help solve global challenges – whether climate change, pandemic disease or food and drug safety. It is itself a potential source of infectious disease such as SARS or avian flu and accounted for nearly three quarters of growth in world energy consumption in 2008. It burns 43% of the world's coal, produces 37% of the world's steel and emits 25% of greenhouse gases from nitrogen fertilisers.

For reasons of promoting scientific excellence, economic growth and sustainable development the UK has much to gain from its engagement.

But China stands to gain too. Twenty-five years of UK support for university research partnership have built strong links with excellent UK science. There is strong interest from Chinese partners in world-class UK research and its record in developing effective policy. University-driven partnerships are growing, including joint postgraduate degree programmes and research collaborations. According to Thomson Reuters, over 3,000 scientific papers in 2008 included Chinese and UK authors, more than with any country apart from the US. Recent UK investments include £10m in renewable energy research from the Engineering and Physical Sciences Research Council and £10m in a Carbon Trust Joint Venture to commercialise low carbon technologies.

In addition, bilateral projects in innovation, research management and intellectual property reflect the benefits to China of working with the UK on science and innovation policy and practice. Chinese researchers engaged extensively in follow up from the Foresight projects including Flood and Coastal Defences and Infectious Disease. The Sustainable Agriculture Innovation Network brings together research and policy making at Vice Ministerial/Chief Scientific Adviser level. And a £4.8m programme in Chinese climate change adaptation led by the Department for International Development is being launched this month.

But challenges remain. Intellectual property management and market access remain an issue for UK investors and innovators. The World Bank ranks China 89th in the world for the ease of doing business. Balanced co-operation in research and in opportunities for industrial innovation should go hand in hand and benefit both parties. Both the UK and Chinese research systems have complex structures for decision making and funding that create obstacles to a strategic approach for exploiting benefits. Differences in national funding can hamper development of joint PhDs. The speed of China's rise in science poses challenges in identifying promising opportunities for UK researchers. And there are some signs of overheating in China's science, with reductions since 2005 in citation impact and impact of joint publications with the UK[1].

The UK seeks constructively to support, influence and benefit from China's development. Commitments at Prime Ministerial and Ministerial level include increasing investment, joint scientific papers and joint funding. They also include sectoral initiatives such as on food security and sustainable development.

Working with other UK agencies, the Science and Innovation Network in China promotes greater transnational innovation – through policy collaboration, bilateral programmes and sectoral initiatives. It uses science to address climate change, sustainability, health and food security. The Network is identifying areas where excellent research can be supported by new funding opportunities, focusing mainly on climate change, energy and the environment, stem cell and regenerative medicine, infectious disease, nanotechnology, materials and space. Recognising the lack of awareness in the UK, the Network is working across the country to identify what China can offer in science and technology and promote this to UK partners. And it is exploring the scope to improve the framework for University-led research partnership.

This agenda is challenging to deliver across such a large country, but critical to the UK's long term interests.

1 International comparative performance of the UK Research base, Evidence, July 2008 for Department of Universities, Innovation and Skills

SCIENCE AND EDUCATION AT THE EDEN PROJECT

Professor Sir Ghillean Prance FRS, VMH
Scientific Director, The Eden Project

The Eden Project is one of the most successful of all the Millennium projects in the UK and is known as a popular tourist destination that has done much to improve the Cornish economy. However, its main purpose is to promote public education and research in flora, fauna and other aspects of the natural world and to encourage sustainable use of natural resources.

The Eden Project is owned by the Eden Trust which is a company limited by guarantee and a UK registered charity. It depends largely upon visitor income to support its work and since opening in March 2001 it has received over 11 million visitors. Eden seeks to communicate its message in many different exciting and positive ways which vary from story telling and lectures to theatre, music and art. It is all about challenging our visitors to be concerned about such issues as species loss, climate change, food security, increasing energy costs and environmental services. Eden explores the need for adaptation to meet the challenges of the 21st century and it communicates stories on how people and organisations are working towards positive initiatives in these fields in order for humankind to survive and thrive. Above all we seek to present up-to-date accurate scientifically-based facts in ways that will get our message over.

The Eden Project is a splendid resource for education at all levels. The young people's education programme at Eden is innovative and exciting thanks to the creative approach of the education staff. Every day groups of young people are to be seen busy with learning projects. For example, someone dressed as a chef may address a school group and explain that he is lacking the ingredients of a cake he planned to bake. The children are sent off to find them throughout the Biomes and come back reporting where to find the plants that yield sugar, chocolate, flour, raisins, cinnamon, and other ingredients. When they return the chef bakes the cake and they go home remembering that plants produce most of the ingredients. They may explore the Rainforest Biome in the programme "Don't forget your Leech Socks" where they search for survival foods and shelter from the plants. Education at Eden includes programmes on such topics as climate change, food, nutrition, health, biodiversity and the sustainable use of biological resources.

Around 50 thousand students visit the Eden Project in organised educational groups every year so it reaches a large audience. To communicate the message of Eden is the main purpose of the project and for this, three areas of education are most important; the guides or 'Pollinators', exhibits and interpretative signage. On busy days the story telling Pollinators are placed at strategic points across Eden's global garden. They are versatile and may act as performers, guides or storytellers. They are delivering economic botany classes and stories concerning sustainable development to the public on a daily basis. The project also has much interpretative signage and many exhibits that seek to tell the stories of plants simply, but interestingly.

Eden offers a two-year diploma in horticulture in collaboration with Duchy College. It is hoped to upgrade this course soon to the level of a foundation degree. The popularity and need for this diploma is evidenced by the large number of applicants received for the ten available places. This year a Master's degree in horticulture will be started with the University of Plymouth.

Already a number of students have completed their PhD or Master's degree research at Eden or at Eden sponsored sites around the world. We were able to obtain a grant from a UK foundation to sponsor post-graduate students. Their work ranges from studies of soil and pest build up in the Biomes to work with rare and endangered plants in such places as The Gambia, St Helena, the Seychelles and the Atlantic rainforest of Misiones, Argentina. Eden is working closely with the Universities of Exeter, Plymouth and Reading and a number of other universities worldwide.

Conservation work in the Seychelles led to the creation of a new ornamental hybrid *Impatiens* called 'Ray of Hope." This was a cross between a critically endangered Seychelles endemic, *Impatiens gordonii*, and a common domestic impatiens species. The sale of this new variety through the Eden shop is both raising awareness about the conservation of rare species and is raising funds to support conservation work in the Seychelles.

The Eden Foundation has formed partnerships to work in collaboration with a large number of organisations at home and abroad. These vary from conservation organisations such as 'Plantlife' to the Iwokrama Project in Guyana, which is working on the sustainable use of rainforest. Some of the other organisations Eden works with are the Earth University in Costa Rica, the Yaboti Biosphere Reserve in Argentina, the Forest Restoration Research Unit (FORRU) in Asia, and the Ballabu Conservation Project in The Gambia. Closer to home Eden is collaborating with the UK Homes and Communities Agency in their 'Places of Change' programme.

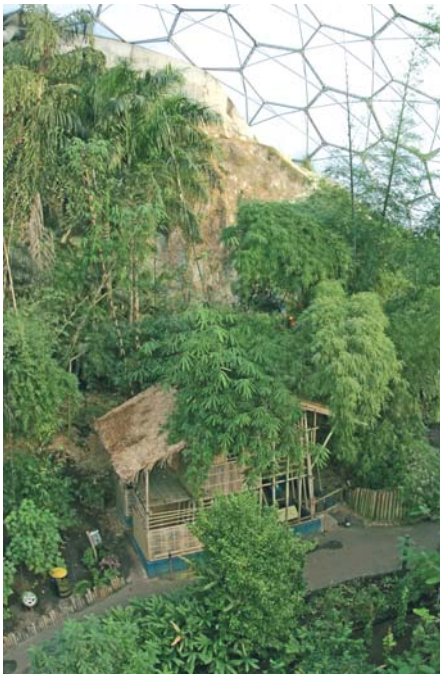
Impatiens 'Ray of Hope.'

This focuses on homeless people and prisoners and the causes for their exclusion from society. In 2009 this was brought to the attention of the public through exhibiting a garden at the Chelsea Flower Show. All the plants for this exhibit were grown by homeless people and prisoners. Eden has a programme working with Dartmoor Prison to teach prisoners to grow vegetables. We are finding that growing food in prisons has caused marked benefits to the health, behaviour and outlook of prisoners. Each of these collaborative projects brings a new dimension to the Eden Project. The organisations, projects and programmes benefit from the publicity that Eden can generate for them, and Eden learns more about the messages that it can bring to the public. This open sharing and co-operation is one of the aspects of Eden that I find most attractive.

Another outreach programme of Eden is 'Gardens for Life' which connects children around the world through their shared experience of school gardening. Over 300 schools are currently involved. This programme supports children, young people, teachers, project leaders, families and communities worldwide to garden and grow crops. It is now functioning in localities in the UK, Singapore, The Gambia, Kenya and India. The aim is to create a global community that is equipped to face the challenges of the 21st century, such as food security and health, climate change and water, indigenous knowledge, cooking, medicine and youth empowerment.

Eden offers a ray of hope for the future at a time of environmental and financial crisis. It has rapidly become a force for plant science, education, conservation and sustainability. To quote its Chief Executive and Co-founder, Tim Smit, "Eden is about optimism and the possibility of change."

To learn more about the Eden Project visit: www.edenproject.com



Eden's Rainforest

Indian school taking part in Gardens for Life

Storytelling

BRITISH INDIAN OCEAN TERRITORY (CHAGOS ARCHIPELAGO): OUR GLOBAL OPPORTUNITY

Professor Charles Sheppard
Biological Sciences,
University of Warwick

The British Indian Ocean Territory (BIOT) contains, within its 20,000 km^2 of shallow coral reefs, a greater marine biodiversity than the rest of the UK and its other Territories combined. It contains as much as half of that ocean's coral reefs which are in good condition even though it is relatively small on an oceanic scale.

The reason for this is simple: except for the island of Diego Garcia which contains the military base, it has been uninhabited for over 35 years. During that period, most parts of the tropical oceans have seen massive environmental declines from pollution, over-exploitation and development using a wide range of unwise practices. In contrast, this British archipelago has missed all that, having been in a sort of time capsule, in which its rich coral reefs have survived in a way no longer seen in most parts of the world. Even the land has started to see recovery from depredations in their past.

The islands are, by comparison to the reefs, relatively tiny, being just 60 km^2 in total, spread across 55 or so islands. Half of this land area is the atoll of Diego Garcia with its military base; the other half is contained in 54 tiny islands spread across the Territory. Especially on islands which were too small to convert into coconut plantation, wildlife thrives. The result today is that in this Territory (whose geographical name is the Chagos Archipelago) you will see coral reefs and small tropical islands as they would have looked a century ago, and observe scenes which today are found only in a diminishing number of locations where man has passed them by. Not many places look like this now; there are scattered patches in some remote parts of the Seychelles and Maldives, for example, but there are certainly no other areas with the concentrated richness and size of Chagos. On land, its tiny islands contain about ten internationally designated Important Bird Areas, for example, and even the turtles, once nearly extinguished for food and their shells, are coming back.

The reason for its present, surviving, great biological wealth is, of course, its lack of population. I do not argue that the now well-known eviction in the early 1970s to make way for the present US military base was handled well, or was fair, or that the previous islanders were not then subjected to miserable conditions. I don't know anyone who thinks they did fare other than badly (although those who were sent to the Seychelles were integrated very much better). Whatever aid that was given at the time, most who went to Mauritius, at any rate, appear to have had a miserable time of it. But, since the days of the eviction many things have changed. The mainstay of the Chagos population was coconut oil, but the palm-oil industry that took off around then had overtaken the increasingly expensive coconut oil by the mid 1970s. According to a recent survey carried out by a prominent Chagossian supporter only about a dozen individuals were identified who say they wish to return permanently.

What to do about Chagos today? Given that it is a core of biodiversity in the increasingly overexploited and populated Indian Ocean, is it worth preserving? Does every ocean really need at least one surviving remnant, a legacy of the world's past? Is it possible that Chagos is a significant source of biodiversity, including essential and scarce protein, for down-current areas (which in this case is most of the western Indian Ocean and East Africa)? As a result of my own research there over several decades, and that of 50 other scientists who have visited, I have argued that the Indian Ocean needs Chagos, for these and several more reasons. Most of these reasons are scientific, but several are very pragmatic.

Their rich biological wealth would certainly not survive the sort of fishing pressure and hotel, airport and port development typical of many Indian Ocean islands, and which has recently been proposed by some as a way in which the islands could pay their way in a direct, immediate sense. How therefore, could they 'pay their way'? Does everywhere actually have to pay its way in fact, or can the world spare a small number of near-pristine legacy sites?

Earlier this year, at a meeting in the Royal Society, a group of leading scientists prepared a brief document summarising the prognosis for the world's reefs. Why anyone should care about reefs at all is simply because they house the world's richest

marine biodiversity, they provide essential protein for countless millions of people, and for many entire nations they also provide the land itself (the Maldives for example are entirely coral islands, which do not exist long if their component corals don't survive). For many more countries they also provide important breakwaters which, when damaged, leads to flooding and erosion of the land – an important concern when much of that land is scarcely above sea level. In short, coral reefs are needed. The prognosis at the Royal Society meeting was grim. A third of the world's reefs are already dead, mainly because of overfishing, pollution and misuse. The world is warming because of increases in atmospheric carbon dioxide and this is progressively killing more. Added to this, ocean water is acidifying, something also caused by rising carbon dioxide dissolving in water. (This affects not only the skeletons of coral of course, but also the large array of key components of the ocean which make limestone in their skeletons.)

Unfortunately, reefs don't tolerate well the impacts and insults inflicted upon them by the rising numbers of people in the Indian Ocean, who have a population-doubling time, in many countries, of no more than about a decade. It is said often enough that conservation is littered with examples of failure and destruction of resources because people have not been properly engaged in the process. But while sometimes true, most conservation failures are of course caused by the people themselves, whether engaged or not: too many, too hungry, taking too much, so that the capacity of the habitat to support people is exceeded. Of the thousands of coastal communities in the world, over the last 25 years the same handful of examples are regularly produced to attempt to show how people can live harmoniously with their marine environment, but most of these, if not all, have not stood up to scrutiny; some were royal preserves, poaching in which was severely punished. Given that this human behaviour is unlikely to change, what can be done?

Conservation theory seems to go in cycles. One hundred years ago it was thought we (usually 'great white hunters' and the like) should exclude people in order to conserve, or preserve. This was unfair, and didn't usually work very well in any case. Then it was thought that the best way was to engage people in husbanding their habitats. This was socially nicer, but it usually didn't work either; after all, that phase has seen the greatest deterioration of natural habitats. Examples of good habitat, like that in Chagos, are running out, so should we now revert to preserving a few 'legacy' areas which, on one hand, are in good condition now for whatever reason, and on the other have a good chance of remaining so? Candidate sites are few and diminishing, and we must remember that once gone, all past evidence shows that we cannot get it back. Chagos is probably the only remaining site in the Indian Ocean where this could work. The social dimension may still need a solution, but the science is pretty clear – the ocean needs Chagos as it is.

This is not the place to talk of species' stepping stones, export of larvae, commercial or pharmaceutical values of biodiversity and so on, and in too many cases we find these things difficult to quantify. Some accepted standard methods of valuing habitats have produced values for Chagos of about $1 billion per year, a value benefiting the Indian Ocean generally. Astonishingly perhaps, this makes the British Indian Ocean Territory a greater provider of aid to the ocean and its nations than other UK government departments and NGOs!

The reason for the existence of British Indian Ocean Territory in the first place was perceived military needs of the cold war. Then, no thought at all was given to other aspects – human or biological. But because of this history, the value of the place in environmental terms is now supreme. It is needed now for many more reasons than could have been envisaged back then, including, for example, its use as a reference site for other parts of the Indian Ocean which are undergoing costly but largely ineffectual attempts at conservation. It shows that, to give another example, a tropical marine area can still recover from climate change impacts when it does not also suffer from local forms of degradation. Chagos gives a prime example of what we need to aim for, which makes its scientific value incalculable. It has been said that Chagos is amongst those very few sites that will survive global warming for longest (others include the southern Red Sea, a few in the Pacific, but probably none in the Caribbean). Enormous care, not just hopeful aspirations, is now needed to ensure that its continued benefits survive. In any case, most of the world does not have the luxury of time in this regard.

Chagos has been recognised by the Global Ocean Legacy programme of the Pew Environment Group as being one of four sites globally worth establishing as totally protected, and the British Government is exploring details of this. If it is thus established, it would not be just another 'paper park' of the kind that litter the world, but would provide about 20% of the World's Marine Protected Areas. However, most of the latter permit extractive resource use in several ways, so a no-take Chagos conservation area would comprise more like two-thirds of the global total of no-take protected areas. This would be an extraordinary achievement which, today, is possible only here. There is much work to be done on how exactly this should be done, but the need is clear.

For further information on the Chagos Archipelago and this article contact Charles.Sheppard @warwick.ac.uk

DESIGNS FOR LIFE – A FUSION OF SCIENCE AND ART

Seeing science in a different light

Designs for Life is a science and art project inspired by the work of the UK's national synchrotron, Diamond Light Source. Situated in south Oxfordshire, Diamond is a research facility that enables scientists to use intense, pinpoint beams of X-ray, ultraviolet and infrared light to investigate the world around us on the molecular and atomic scale.

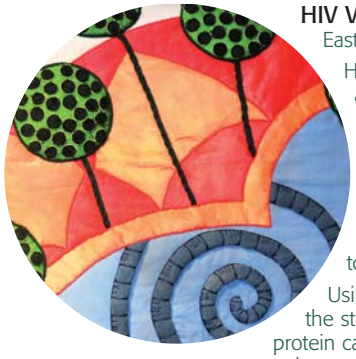
Funded by the Government, via the Science and Technology Facilities Council (STFC), and the biomedical research charity the Wellcome Trust, Diamond endeavours to communicate its science on a regional, national and international scale – not only through the traditional route of published research in scientific journals but also through creative and interactive initiatives to reach out to new audiences and widen access to science as much as possible.

One of Diamond's first projects of this kind, in collaboration with Science Oxford and funded by a People Award from the Wellcome Trust, was Designs for Life, which began in early 2006 when members of the Oxfordshire Federation of the Women's Institute (WI) were invited to Diamond to meet its scientists and to take part in a specially designed dialogue project.

The research which takes place at Diamond is selected via a peer-review panel, who rate the proposed projects according to the quality and technical viability of the science. The dialogue project saw the WI ladies being presented with a number of realistic research proposals and tasked with taking on the role of a peer-review panel to discuss and debate which proposals they believed deserved to be prioritised.

This was a stimulating activity which saw two audiences that aren't traditionally associated with each other – scientists and the WI – getting into really thought-provoking discussions on the socio-ethics of scientific research and the criteria, such as technical feasibility, safety and the quality of the science, on which proposed experiments are judged. It was a mutually beneficial exercise: the scientists present were able to hear first-hand the opinions of the WI ladies on the research at the facility, who in turn learnt about the peer-review process and the challenges involved. Enthused by this experience, and feeling more familiar with the scientific content, the WI groups took away design templates for each panel to begin interpreting scientific images into works of art.

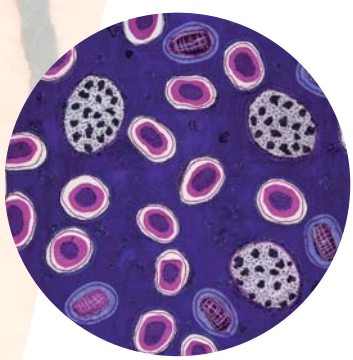
Susan Myburgh from Bloxham WI contributed to a number of the panels. She enjoyed the crossover of science and art and thought it worked very well. She says, "I think both sides gained a lot from the experience; the WI had an insight into modern science processes, and the scientists had the opportunity to find out about the many facets of the WI. It seemed an unlikely combination but we all, scientists and WI, rose to the challenge and thoroughly enjoyed it!"



HIV Virus. Design by Anne Griffiths, made by East & West Hendred WI and Chilton WI.

HIV (Human Immunodeficiency Virus) is a virus that attacks our immune system. This means that our immune system cannot kill HIV as it would other viruses. HIV can also mutate or change its form very easily, so even once someone has developed some immune response, the virus can mutate to evade it.

Using Diamond's intense X-rays to look at the structure of part of the HIV virus (a protein called reverse transcriptase) will help researchers to identify new areas to target with drugs.

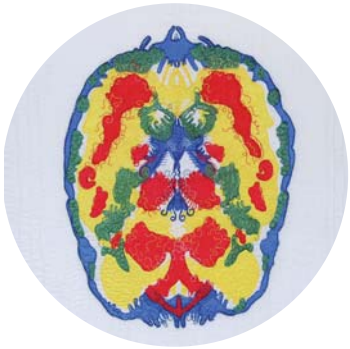


Malaria. Design by Anne Griffiths, made by Bodicote WI, Little Compton WI, Over Norton WI and Salford WI.

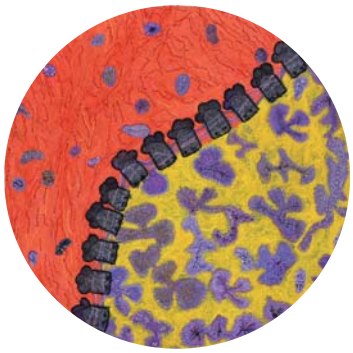
Chromosomes. Design courtesy of the Wellcome Trust, made by Otmoor WI, Clagrove WI, Waterstock & Tiddington WI, Benson WI, and Cuddesdon & Denton WI.

Many of the ladies were keen to work on panels that had a significant meaning to them through their personal experiences of some of the diseases. WI member Jackie Flynn, the wife of an Alzheimer's sufferer, chose to work on the BSE/vCJD panel because it represents the way diseases like BSE, CJD and Alzheimer's affect the brain. Commenting on the science and art project, she says, "From my point of view it's a good thing because it raises public awareness of the disease."

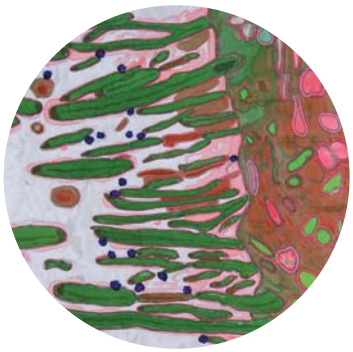
Anne Barber of Standlake WI works as a nurse and was interested to learn more about the flu virus, and the research being carried out in this area. She enjoyed the challenge of taking the designs and interpreting them into art. Anne says, "The panels are a really good visual representation of science. I think it was great that Diamond was able to reach out to members of the community who aren't usually involved in science and give them the opportunity to take part in a project like this."



Brain scan. Design by Anne Griffiths, made by Begbroke WI, Filkins WI and Broughton Poggs WI.



Osteoporosis. Design by Jill Gemmell, made by Chadlington WI.

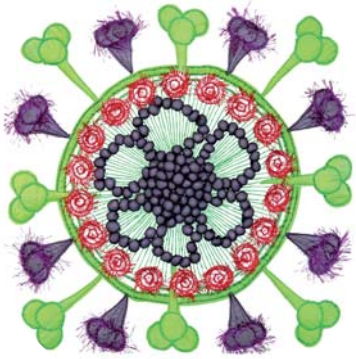


Asthma and pollen. Design courtesy of the Wellcome Trust, made by Bodicote WI and Weston on the Green WI.

Breast Cancer. Design by Michele Tootelle, made by Weston on the Green WI and Stanton St John WI.

Rates of breast cancer in the UK are still rising despite much better prognosis and treatment, with around 40,000 new cases of breast cancer diagnosed each year.

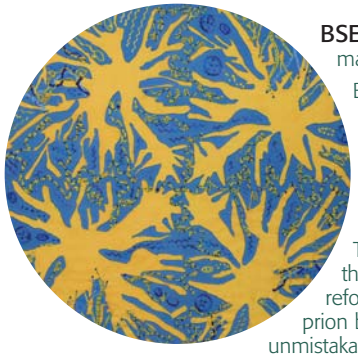
A number of Diamond's experimental stations, or beamlines, are dedicated to making important advances in the field of life science. These beamlines can be used by researchers to solve the atomic structure of the proteins that play a part in this common disease. Knowing the structure of a protein helps scientists to come up with potential drug targets.



Flu Virus Cross Section. Design by Anne Griffiths and Jane Madden, made by Filkins WI and Standlake WI.

A notable example of the successful use of synchrotron technology to advance drug design lies in the development of the anti-flu drug Tamiflu® (approved in 1999) which was designed based on knowledge of the 3D structure of the enzyme neuraminidase.

One of Diamond's users, Prof Elspeth Garman from the University of Oxford, will be using Diamond to examine the N protein in the new H1N1 swine flu virus since the disease can be contained by locking this protein into a cell, preventing swine flu from spreading through the body.



BSE/vCJD Plaques. Design by Anne Griffiths, made by Stoke Lyne WI and Bucknell WI.

Bovine Spongiform Encephalopathy or BSE is a disease that affects the brain and central nervous system of cattle. BSE is caused by prion proteins inside the animal's brain and nervous system changing into a new, deadly shape.

Creutzfeld-Jakob disease (CJD) is a very rare form of dementia that is also caused by prions. The prion involved is similar to the BSE prion and the two conditions seem to be linked.

The normal type of the prion involved can be broken down inside the brain by the body's own chemicals. The abnormal form, which causes diseases, has refolded into a different shape, which means it can't be broken down easily. The prion builds up inside the brain, so that it becomes riddled with holes, giving it an unmistakable spongy appearance.

Prions are currently not very well understood. By using a synchrotron to look closely at the structure of both the normal and abnormal forms of the prion, scientists hope to be able to understand the job the prion should be doing inside the brain.

Alzheimer's Tangles. Design by Anne Griffiths, made by Stanford in the Vale WI, the Letcombes WI, Charlton WI and King Alfred's WI.

Alzheimer's is caused when nerve cells in the brain responsible for processing, storing and retrieving information degenerate and die. Scientists have found two unusual structures called 'plaques' and 'tangles' in sufferers' nerve cells. Affected areas also seem to contain unusually high concentrations of iron-rich particles.

Diamond's intense synchrotron light can be used to investigate the structure of the proteins responsible for forming the plaques and tangles, and to identify the areas in the brain which contain unusually high concentrations of iron.

Completed in December 2006, the panels were put on public display at a number of venues throughout Oxfordshire before returning to Diamond in July 2007 for its public open day, which saw over 4,000 people visiting the facility. The panels' most recent outing was at the Royal Society's Summer Science Exhibition in July this year.

Isabelle Boscaro-Clarke, Diamond's Head of Communications, says, "Diamond is extremely grateful to all the members of the Oxfordshire WI who contributed to this exciting science/art project. The initiative has been a fantastic success and reflects Diamond's commitment to working with the local community to promote a better understanding of our work. This innovative fusion of science and art is now on display in the Diamond House atrium, where staff and visitors can enjoy its intricate stitch work, stunning colours and thought-provoking source material for years to come."

The panels are currently at the Diamond facility and will be on public display at the North Wall Arts Centre in Oxford from 11th – 29th January 2010. www.thenorthwall.com

There are a number of opportunities to visit Diamond throughout the year, if this is of interest to you, please call 01235 778639 for more information. **www.diamond.ac.uk**

THE PARLIAMENTARY AND SCIENTIFIC COMMITTEE

70 Years of Bringing Science to Parliament

The Parliamentary and Scientific Committee came into being on 8th November 1939 as successor to the Parliamentary Science Committee, which had been dissolved with the resignation of its Secretary at the outbreak of war. By the end of January it was in funds and at work on an enquiry into the nutritive value of bread and an issue of *Science in Parliament* had been circulated to members early in January.

Since then, in war and peace, it has contributed steadily to the information and education of Parliament on the great scientific and technological issues of the day.

In 1943 the Committee's membership was made up of nearly 150 Members of the House of Commons and House of Lords and 43 Organisations (scientific institutions and research associations) of which several are still members today. Over the years membership has been extended to include UK members of the European Parliament, UK universities, trade associations and commercial companies operating in Britain, which are in the forefront of scientific and technological developments in their various fields of activity. In 2002 a new Associate category of membership was created to include those organisations which, though not engaged in scientific research, represent the interests of those who are significantly affected by science.

Over the decades the Committee has been involved in many important developments in the field of public policy relating to science and technology. In some of these it has played a key role, for instance on national policy for libraries and the utilisation of scientists in wartime. Members of the Committee were active, also, preparing the ground for the establishment of the Commons Select Committee on Science and Technology, which did much useful work between 1966 and 1979, and the setting up of the Lords Select Committee on Science and Technology, which came into existence following the demise of the Commons Committee.

The Committee's most important role, however, has been in the dissemination of scientific and technical information. It has fulfilled this role over the years mainly through its monthly meetings at the House of Commons, through seminars and publications, notably *Science in Parliament,* which provides a record of addresses to the Committee and, through its website, the only regular digest of scientific and technological matters before the British Parliament and the European Community.

In 1988 the Committee took the giant step of establishing a new body to provide Parliamentarians with an independent source of high grade information – the Parliamentary Science and Technology Information Foundation, which founded and initially financed the Parliamentary Office of Science and Technology (POST). Funds were raised for this charitable organisation from industry, institutions and from Parliamentarians themselves. The intention was that POST should become part of the Parliamentary establishment; this took place in 1993, and POST is celebrating its 20th anniversary this year.

Such has been the reputation and importance of the Committee over the years that it has drawn to it men and women of stature from both Parliament and the world of science and technology: among past Presidents have been Lord Samuel, Mr Herbert Morrison, Lord Halsbury, Lord Sherfield, Lord Zuckerman, Lord Shackleton, Lord Todd, Lord Gregson, Lord Flowers, Lord Selborne, Lord Waldegrave and Lord Soulsby. His Royal Highness The Duke of Edinburgh has had a long association with the Committee, addressing the annual lunch on a number of occasions and acting as president during its fiftieth anniversary year.

The Committee currently has in membership about 140 parliamentarians from both the Westminster and the European Parliaments, 125 scientific and technical institutions, 40 universities, 35 industrial organisations and 4 associate members.

Expert speakers of great distinction in their fields come to speak at the Committee's monthly meetings at Westminster, and the Annual Luncheon provides each year the occasion for a major speech on some aspect of policy relating to science and technology. In addition to many eminent scientists, including at least two Nobel prizewinners, most Prime Ministers since 1939 have addressed the lunch, as have the Prince of Wales and the Princess Royal. The Committee also arranges visits to research establishments and other places of interest to members. In 2009, for the first time, it joined forces with several learned societies to run SET for BRITAIN, a poster competition and exhibition in the House of Commons for early-stage researchers.

The success of the Committee has encouraged the establishment of other specialist all-party groups within the Westminster Parliament and has led to the setting up of similar bodies abroad in Canada, Australia and India.

The Committee is the oldest of the almost 420 registered all-party subject groups in Parliament, and, while many of those formed most recently tend to be focused in narrow subject areas, it has remained the only group which continues to address all aspects of science and technology. Through its regular monthly meetings, and the dinner discussions which follow, it aims to provide Members of both Houses of Parliament with up-to-date information on the science behind topical issues.

Science in Parliament, which started as a duplicated circular containing summaries of debates and parliamentary questions, has developed into a 64-page journal published four times a year. Its twin objectives are to inform the scientific community of scientific activities within Parliament, and to keep Parliamentarians abreast of scientific affairs. The journal and details of the Committee's activities can be found on the website www.scienceinparliament.org.uk.

EPSRC

EXPLORING THE IMPACT OF SCIENCE ON SOCIETY AND THE ECONOMY

The Engineering and Physical Sciences Research Council (EPSRC) is the main UK government agency for funding research and training in engineering and the physical sciences – from mathematics to materials science and from information technology to structural engineering. Working with UK universities, **it invests around £740 million a year in world class research and training to promote future economic development and improved quality of life.**

Engineering and the physical sciences has a huge impact on the world around us – fighting crime and terrorism, improving transport and healthcare, and developing solutions to challenges such as climate change and energy production. Some of the technology we take for granted – the internet, mobile phones, and MRI scanners – exist because of fundamental research undertaken by scientists in the past.

EPSRC funds research that tackles some of the most difficult issues facing the world today and is helping to build a better future for everyone. The impact of that research can be seen across many aspects of our lives including the economy, healthcare, security, transport, energy, culture, knowledge and public policy.

In order to help demonstrate the impact of this research EPSRC launched its national IMPACT! campaign earlier this year at the Cheltenham Science Festival. Science Minister, Lord Drayson, joined young technology entrepreneurs to discuss how science can help build a better future at the IMPACT! debate and an IMPACT! trail of exploration around EPSRC funded research exhibits within the Discover Zone was followed by 2,500 school children.

The campaign aims to reach out to new audiences to communicate the impact that research has on the economy, quality of life, culture and knowledge, public policy and much more.

EPSRC Chief Executive Dave Delpy said:

"Science and engineering research is the key to our prosperity, one of the driving forces of our economy, and it creates thousands of jobs that keep Britain at the leading edge. This campaign shows what science is doing for us now and how it is going to result in a better future for us all with new technologies to stimulate economic growth, improve our quality of life and help us to meet the challenges of the 21st century."

As part of the IMPACT! campaign EPSRC launches its IMPACT! world website at the end of September which is a fun and informative site enabling visitors to explore the "world" by reading case studies and watching films about the research being funded by EPSRC. Examples of the impact case studies include:

- The £2 light bulb that lasts 60 years. Installed in every home and office *could cut the proportion of UK electricity used for lights from 20 per cent to 5 per cent.*
- Downloadable software for your mobile phone *could help doctors monitor asthma, diabetes, and other chronic conditions remotely.*
- The world's first fully sustainable racing car, *which is paving the way for "green motorsport" and showcasing cutting-edge materials technologies.*
- Cutting edge spectroscopy technology *helping conservationists preserve our heritage buildings and pinpoint many of the problems facing irreplaceable collections and artefacts.*
- Sheets of carbon just a single atom thick that *could herald a new generation of electronics.* The new material could be used to make next generation transistors that are a fraction of the size of current devices to miniaturise microelectronics.

To explore IMPACT! world visit **www.impactworld.org.uk**

EPSRC is attending a number of events over the next few months including Innovate 09, Science and Innovation 09 and UK Trade & Investment's Technology World 09 where you can hear about the impact of the research we fund – details of these events and EPSRC's involvement can be found on the IMPACT! world website.

In February 2010 EPSRC will be holding a mixed-media exhibition of original works of art which will explore the relationship between science and society, looking at the different types of impact that engineering and the physical sciences have on the world. The exhibition is a joint venture with the Royal College of Art and is also sponsored by NESTA. Artists and researchers will be blogging about their experiences in the run up to the month-long exhibition at the Royal College of Art – you can follow this blog by visiting **http://impact-art.ning.com.**

To find out more and keep in touch with the IMPACT! campaign you can sign up to receive our monthly e-newsletter by emailing **ImpactNews@epsrc.ac.uk.**

ROYAL SOCIETY OF CHEMISTRY LINKS DAY – WEDNESDAY 24TH JUNE 2009

SCIENCE AND GLOBAL SECURITY

John Bercow, the recently elected Speaker, put in an unexpected visit prior to the start of the proceedings. He referred to the network of scientific organisations responsible for putting in place the biggest scientific and engineering event of the year in Parliament and the need for everyone to be fully aware of its significance. He pointed out that science and engineering are directly relevant to many areas of public policy, particularly so today, and wished everyone a great day and successful year.

Brian Iddon FRSC MP rose to commence the formal proceedings and welcome the guests. He introduced Professor Dave Garner FRSC FRS, President of the Royal Society of Chemistry, who referred to the importance and power of scientists acting collectively and either hanging together or hanging separately. For example, global security requires constant surveillance in order to monitor rogue states and to ensure sustainability for 9 billion people. The Royal Society of Chemistry has taken the lead with a roadmap which now requires fundamental research and funding. He then introduced Hilary Benn MP, Secretary of State for Environment, Rural Affairs and Food, having emerged unscathed from the turmoil of

Adam Afriyie MP

Rt Hon John Bercow MP

Phil Willis MP

Rt Hon Hilary Benn MP

recent weeks, to deliver the Keynote Address on Science and Global Security.

Hilary Benn referred to a crisis of sustainability which required deep understanding between Parliament, Science and Engineering, all of which impact on Global Security. Obama has restored science to its primal place in US Government policy, and in the UK Bob Watson demands the best evidence we can obtain on which to base future policy. The UK punches above its weight on the world stage where India and China are emerging as superpowers, resulting in more demand for our expertise worldwide. Climate change maps for the end of this century indicate potential changes resulting in temperature increases of 2°-6°C; the hot summer of 2003 is estimated to have been responsible for the deaths of 35,000 people; sea level in London is predicted to rise by 36cms where an average temperature of 36°C is anticipated. Scientists and engineers will have to work very hard to adapt our environment to cope with and minimise such rapid and drastic change that may be accompanied by the import of new diseases. Food security needed a new Norman Borlaug to lead a new Green Revolution to feed an increasingly hungry world. Carbon Capture and Storage (CCS) is also urgently required, based on developing partnership across the globe between scientists and engineers to bring this about. People will migrate towards increasingly scarce sources of fresh water and also towards India from low-lying coastal areas such as Bangladesh as it sinks beneath the Bay of Bengal. We cannot escape climate change, but we can attract young people to study the implications and devise solutions and help to minimise impacts before it is too late!

A series of summary Scientific Presentations delivered by six speakers then followed, each with a different and specific scientific or engineering message related to Science and Global Security. Lord Rees, President of the Royal Society, led off on the urgent need to rebalance our economy from one solely concerned with finance to one based on high technology manufacturing even though the payoff sometimes takes decades. The UK has expertise in:

1. Spearheading the world's CCS requirements, which is crucial in the light of China's 100 coal fired power stations built last year alone;
2. Promoting energy storage using batteries;
3. Developing Nuclear Power with 4th Generation Reactors;
4. Proving and developing Nuclear Fusion as a clean source of Energy;
5. Developing solar power in the Sahara and transmitting via HVDC cable.

The alternative and pessimistic 'Plan B' in which we never achieve our goals, envisages global population growing from 3 billion 50 years ago to 6 billion currently, to an estimated 9 billion by 2050, with a billion more in Africa alone, requiring a second Green Revolution to feed the world, which will force science up the agenda, as in the Royal Society's "Future Curiosity" programme.

Dr Scott Steedman, Royal Academy of Engineering, with 1000 Fellows and 250,000 Chartered Engineers underpinning "Engineering the Future", sees many opportunities for high profile work in three main areas, Energy, CCS and the Environment with policy issues focusing on water security and DECC.

Alan Pratt, Institute of Physics, referred to 2500 enquiries received by the Home Office Scientific Development Branch where science was used in the response. He presented a case for the application of physics, in conjunction with other scientific disciplines, to counter terrorism in four areas, the 4 Ps: Prepare, Prevent, Protect, Pursue, with particular reference to Chemical, Biological, Radiation and Nuclear (CBRN) attacks. Challenges are ongoing where science and technology are essential and threats must be tackled in an integrated manner.

Professor Alan Malcolm, Biosciences Federation and Institute of Biology, referred to the current underestimation of the need for "Natural Capital" such as:

1. Fresh water, eg where fresh water availability per head of population is decreasing as population increases;
2. Acidity of the oceans is increasing very rapidly due to the uptake of increasing amounts of CO_2 from the atmosphere;
3. Bees and other crop pollinators urgently require scientific study if their decline is to be arrested before it is too late;
4. Wind farms and their possible negative impacts on bird migration and radar monitors;

Professor Paul Monks, Royal Society of Chemistry, emphasised the role of Earth Observation Science and data collection from global to local scale as a health check and for specific studies related to tropical deforestation resulting in loss of the earth's lungs, decreasing biodiversity, and increased greenhouse gas emissions which are facilitated by the use of high resolution radar for detection of logging tracks. Illegal logging in Indonesia requires very rapid response times from radar if it is to provide an effective means of control. It is also possible to identify emission and uptake by plants of greenhouse gases from space.

Air pollution, which gives rise to between 12,000 and 24,000 deaths in the UK annually, can also be monitored. Information on air quality can help reduce hospital admissions by dissemination of air quality data by mobile phone as part of a GMES (Global Module for Environmental Security) for business, covering marine, atmospheric and land based emergencies. Hence science can now bridge observational and societal benefits while the world faces a 'perfect storm' of problems by 2030, as the Chief Scientist warns.

Dr Richard Herrington, Geological Society of London, discussed the challenges of maintaining a sustainable mineral supply for a wide range of metals, energy minerals, industrial minerals and raw materials for the construction industry. The southern hemisphere is currently the location for many of the world's mineral deposits, raising questions concerning security of supply, technological innovation and substitution. For example, the BRIC Countries (Brazil, Russia, India and China) are changing from net exporters to importers of raw materials as their own domestic economies grow, resulting in increased competition for scarce resources, even to the point of armed conflict such as conflict diamonds from certain locations in West Africa and Tantalum for mobile phones obtained from a relatively few deposits in the DRC (Democratic Republic of Congo). China now controls the global supply of Rare Earth Elements (REE) which are essential to the US military for use in magnets in GPS systems located in Cruise Missiles. Lithium deposits, essential for new generation batteries required for transport, are located in Chile, Argentina and Bolivia. Science thus plays a major role in predicting location

of new sources of supply, possible substitutions, mitigating risks and minimising waste.

The 'View from Parliament and Government' was introduced by Adam Afriye MP, Shadow Minister for Innovation, Universities and Skills. It has been a turbulent year on many fronts and science is not unaffected by the financial crisis, economic downturn, borrowing difficulties and housing, all emphasising the need for a world-class research base to help rebalance the economy, especially in chemistry, biology, aerospace, pharmaceuticals etc. The lead we maintain in plastic electronics and nanotechnology is also important, as we are not just 'bankers and borrowers' and our universities also attract much attention from Parliament and Government. Recent departmental changes include the move from DIUS and BERR to BIS, a huge department with six Ministers in the House of Lords, restricting the ability to hold the Government to account.

If politicians claim to put science at the heart of Government, they should mean it! Scientific literacy in Parliament is vital if we wish to avoid more MMRs. It will therefore be compulsory for all incoming Conservative MPs to enrol on a scientific literacy course in future, with emphasis on statistics and scientific concepts. POST has designed a programme for all MPs in Parliament.

Current topics include the need for the independence of science from undue political influence as questions need answers. Should science spending be directed to achieve economic growth? What is the relationship between the science budget and regional development? What is the role and responsibility of the Minister? Scrutiny of scientific policy is essential although it may be the responsibility of more than one select committee. The Science and Technology Select Committee is very important and therefore science will be free to flourish under a Conservative Government lead that recognises the independence of scientific research. There is also need for a longditudinal study of young people to examine how science and society impact on their training in science.

Professor John Beddington, Government Chief Scientific Adviser and Head of the Government Office for Science, summarised in a series of illustrations the increases in current Global Security Challenges:

1. World Population Growth (increasing)
2. Urbanisation (increasing)
3. Poverty (increasing)
4. World Food Requirements (increasing)
5. World Primary Energy Demand (increasing)
6. Fresh Water Availability – 70% for Agriculture (a massive problem by 2025)
7. Climate Change – Arctic free of ice by 2030 (earlier than the IPCC prediction)
8. Ocean Acidification (sudden recent increase from pH 8.2 to pH 7.6)

These factors will combine to produce the 'perfect storm' involving energy, food and water, coastal vulnerability, mega delta flooding, increasing migration seeking food, water, energy and giving rise to global conflict, a coastal risk of flooding, and demonstrating a need for science, engineering and social and behavioural science resources on a much faster time scale and with particular reference to the increased availability of contraception for women.

Phil Willis MP, Chair, Commons Select Committee for Innovation, Universities, Science and Skills, announced that the meeting is not a wake, thanks to Brian Iddon! With the recent resurrection of the Science and Technology Select Committee, "Science is back at the heart of Government". Government is no good if not scrutinised by a committee championing science. Science is not the exclusive property of a few individuals. A wide range of topics, both local and global, and ranging from tidal power to biofuels, and the Royal input to the GM debate, many of them covered in more detail in the earlier presentations, were briefly summarised as important to the new Select Committee. However, particular reference was also made to the likely combined impact of housing and surface groundwater to water availability in the south east of England where demand for affordable housing exceeds the predicted availability of underground water in aquifers for the current population.

Mark Lancaster TD MP, Shadow Minister for International Development, closed the proceedings and thanked all the speakers.

POTENTIAL HAZARDS OF NANOTECHNOLOGY

Vicki Stone

Professor of Toxicology, Director of the Centre for Nano Safety, Edinburgh Napier University

Rob Aitken

Director of SAFENANO and Director of Consulting, Institute of Occupational Medicine

INTRODUCTION

Nanotechnology is a rapidly developing field of science, technology and industry that has the potential to greatly improve our lives through a diverse array of products and applications; but what is nanotechnology? Nanotechnology involves the production and manipulation of materials at the nanoscale (less than 100nm). To put this into perspective, a human hair is 80,000 nm in diameter, while a red blood cell is 7,000nm. Many of the products made by nanotechnology are nano-objects or nanoparticles, which

means that they either have 2 or 3 dimensions respectively in the nanoscale. Such nanomaterials are manufactured due to their unique or enhanced properties compared to larger forms of the same material. For example, they may be lighter, stronger, conduct electricity, or more reactive, enabling industry to generate new products. These products include improved drug delivery, antimicrobial surfaces, environmental decontamination, water purification, suntan lotions, cosmetics and electronic gadgets, all of which could contribute to our quality of life and economic development. For these reasons, the UK Government has invested in the development of nanotechnology allowing industry and academia to make thousands of different types of nanomaterials, varying in their physical and chemical characteristics. Many of these nanomaterials are already being used in industry, homes and in the environment, therefore resulting in the exposure of both humans and the environment. A number of Government commissioned reports have investigated nanotechnology and potential safety implications (eg The Royal Society and The Royal Academy of Engineering, 2004). Such reports have concluded that if nanotechnology is to be safe and sustainable then we need to consider whether exposures occur, and whether they pose any risk.

PARTICLE TOXICOLOGY

The toxicology of a number of different particles has been extensively studied. For example, it has been clearly demonstrated that inhalation of asbestos can lead to cancer, while substances such as titanium dioxide are low toxicity dusts. However, in the 1990s a group in the USA, led by Gunter Oberdorster, identified that the ability of TiO_2 to cause inflammation (activation of the immune system) and toxicity to the lung was related to particle size, with nano-sized particles being more toxic than larger particles. In addition, air pollution research has demonstrated that nano-sized particles can have adverse health effects in susceptible individuals, such as enhanced asthma, bronchitis, and cardiovascular disease.

For fibres such as asbestos, there is a wealth of evidence to show that length and durability are important in determining their potential toxicity. Short fibres are easily cleared from the lungs via the body's immune system. However, if the fibres are longer than the immune cells, the fibres cannot be cleared, allowing them to persist within the lung causing disease such as asbestosis or the cancer, mesothelioma. A number of nano-objects are fibre-shaped, including carbon nanotubes, which are already manufactured in tonne quantities. Studies have already demonstrated that some nanotubes have the potential to behave like toxic asbestos fibres in the mouse body (Poland et al, 2008), and so continued research is required to investigate this risk in more detail.

NANOTOXICOLOGY

A new field of research has now developed, bringing together particle toxicology and nanotechnology, in order to address the potential hazards of the newly developed nanomaterials. This is a difficult task since the diverse array of nanoparticles available means that they are unlikely to behave as a single class of particles, instead demonstrating biological activity that is related to their diverse physical and chemical characteristics. Furthermore, while the lung has been a major focus of particle toxicology in the past, Nanotoxicology now needs to address exposure via ingestion, the skin, and direct injection. The challenge for Nanotoxicology is to identify which characteristics are associated with toxicity, following exposure via different routes, and then to try to develop predictive models in the future that will allow identification of hazard with a reduced need for toxicity testing, especially with respect to animal testing.

EXPOSURE TO NANOPARTICLES

The toxicity shown for certain types of nanoparticles will only lead to risk if people or the environment become exposed to them. Without exposure there is no risk. Information about the potential for exposure of workers or consumers, by inhalation, ingestion or through the skin is currently poor. It is clear that increased investment in research, increasing production volumes, lower costs and an increased general prevalence of these materials will lead to more nano-enabled products from which there is the potential for exposure.

UK INVESTMENT

SAFENANO (www.safenano.org) was launched in January 2008 as a venture between the Institute of Occupational Medicine (IOM) and Edinburgh Napier University. This initiative is funded by the UK and Scottish Governments and has been developed to be the Micro and Nanotechnology (MNT) UK centre for proactive risk assessment of nanoparticles, which aims to work with industry to promote responsible development of nanotechnology. SAFENANO focuses on capturing, evaluating and disseminating the emerging evidence on nanoparticle risks. In addition, SAFENANO offers state-of-the-art *in vitro* toxicology testing, occupational hygiene, training, and laboratory services related to nanotechnology risks.

Defra has funded several review activities to assess current opinions in relation to the use of reference materials in toxicity testing (REFNANO), the potential for high aspect ratio nanoparticles to behave like asbestos (HARN), and an assessment of the current status of research projects world-wide (EMERGNANO). Over the last two years there has also been an increase in the funds available via research councils to investigate the potential toxicity of nanoparticles. This will enable the UK to play a key role in assessing the potential risks of different nanomaterials over the coming years, but since the number and diversity of particles available is so vast, this is not going to be a simple problem to tackle.

References:

The Royal Society and Royal Academy of Engineering (2004) http://www.nanotec.org.uk/finalReport.htm

REFNANO report http://www.iom-world.org/pubs/REFNANOReport.pdf

HARN report http://randd.defra.gov.uk/Document.aspx?Document=CB0406_7760_FRP.pdf

EMERGNANO report http://www.safenano.org/Uploads/EMERGNANO_CB0409_Full.pdf

Poland, *et al.* Carbon nanotubes introduced into the abdominal cavity of mice show asbestos-like pathogenicity in a pilot study. *Nature Nanotechnology* **3**, 423 - 428 (2008)

SUSTAINABLE ELECTRICITY, TRANSPORT FUELS AND HEAT

Gordon Taylor
Chartered Mechanical Engineer,
G T Systems

In the UK and other developed countries, electricity is about 20% of final energy, transport fuels 30% and heat 50%. Hence energy and climate policy must consider much more than electricity supply. In the UK, considering electricity in isolation has resulted in very high losses, with about 20% of primary energy being rejected to cooling towers and the sea. This could be avoided by thermally integrated solutions, as practised widely in Continental cities and in most industrial process plants.

Sustainable energy supply solutions must use renewable sources, mainly solar heat and electricity, wind electricity, and biomass electricity, fuels and heat. Hydro-electricity and geothermal energy are limited to certain regions and their overall contribution would be small, while tidal, marine current and wave electricity generators are not yet in volume production, so cannot be fully evaluated and costed.

As an annual average, the world final energy demand is about 10 TW, of which electricity is about 2 TW. (1 TeraWatt is 1 billion kiloWatts). The global wind electricity resource has been estimated as 72 TW, so most countries should be able to meet their total energy demand, never mind their electricity demand. In practice, other renewable electricity sources would increase the overall reliability. Measurements in Germany have shown that the electricity load can be met almost entirely from renewable sources, with wind electricity 61%, solar electricity 14%, biogas electricity 25% and smaller amounts from pumped-storage and imports.

TRANSPORT FUELS AND HEAT

The world transport fuel demand is some 3 TW, and the heat demand about 5 TW. Compared with heat and electricity, transport is the least tractable because the world's vehicle fleets are almost all powered by internal combustion engines using petroleum-based liquid fuels. Transport fuels are also the most urgent, because the world production of conventional oil is peaking about now. While similar fuels could be produced from unconventional oil from tar sands and oil shale, and from coal, these would be much more energy- and carbon-intensive. Moreover, this would increase until the energy cost exceeded the energy gain.

BIOFUELS

Liquid fuels made from biomass may have lower net carbon emissions and some biofuels may be used in existing engines. However, they are constrained by land, water, and nutrients and cause 'food-fuel' conflicts when the world population is still increasing. Moreover the potential for most developed countries is only 10% to 30% of all transport fuel. Yet the constraints are already apparent at less than 5% of road transport fuel.

HEAVY DUTY VEHICLES

Heavy duty vehicles are heavy trucks, buses, trains, and ships, using diesel; and aircraft, using kerosene. Compared with conventional liquid fuels in tanks, the energy density of hydrogen at 700 atmospheres in tanks is lower by a factor of about 5, and that of electricity in batteries lower by about 100. Moreover, these penalties are fundamental and cannot be overcome by R&D. Hence replacement liquid fuels are required to retain the payloads and ranges of such vehicles. Since they use about 50% of all transport fuel, almost all would have to be renewable synthetic liquid fuels.

LIGHT DUTY VEHICLES

Light duty vehicles are passenger cars and light trucks, using petrol and diesel. Because

. . . most countries could never afford all-new battery electric and hydrogen fuel cell vehicles

the payloads and ranges of such vehicles are less critical, fuel cell and battery electric vehicles might still be considered.

However, while batteries and hydrogen fuel cells have been demonstrated in passenger cars, their weights and costs are higher by a factor of 2 or more. Yet cars are used only about 5% of the time, so could not repay the added investments of 'embedded' (materials and manufacturing) energy and of money within lifetimes of 10 to 15 years. Moreover, most would have to be purchased by private individuals, with little availability and high cost of capital. Thus most, if not all, countries could never afford all-new battery electric and hydrogen fuel cell vehicles and their energy/fuel infrastructures.

In addition, several vehicle companies are near bankruptcy and none can afford to write off their existing assets for making internal combustion engines and invest in huge new plants for batteries and fuel cells. In any case, such vehicles could only offer major reductions in carbon emissions when using near-zero carbon renewable energy. Yet this could instead be used to produce near-zero carbon liquid fuels for use in existing and new affordable vehicles with internal combustion engines.

Since renewable liquid fuels would be needed for heavy duty vehicles, it would be logical to use them also for light duty vehicles, rather than changing to new infrastructures and fuel cell or battery electric vehicles. In any case, the latter would be limited to short-range, local usage, for which a much better solution is public transport, which would also relieve congestion. By being used up to 75% of the time, the costs of the latter could be repaid well within the lifetimes of 30 to 50 years.

SYNTHETIC LIQUID FUELS

Spark ignition engines are much less costly than diesels, and have far lower particulate emissions. Also, methanol has been shown to give much higher energy efficiencies than petrol. Moreover, engines capable of using up to 100% methanol could also use up to 100% ethanol. So developed countries could produce synthetic liquid fuels, including methanol, while many developing countries could produce bio-ethanol. 'Flex-fuel' and 'Total Flex' light duty vehicles can use high blends of ethanol and methanol with petrol, to suit the transitions in the different countries. For heavy duty vehicles to retain their payloads and ranges, methanol would be converted to kerosene (for jet aircraft) and diesel (for heavy trucks, trains, and ships). This would also avoid the need to re-develop and re-qualify

Energy and Fuel Options for Light Duty Vehicles	Renewable Sources – eg Wind Electricity	Conventional Oil	Unconventional Oil – e.g. Tar Sands
Internal Combustion Engine Vehicles	Methanol, Ethanol	Petrol, Diesel	Petrol, Diesel
Fuel Cell Vehicles	Hydrogen		
Battery Electric Vehicles	Electricity		

. . . methanol has been shown to give much higher energy efficiencies than petrol. . .

such vehicles for payload, range and safety, when their lifetimes may be about 20 to 30 years.

Synthetic liquid fuels can be produced from renewable hydrogen and CO_2 captured from fluegas and the air. The energy input could be provided by wind and other sources of renewable electricity. The electrolytic production of hydrogen and the capture of CO_2 would be very large loads, but they would be 'interruptible', and the liquid fuels storable – so increasing the reliability of grid electricity. Yet this is less necessary for wind turbines than for fossil and nuclear plant, which have much larger units needing corresponding backup.

The capture of CO_2 from the fluegas of power plants would reduce their output and efficiency and they may run only 50% of the time. Conversely, units to capture CO_2 from air could be installed independently of power plants and run up to 100% of the time. Moreover, the use of captured CO_2 for renewable synthetic liquid fuels would avoid the need for costly sequestration, by displacing fossil oil with its ever-worsening carbon emissions. As well as being environmentally sustainable, such fuels would be indigenous, and could reduce oil imports and defence costs and increase energy security right up to self-sufficiency. Moreover, with a strong home market, the UK could make and sell such plant and equipment for export.

The renewable liquid fuel synthesis efficiency may be about 40% to 50%, with a similar proportion available as reject heat. Hence locating the air CO_2 capture units, electrolysis and synthesis plant at power station sites and cascading the reject heat into city-wide heat networks could meet about two-thirds of the heat demand. Such thermally integrated solutions would displace considerable natural gas, so greatly reducing costly imports, further increasing energy security and further reducing carbon emissions.

DELIVERY OF THE TRANSITION

Governments are concerned about energy security, the costs of imported coal, oil and gas and climate change. Hence – after consultation – they should set the framework for the transition to a sustainable energy system. Logically, the cost should be borne by companies whose fuels cause the problems and who are well able to bear it, rather than by Governments or private individuals. Oil and energy companies are well aware of the ever-increasing cost of replacing declining capacity, let alone that of increasing the supply. Renewable electricity, synthetic liquid fuels and heat would be sustainable, yet such plants would run from 35% to 95% of the time. With carbon targets set and enforced by Governments, the companies could be relied on to deliver the transition, since it would be compatible with their existing businesses while also reducing their risks.

This proposal was developed with Dr Richard Pearson of Lotus Engineering, Hethel, Norwich, Norfolk. A presentation and the full paper, with references, is available at: http://www.energypolicy.co.uk/cast.htm

HOUSE OF COMMONS SELECT COMMITTEE ON SCIENCE AND TECHNOLOGY

Under the Standing Orders of the House of Commons, the Innovation, Universities, Science and Skills Committee's terms of reference were to examine "the expenditure, administration and policy" of the former Department for Innovation, Universities and Skills (DIUS) and its associated public bodies. This included the Government Office for Science, headed by the Government Chief Scientific Adviser. On 5th June 2009 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 former Innovation, Universities, Science and Skills Committee and its terms of reference are to examine "the expenditure, administration and policy" of the Government Office for Science and its associated bodies.

The current Members of the Science and Technology 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 Innovation, Universities, Science and Skills Committee at its first meeting on 14 November 2007 and continues as Chairman of the Science and Technology Committee from 1 October.

ORAL EVIDENCE

The transcripts of these evidence sessions are available on the Innovation, Universities, Science and Skills Committee's website.

Office for Strategic Co-ordination of Health Research (OSCHR)

On 8 June the Innovation, Universities, Science and Skills Committee took evidence on the activities of OSCHR from Professor Sir John Bell, Chairman of OSCHR, and Professor Sir Alex Markham, Chair of OSCHR's Translational Medicines Board (HC 655-i).

CURRENT INQUIRIES

Evidence check - call for suggestions

On 3 August, in preparation for the creation of the Science and Technology Committee on 1 October, the Innovation, Universities, Science and Skills Committee began commissioning work to assess the Government's use of evidence in policy-making. The Committee wrote to the Government on a number of topics and asked about policy and the evidence on which the policy was based. The topics were: the licensing of homeopathic products by the MHRA (Medicines and Healthcare products Regulatory Agency); the diagnosis and management of dyslexia; swine flu vaccinations; literacy and numeracy interventions; the teaching of 'pseudoscience' at universities; health checks for over 40s; measuring the benefits of publicly-funding research; the future of genetic modification (GM) technologies; the regulation of synthetic biology; and the use of offender data. The Science and Technology Committee will review the Government's responses in October.

Additionally, the Innovation, Universities, Science and Skills Committee called on the public to identify other areas of Government policy that required an 'evidence check'. Topics had to be within the remit of the new Committee—to look at all matters within the responsibility of the Government Office for Science, including cross-departmental responsibility for scientific and engineering advice.

REPORTS

Spend, spend, spend? – the mismanagement of the Learning and Skills Council's capital programme in further education colleges

On 17 July 2009 the Innovation, Universities, Science and Skills Committee published its Seventh Report of Session 2008-09, *Spend, spend, spend? – the mismanagement of the Learning and Skills Council's capital programme in further education colleges,* HC 530.

Pre-appointment hearing with the Chair-elect of the Science and Technology Facilities Council, Professor Michael Sterling FREng

On 21 July 2009 the Innovation, Universities, Science and Skills Committee published its Ninth Report of Session 2008-09, *Pre-appointment hearing with the Chair-elect of the Science and Technology Facilities Council, Professor Michael Sterling FREng,* HC 887.

Putting Science and Engineering at the Heart of Government Policy

On 23 July 2009 the Innovation, Universities, Science and Skills Committee published its Eighth Report of Session 2008-09, *Putting Science and Engineering at the Heart of Government Policy,* HC 168-I

Sites of Special Scientific Interest

On 29 July 2009 the Innovation, Universities, Science and Skills Committee published its Tenth Report of Session 2008-09, *Sites of Special Scientific Interest,* HC 717.

Students and Universities

On 2 August 2009 the Innovation, Universities, Science and Skills Committee published its Eleventh Report of Session 2008-09, *Students and Universities*, HC 170-I.

GOVERNMENT RESPONSES

Engineering: turning ideas into reality: Government Response to the Committee's Fourth Report

On 26 June 2009 the Committee published the Government Response to the Innovation, Universities, Science and Skills Committee on *Engineering: turning ideas into reality,* HC 759.

FURTHER INFORMATION

Further information about the work of the Science and Technology Committee or its current inquiries can be obtained from the Clerk of the Committee, Glenn McKee, the Second Clerk, Richard Ward, or from the Senior Committee Assistant, Andy Boyd on 020 7219 8367/2792/2794 respectively; or by writing to: The Clerk of the Committee, Science and Technology Committee, House of Commons, 7 Millbank, London SW1P 3JA. Inquiries can also be emailed to scitechcom@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 which can be accessed from www.parliament.uk/iuss where all recent publications, terms of reference for all inquiries and press notices are available.

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 were co-opted to the Select Committee for the purposes of a short follow-up inquiry into pandemic influenza; Baroness O'Neill of Bengarve, Baroness Finlay of Llandaff, Lord Patel (as Chairman of Sub-Committee II), Baroness Perry of Southwark, Lord Taverne and Lord Winston were 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 is Lord Mitchell.

SETTING SCIENCE AND TECHNOLOGY RESEARCH FUNDING PRIORITIES

Cuts in overall public spending due to the current economic climate will lead to some difficult decisions about how to allocate public funds for science and technology research. Effective mechanisms for allocating funds are vital if the UK's science base is to remain healthy both now and in the future.

In July 2009 an inquiry into the setting of science and technology research funding priorities was launched. The inquiry will be conducted by the Select Committee under the chairmanship of Lord Sutherland and will investigate: how decisions on funding research to meet societal needs are made; what is the balance of funding for targeted versus unsolicited response-mode, curiosity-driven research; and how research is commissioned in Government departments and agencies.

The Committee published a call for evidence on 31 July 2009 with a deadline for submissions of 25 September 2009. A seminar will be held in October followed by a number of oral evidence sessions. The Committee is likely to report in spring 2010.

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, 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 24 June 2008 the Committee decided to conduct a brief follow-up to its 2005 report. As a result, on 25 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 17 March. Following the outbreak of swine flu, the Committee's focus shifted and a second evidence session, with the Minister of State for Public Health, Gillian Merron MP, was held. The Committee's report was published on 28 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.

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 25 February 2008 with a deadline for submissions of 21 April. The Sub-Committee was reappointed at the beginning of the current session (2008-09).

The inquiry examined 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 held a number of public meetings and took evidence from a wide range of witnesses. They 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 6 July 2009 and received extensive media coverage; it 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 3 February 2009 with a deadline for submissions of 13 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 31 March with representatives from Government departments. It has held regular evidence sessions throughout the year prior to the summer recess. 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 representatives of 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. 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.

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.

Green Energy (Definition and Promotion) Bill: Committee Stage Report

Research Paper 09/63

This is a Private Member's Bill introduced by Peter Ainsworth MP. The Bill seeks to define and promote "green energy". The original Bill aimed to facilitate the development of green energy by: requiring a review and revision of the Government's Microgeneration Strategy including feed-in tariffs; changing permitted development rights in planning law; and ensuring that green energy installations do not result in higher council tax or rates bills.

The Paper deals with the Committee Stage of the Bill. The Government agreed with many of the aims of the Bill but not all of the detail. Government support for the Bill was contingent on several amendments in Committee. However, Peter Ainsworth stressed that there had been no attempt to water down the provisions that he sought to introduce.

PARLIAMENTARY OFFICE OF SCIENCE AND TECHNOLOGY (POST)

POST 20th Anniversary Conference and 2009 Conference of the European Parliamentary Technology Assessment network
2-3 November, 2009, Houses of Parliament

"Images of the Future"

Principal Guests: Hon Bart Gordon, chair of the US Congress House of Representatives Science and Technology Committee

Professor Jim Dator, Hawaii Research Center for Futures Studies, Honolulu, Hawaii

Further details – contact Nadine Walters at POST (waltersn@parliament.uk) on extension 8377

RECENT POST PUBLICATIONS

Treatments for Heroin and Cocaine Dependency

June 2009 *POSTnote 337*

Some 11.3 million people in Britain have used an illicit drug at least once in their lifetime. Cocaine and heroin are the most damaging in terms of health impacts to dependent individuals and the cost of drug-related crime. This POSTnote looks at the treatments currently available for heroin and cocaine dependency, assesses the prospects for new treatments, and examines the issues these raise.

Environmental Noise

July 2009 *POSTnote 338*

Noise pollution affects quality of life and has been linked to health problems. The EU Environmental Noise Directive (END) aims to manage noise and to preserve quiet areas by engaging the public, local authorities and operators. This POSTnote examines the effects of noise, the END and practical measures for noise management.

Nutritional Standards in UK Schools

July 2009 *POSTnote 339*

In 2006 617 million school meals were served in England alone. The situation regarding school meals differs in the constituent countries of the UK. In England new legislation on minimum nutritional standards in schools began in 2008 in primary schools and will come into force in secondary schools by September 2009. It sets out food- and nutrient-based standards for school food. The devolved administrations have already implemented similar legislation and face similar issues in improving school food. This POSTnote outlines children's nutritional requirements, the take-up of school meals in the UK, the capacity to enforce the standards and the impact of children's diet on behaviour and learning.

The Dual-use Dilemma

July 2009 *POSTnote 340*

Science is primarily used to benefit humanity, but it can be misused, presenting scientists and others with an ethical quandary known as the dual-use dilemma. This POSTnote examines three scientific areas posing a significant risk of misuse and considers how to tackle dual-use dilemmas in these and other areas.

CURRENT WORK

Biological Sciences – Assisted Reproduction, Single Embryo Transfer, Animal Cruelty and Interpersonal Violence, Counterfeit Medicines, Deception Detection Technologies and Teaching Children to Read.

Environment and Energy – Security of Energy Supply, Future Electricity Transmission, 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, Technology for the Olympics, Space Debris, Space Weather.

CONFERENCES AND SEMINARS

Geoengineering

In July POST collaborated with the All Party Group for Climate Change in a seminar that explored the controversial, but increasingly discussed, concept of geoengineering – direct intervention to cool the Earth or to remove greenhouse gases from the atmosphere. As it looks increasingly uncertain that the Copenhagen climate change conference in December will produce an effective international agreement to reduce greenhouse gas emissions, geoengineering could play a key role in reducing the impacts of climate change. Speakers were:

• Professor David Keith, Director of the ISEEE Energy and Environmental Systems Group at the University of Calgary, who discussed the general history of geoengineering, as well as the concept of solar radiation management.

• Dr. Chris Tyler, Committee Specialist with the House of Commons Innovation, Universities, Science and Skills Committee, who highlighted the findings of the Committee's report on geoengineering.

• Professor Tim Lenton, Professor of Earth System Science at the School of Environmental Sciences, University of East Anglia, who gave an overview of different geoengineering proposals.

• Professor John Shepherd, Deputy Director of the Tyndall Centre for Climate Change Research at the University of Southampton and chair of the Royal Society study group on Geoengineering Climate, who spoke about the challenges for policy makers and the near future of the field.

The Draft Water and Flooding Bill: Risk Management of Flooding and Coastal Erosion

Also in July POST collaborated with the Natural Environment Research Council and the Centre for Ecology and Hydrology to organise a seminar on this subject.

The draft Flood and Water Management Bill was published for consultation and pre-legislative scrutiny on 21 April 2009. It set out the Government's proposals to improve flood risk management and to ensure water supplies are more secure. The broad objective of the bill is the sustainable management of water in the face of climate change. It includes legislative measures on the institutional framework to implement Flood and Coastal Erosion Risk Management (FCERM) and on Sustainable Urban Drainage Systems (SUDs). In particular, it follows up on the recommendations of the Pitt report, *Learning the Lessons from the 2007 Summer Floods,* and aims to achieve the strategic objectives set out in the Government's water strategy, *Future Water*. It is also key to the implementation of the EU Directive 2007/60/EC on the assessment and management of flood risks. The seminar examined

- key scientific issues for flood risk management
- social and economic aspects of flooding
- surface water management and drainage issues
- adaptation and resilience in a changing climate.

WORK FOR SELECT COMMITTEES

House of Commons

Defence: Dr Chandrika Nath has framed questions and proofread briefings for two evidence sessions with the Ministry of Defence and with commanders recently returned from Afghanistan as part of the committee's inquiry into the contribution of ISTAR (Intelligence, Surveillance, Target Acquisition and Reconnaissance) to military operations.

Energy and Climate Change: Dr Michael O'Brien has prepared a briefing for the committee on Severn Estuary Tidal Projects.

STAFF, FELLOWS AND INTERNS AT POST

Special House of 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 series of fellows dedicated to working either with the committee or with POST directly.

The first such fellow, who is working with the committee on its inquiry programme, Dr Greg Offer, was a POST fellow in 2004 prior to joining Imperial College.

Conventional Fellows

Thomas Douglas, Oxford University, Wellcome Trust Fellowship

Fiona Duff, York University, British Psychological Society Fellowship

Johanna Forster, University of East Anglia, Economic and Social Research Council Fellowship

Chris Roberts, Cambridge University, Natural Environment Research Council Fellowship

Intern

In July POST welcomed Andrew Spurr, currently doing a Masters degree in Physics at Oxford University, as a summer intern. Andrew prepared a data base on current MPs and parliamentary candidates in preparation for the next general election and also worked on research for forthcoming POSTnotes.

INTERNATIONAL ACTIVITIES

POST African Parliaments Programme

In August 2009 Dr Kirsty Newman, the programme manager, organised a week-long course in Kenya on advanced internet searching for parliamentary staff from countries in East Africa.

In September 2009 Dr Nath travelled to Uganda to speak during National Science Week about the work of POST and the progress of the programme to date.

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 1st June to 21st July 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

AGRICULTURE

Organophosphates

Debate in the House of Lords on Wednesday 17 June

To ask Her Majesty's Government whether they will reconvene the Interdepartmental Group on Organophosphates (the Carden Committee)

The Countess of Mar: I was poisoned by organophosphate sheep dip in 1989. In fact, it is almost exactly 20 years since I was doused while helping to dip our sheep. Prior to that, I had been chronically exposed to a variety of OPs in common use on farms and in homes. At the time we were led to believe that OPs were safe if used as instructed. It was not until 1991, after a long process of elimination and observation after further exposures, that the cause of my illness became clear to me and to my GP. Contrary to received belief, the signs and symptoms of poisoning were not temporary and, for me, the effects are still evident today. I am extremely fortunate in that I have supportive medical practitioners whose main objective in life is not to poison me further.

Sheep dipping once or twice yearly in the UK was compulsory from 1975 to 1992 as part of the regime to control sheep scab. OPs replaced organochlorines from the early 1980s after the latter were found to persist in the environment. At first, the Government assured us that these products were safe and that they presented no risk to human health. Since then there has been progress and their acute effects are readily acknowledged. Many OPs have been removed from the market, while stringent instructions now apply to those that are still in use. But there is still no recognition of their chronic central and autonomic nervous system effects.

Following close on the heels of the sheep farmers and other agricultural workers were some Gulf War veterans who reported very similar adverse health effects following medication with pyridostigmine bromide, a carbamate closely related to OPs, and exposure to OP nerve gas and pesticide sprays. Despite the fact that the US Research Advisory Committee on Gulf War Illnesses recently concluded that some 25 per cent of Gulf War veterans – 25 per cent of more than 6,000 people – are suffering the effects of OP poisoning, the British Government persist in their denial that these same exposures have had any effect on our troops. More recently, airline pilots and crew have reported ill effects following exposure to cabin air contaminated by leaking engine oil that produces very toxic OPs when heated.

In all these groups, scientific research has shown consistently that there may be a relationship between long-term, low-level exposure to organophosphates and the development of neurobehavioural problems.

Lord Davies of Oldham, Minister of State, Department for Environment, Food and Rural Affairs: A number of speakers suggested that the Government have been tardy in responding to these issues out of an unwillingness to commit resources, or from anxiety about compensation that may be payable. Those are unfair charges. The issue is straightforward, as Lord Taylor emphasised; namely, that we must make progress on the basis of the scientific evidence. As I understand it, the problem is that we do not have a secure enough scientific base to know exactly what to do. That is not to say that we are not aware of studies such as the one to which Lord Greaves referred. After all, that was commissioned by Defra. The researcher, Dr Sarah Mackenzie Ross, found that the results suggested there may be a relationship between long-term, low-level exposure to OPs and the development of neural behavioural problems. This is an important piece of research but we have commissioned two other research reports as a result of COT's work in 1999 and we await their publication. We cannot publish them yet because they have not been subjected to peer review and proper scientific vetting and analysis. All these reports, and our response to them, will be produced in the very near future.

HEALTH

Public Analysts Service

Debate in Westminster Hall on Tuesday 2 June

Brian Iddon (Bolton South East): Food security is high on the political agenda at the

moment. Population increases, and the consequent increases in prosperity and demand for food and energy, pose a huge problem in a world faced with climate change and global warming. However, we must not take our eye off the safety of our increasingly global food supplies. A succession of food scares before this Government came to power in 1997 led to the establishment, in 2000, of the Food Standards Agency, which is now the competent authority for the implementation and monitoring of food and feed law in this country. In practice, the FSA delegates many of its responsibilities. European regulation 882/2004 on food and feed controls requires adequate laboratory provision for the testing of food and animal feedstuffs throughout its member states.

In this debate, however, I want to examine the role of public analysts, who play a vital role in maintaining the safety of our food, and their relationship with the newly created FSA. On 11 February, in a letter to Sir Robert Smith, my right hon Friend the Minister, who I am very pleased to see in the ministerial chair this morning, wrote:

"The proposed changes to The Food Safety (Sampling and Qualifications) Regulations 1990 will enable suitably qualified people to become official food analysts. This will help address the decline in the current number of existing analysts and ensure that the capacity and skills for analysis of food is maintained and enhanced. This will widen the market for analytical services, increasing capacity and providing improved access to a broader base of analytical services to ensure sufficient levels of control and consumer protection".

That is a worrying statement and suggests an end to the highly professional and highly trained public analysts as we have known them since 1860. It also indicates the possibility of more privatisation of the food analysis service. Will the Minister say whence these proposals have come, how much consultation there has been, how highly trained she expects analysts to be in the future and whether they will be adequately trained to represent themselves in the courts of law?

By contrast, the Association of Public Analysts believes that the MChemA and its holders demonstrate unique competencies in the application of analytical chemistry in the ever-changing context of food law and, more importantly, that they are able to present their findings in criminal courts. Furthermore, removing the need for this qualification and allowing official samples to be sent to other types of laboratory will not prevent the continued decline in food sampling and analysis.

Dawn Primarolo, Minister of State (Public Health), Department of Health: I agree with Dr Iddon about the importance of the work of public analysts in protecting consumers and preserving public health. The FSA is addressing that with the future career structures and qualifications for the service. I will come back to that because he raised a number of questions on that. I will deliver my speech in two parts. I will first discuss the importance of public analysis and the work that is going on, look forward to what else the service could do and consider the types of qualifications we would need. The second half will deal specifically with the role of the pre-eminent qualification, which will remain pre-eminent, and the consultation that needs to take place. I will also pick up on comments made by other hon Members.

As has been mentioned, there are currently about 900,000 cases a year of food-borne disease in the UK. Every year, about 500 people die because of what they have eaten. New challenges over food safety have developed over the past few decades. As production methods, supply chains and food technologies have evolved, the response required has become much more complex. The approaches needed to reduce health risks from contamination or adulteration and to protect consumers are becoming increasingly specialised. We must ensure that the claims made by food producers are subject to robust scientific scrutiny. European law states that the FSA must designate official control laboratories to carry out analysis of official control samples. It is true that we have seen a significant reduction in laboratory numbers since the mid-1950s. It is also true that the volume of work commissioned by local authorities has fallen considerably. The FSA has investigated and continues to investigate those matters. It advises me that the current level of laboratory provision is adequate. First and foremost, the UK has moved from a scatter-gun approach to sampling to a more targeted and risk-based approach. In the past local authorities traditionally operated independently of each other. They selected a shopping basket of products for sampling based on local concerns. That meant that authorities in adjoining areas could have run tests on products from exactly the same source. As a crude example, several local authorities could conceivably have sampled food coming from the same warehouse at the same time and using the same manufacturing process. What happens now is that local authorities co-ordinate their efforts through the food liaison group run by the Local Authorities Co-ordinators of Regulatory Services, which established a national sampling programme and shares evidence. That reduces duplication between councils.

Addiction to Medicines

Debate in Westminster Hall on Tuesday 16 June

Brian Iddon (Bolton South East): This is my valedictory address as chairman of the all-party group on drugs misuse. I hope to hand over the group's chairmanship this very afternoon, after serving in that capacity for 10 years. I am sure that I will leave it in good hands. I am introducing this debate on addiction to and physical dependence on prescription and over-the-counter medicines in the hope that the Government will take the issue on board when they make policies in future. It is now recognised by many that the war on drugs has caused displacement – substance displacement, geographical displacement and even policy displacement. The press kit for the United Nations 2006 International Narcotics Control Board annual report states, at page 11:

"The abuse and trafficking of prescription drugs is set to exceed illicit drug abuse, warned the International Narcotics Board in its Annual Report released today".

That was on 1 March 2007. The passage continues:

"The Board added that medication containing narcotic drugs and/or psychotropic substances is even a drug of first choice in many cases, and not abused as a substitute. Such prescription drugs have effects similar to illicit drugs when taken in inappropriate quantities and without medical supervision. The 'high' they provide is comparable to practically every illicitly manufactured drug."

Why should a person risk a fine or prison sentence when perfectly legal substances can give them a buzz equal to that obtained from street drugs such as heroin, cocaine and crack cocaine? As we increase the penalties for those who use controlled drugs, as we have done, again, for cannabis users, or increase the number of classified substances – perhaps it will be khat or other legal highs next – people will seek alternatives to give them a buzz. Stronger enforcement merely leads to what I and others term substance displacement. Concerns have been rising in recent years about the number of people who have become physically dependent on or addicted to legal substances, even overdosing on them, which has sometimes resulted in tragic deaths. The high-profile death of the famous Heath Ledger was only one example of very many.

The Minister of State, Department of Health (Phil Hope): For the Government, it is important to address all drug addiction, including addiction to prescription and over-the-counter medicines. We want to make it clear that tackling drug misuse of any kind is a Government priority, and we have made massive strides in reducing the harm that drug misuse can do to individuals and to society as a whole. We have made a substantial investment in drug treatment through the pooled drug treatment budget that has been allocated to primary care trusts on behalf of local drug partnerships. In the past 10 years, investment has increased from £142 million in 2001-02 to £406 million in this financial year. Of that sum, £24.7 million has been earmarked specifically to support treatments for young people.

We are committed to getting drug misusers off their drugs of addiction, and we are supporting drug users in working towards that goal. As we have heard today, drug addiction can be a long-term, chronic, relapsing condition that requires treatment over an extended period. Independent research shows that drug treatment is one of the most effective treatments in the NHS. For every £1 we spend on drug treatment, we make a saving of £9.50 for society as a whole. Some 83 per cent of those treated in 2007-08 either completed treatment successfully or were still in treatment on 31 March 2008, so we are keeping 78 per cent of people in treatment for at least 12 weeks because we know that staying in treatment for 12 weeks has a lasting and positive impact on reducing the harms associated with addiction and that it is a key measure of effective treatment. In the three years from 2007 to 2010, we are investing £54.3 million of new funding, over and above the pooled drug treatment budget, to fund the expansion of in-patient detoxification and residential rehabilitation services to help drug users to beat their addiction.

Archer Inquiry

Debate in Westminster Hall on Wednesday 1 July

Jennifer Willott (Cardiff Central): Some 1,200 patients were infected with HIV and 4,670 with hepatitis C as a result of NHS treatment in the 1970s and 1980s. Many of those patients were unaware of their infection and went on to infect their husbands and wives as well. So far, some 1,800 members of the haemophiliac community have died. In the past few years, many of the survivors have been told that they may have contracted variant Creutzfeldt-Jakob disease from infected blood products.

Haydn Lewis, a constituent of mine, has been infected with hepatitis B and C and HIV. He also infected his wife with HIV before he was aware of his own status. His brothers, who are also haemophiliacs, are infected as well. Last year, Haydn was informed that he had been exposed to VCJD. Moreover, as a result of his hepatitis C, he developed liver cancer and has recently had a liver transplant. Haydn's health has suffered massively over the years. He had to give up work early, and his entire family has suffered as a result of his condition. His family is just one of thousands across the country.

Despite the fact that a large number of people have been affected, there has been a desperate lack of public debate on the subject. The last debate in the Commons was in 1990, and the last Westminster Hall debate was nearly 10 years ago. The Department of Health did not even make an oral statement when it responded to Lord Archer's report. The level of interest in today's half-hour debate demonstrates the need for a much longer debate in Parliament.

Oliver Letwin (West Dorset): Does the hon Lady not agree that what is so extraordinary is that the Government do not appear to want to engage with Lord Archer even at this stage?

Jennifer Willott (Cardiff Central): That is a very valid point, and I was about to mention it. Although Lord Winston described the tragedy as "the worst treatment disaster in the history of the national health service", the Government have always argued that a public inquiry would be unjustified and unnecessary. The Archer inquiry was the first public attempt to uncover the truth, but because it was not a statutory inquiry, Lord Archer could not compel witnesses to give evidence and he could not oblige bodies to release documents. The Department of Health even refused to send witnesses to give public evidence to the inquiry.

The Minister of State Department of Health (Gillian Merron): I am deeply sorry for what happened and have the utmost sympathy for those whose lives have been affected by it either directly or indirectly. Parliament has debated the matter in both the Commons and the other place, and Lord Archer and his team conducted a thorough and valuable review. I thank Lord Archer for his report.

We can all agree that the circumstances are tragic. How could a revolutionary new treatment for haemophilia that offered so much hope at the time – the early 1970s – end in so much tragedy for so many? Almost 5,000 people in the UK and thousands more around the world were infected with hepatitis C and HIV, resulting in the loss of many lives.

Before the treatment became available, the life expectancy of someone with severe haemophilia was less than 30 years. Although there were warning voices at the time about the risk from infection, the consensus in both the scientific and haemophilia communities was that the risk was low and worth taking. Unfortunately, we know now that that consensus was wrong. The best available treatment at the time, a treatment intended solely to improve length and quality of life, resulted instead in heartbreak for many people and their families. The risks were higher than was thought, and the pain and grief caused can never be undone.

If doctors and medical experts had known then what they know now, the tragedy could have been prevented, but the fact is that they did not. Successive Governments have been accused of trying to hide what was said and done during the period when most of the infections occurred, but this Government have done more than any other to make information available about the events, judgments and decisions between 1970 and 1985, after which safer blood products were introduced. In line with the Freedom of Information Act 2000, we have made more than 5,500 documents publicly available. In examining all those documents, which span decades, neither we nor Lord Archer and his team found any evidence of a cover-up.

The hon Member for Cardiff, Central asked about co-operation with Lord Archer's inquiry. I will say straight off that there is nothing to hide.

Air Quality (Aircraft)
Debate in Westminster Hall on Wednesday 1 July

Tobias Ellwood (Shadow Minister, Culture, Media & Sport): Up to about the late 1950s, pressurised air was taken from outside and depressurised using cylinders, but a cheaper way was found that involves taking pressurised air from the compressor stages of an aircraft's jet engines. The air is cooled and flows into a chamber where it is mixed with highly filtered air from the passenger cabin. The air then flows through the cabin and exits through valves in the fuselage. It is called the bleed air system and has worked efficiently for many years. However, while micro-organisms may be trapped by those filters, it is clear that other toxins may not, which is the whole reason for this debate.

The use of air that has passed through the engine means there is a probability that toxins and organophosphates, particularly tricresyl phosphate, or TCP, which is used as an anti-wear additive, can enter the cabin. Those toxins are not removed by the filters. The consequences of TCP entering the cabin can be headaches and drowsiness, as well as respiratory and neurological problems. That is certainly unpleasant for passengers, but is potentially lethal for pilots. Captain Tim Lindsey, a British airline pilot who supplied evidence to the Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment died in January 2009 of brain cancer – a long-term effect of toxicity exposure.

The condition caused by TCP has now been called aerotoxic syndrome, and the airline industry is familiar with it. Unfortunately, however, pressures within the industry mean that reporting of the syndrome is not as fair as it should be. Symptoms include eye irritation, respiratory problems, headaches, skin problems, nausea, vertigo, loss of balance, dizziness, fatigue and cognitive impairment – all things that one does not want the person in charge of the plane to suffer from.

The Parliamentary Under-Secretary, Department for Transport (Paul Clark): The issue is serious, and I say that genuinely. However, we must talk about facts and real evidence, and there has been an awful lot of speculation in some of the contributions. Air quality in commercial passenger aircraft is high, and much of the information that we have heard today would be worrying for anyone who is thinking of travelling on a plane. The Committee on Toxicity estimated in 2007 that fume events occurred in approximately 0.05 per cent of flights, or one in 2,000. In 2008, 97 contaminated air events were reported to the CAA under the mandatory occurrence reporting scheme from 1.2 million passenger and cargo flights by UK carriers.

Of the 97 reported occurrences of contaminated air by aircraft type, 38 were on a Boeing 757, 19 were on an Airbus 319, and six were on an Airbus 320. Some hon Members referred to British Aerospace's BAe 146, and there were two reported occurrences in 2008 for that aircraft. Mechanical system malfunctions occur and may result in abnormal operating conditions, but the CAA has taken remedial action to help operators of specific aircraft to reduce the incidence of fume events, such as engine oil servicing procedures and engine sealing modifications. Those are some of the steps that have been taken to help the industry and those who work on planes and travel by air. It is essential to ensure that health and safety provisions for both categories of people are of the highest level. I recognise the concern that has been raised, but we must have evidence, and we have undertaken work on that. I assure everyone who is listening to our debate and those who read Hansard that it is not a proven fact that cabin air harms health.

Drugs: Risk Assessment
Question and Written Answer on Wednesday 15 July

Sandra Gidley (Romsey): To ask the Secretary of State for Health whether *(a)* his Department and *(b)* the National Patient Safety Agency has undertaken a risk assessment of proposals for generic drug substitution.

Mr Mike O'Brien: No such formal assessment has been undertaken.

Patient safety will be paramount in taking forward the work on generic substitution. It has long been the Department's policy to encourage generic prescribing where possible, for reasons of good professional practice and because of the opportunities for more effective use of national health service resources. However, we have always recognised that there are circumstances in which it may be clinically appropriate to prescribe a particular brand of drug even where a generic is available if the prescriber considers it essential for the patient to receive that specific product. This position will need to be maintained under any new specific proposals made as part of the work on generic substitution.

ENERGY AND CLIMATE CHANGE

Extreme Solar Events
Debate in Westminster Hall on Tuesday 9 June

Graham Stringer (Manchester, Blackley): On 23 April 2008, the Select Committee on Innovation, Universities, Science and Skills published its report on science budget allocations. During the course of the Committee's inquiry, we received a number of representations from different scientific bodies about the decision of the Science and Technology Facilities Council to reduce the budget allocation for ground-based solar terrestrial physics to zero. We received evidence from UK Solar Physics research and from the British Academy, but the clearest evidence that we received was from the British Antarctic Survey.

I shall quote two parts of the British Antarctic Survey's evidence, in which it makes a case for not cutting the budget in relation to solar terrestrial physics:

"Sun-climate links: researchers are becoming increasingly aware of links between solar variability and the earth's climate. It is critical that we establish the relative importance of solar-induced effects on climate change so we can predict more accurately the man-made influences on climate. The InterGovernmental Panel on Climate Change reported that the current level of understanding is very low and Sir Keith O'Nions, in recent evidence to the Public Accounts committee about the Halley research station in Antarctica, asserted that the 'physics of the upper atmosphere there will be a very key part of climate change'. "

It is therefore an odd decision to cut the budget.

More importantly for the case I want to make, the British Antarctic Survey stated:

"Space weather: solar variability has a very strong influence on the near-earth space environment, including large transient increases in the amount of radiation there. Such space weather events are frequent but intermittent and of varying severity, the prediction of which is an ultimate goal of STP research. They can lead to temporary loss of service from satellites, or even the complete loss of satellites worth about $300 million each. More than half of all space insurance is done through London and is worth $500 million per year."

Joan Ruddock, Parliamentary Under-Secretary, Department for Energy and Climate Change: A recent article in the *New Scientist* raised concerns that a repeat of the Carrington event could have a major impact on national electricity transmission networks. It prompted a letter from a concerned constituent of Dr Fox and a debate in both the Scottish Executive and the Welsh Assembly. I therefore very much welcome this opportunity to discuss the issue and to explain the Government's view on the risk that we believe is posed to the UK's electricity network, and the measures that are in place to monitor events and mitigate the risks.

National Grid Electricity Transmission owns the England and Wales electricity transmission system, and Scottish Power Transmission Ltd and Scottish Hydro Electric each own part of the transmission system in Scotland. National Grid also has responsibility for overseeing and managing the flow of electricity across the whole of the Great Britain transmission network. My Department maintains close contact with those companies on all network resilience issues.

Satellites are capable of giving several hours' warning that a major solar storm has occurred on the sun, and about 30 minutes' warning that the subsequent discharge could impact on the earth. The information is available in real time to National Grid, which has procedures in place that set out the actions that would be taken should such an alert be received.

There is also an international research programme to improve understanding of the potential impact of solar storms. It is led by the Electric Power Research Institute based in the USA, and National Grid is a partner in that research. The programme monitors the ongoing low-level solar storms that are detected from time to time by satellites and correlates them with measurements of induced currents on the ground as detected by monitors placed around the globe. In that way, we are gaining experience in interpreting early warning signs of solar storms.

My hon Friend asked whether it was wise to cut the budget. I shall write to my relevant opposite numbers and make an inquiry further to his inquiry. I am not in a position to make a judgment, but I would say to him that, as in so many such matters, the international scientific endeavour is most important. As the UK Government, and through the partnership of National Grid with the US institute, we are able to obtain up-to-the-minute, appropriate science.

Graham Stringer (Manchester, Blackley): I am grateful for that response, and I realise that this debate covers several departmental responsibilities. While international collaboration may deal with some of the details and with development of policy, there is a real economic importance to work going on in this country because of the insurance industry in the City.

Joan Ruddock, Parliamentary Under-Secretary, Department for Energy and Climate Change: I will certainly look at that.

Climate Change

Question and Written Answer on Thursday 2 July

Lord Dykes: To ask Her Majesty's Government what is their response to warnings by scientists of an acceleration in the melting of ice sheets in Greenland and Antarctica.

The Minister of State, Department of Energy and Climate Change (Lord Hunt of Kings Heath): The Government recognise that if we do not take action now to stop climate change getting worse, the ice sheets will continue to melt, the impacts on future generations will be irreversible and the costs of taking action unaffordable. That is why the UK is pushing for an ambitious global climate change deal in Copenhagen later this year that will meet our objective of keeping global temperature rises below 2 degrees Celsius. This will mean nothing less than a 50 per cent reduction in global emissions by 2050 (compared to 1990 levels).

In the EU, we have already committed to a 20 per cent reduction in EU emissions compared to 1990 levels by 2020, and if other countries make ambitious commitments in December, the EU is prepared to increase this commitment to 30 per cent. This is by far the most ambitious mitigation offer on the negotiation table so far.

At a national level, future sea level rise around the UK coast due to the effects of climate change is a major concern. In November 2008, the Environment Agency, working with the Met Office Hadley Centre, published some climate change research findings as part of the Thames Estuary 2100 project (TE100). The research outlined that relative sea levels could rise between 0.2m and 0.88m by 2100. This figure allows for small land movements over that time, but does not fully account for the remote possibility of future rapid changes in ice flows in the Atlantic or in Greenland, which could lead to the upper figures being much higher.

In response, the Environment Agency commissioned the Met Office to consider this gap in ice flow science. The work investigated a most extreme scenario, known as High + +. This suggested a higher range of sea level rise of up to 1.9m. This is regarded as a remote possibility, highly uncertain and highly unlikely in this century. As we go forward, we will refine our projections in the light of what is happening in practice and as science deepens our understanding.

Defra manages the impacts of sea level rise through a range of policy approaches including supporting flood adaptation and resilience. Long-term strategies and plans, such as Thames Estuary 2100, have been prepared on the basis of current understanding and are designed to be adaptable to ensure that future challenges can be met.

Energy: Light Bulbs

Question and Written Answer on Tuesday 21 July

Lord Hoyle: To ask Her Majesty's Government what assessment they have made of any dangers to people's health arising from the use of fluorescent tubes, low-energy bulbs, halogens and LEDs.

The Parliamentary Under-Secretary of State, Department of Health (Lord Darzi of Denham): In negotiations with the European Commission with regard to implementation of regulation 244/2009 concerning the domestic lighting part of the eco-design of energy-saving products directive 2005/32/EC, the Government successfully pressed for health impacts to be considered and for limits to be set on ultraviolet radiation emissions from compact fluorescent lamps (CFLs). Since early on in the negotiation process, the Government have been in discussion with clinicians and support groups for partially sighted people and people with certain light-sensitive and neurological conditions about low-energy lighting.

The Health Protection Agency (HPA) tested a sample of CFLs and found that some emitted UVR which could, under certain conditions, expose people above international guidelines. As a result of its findings the HPA issued precautionary advice on 9 October 2008 to the general public concerning the use of open CFLs in close-working situations. The HPA's advice can be found at www.hpa.org.uk/webw/HPAweb&HPAwebStandard/HPAwebC/1223445516605?p =1153822623869

The HPA's research was considered alongside other available evidence to inform a report by the European Commission's Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR). SCENIHR's opinion on light sensitivity can be found at http://ec.europa.eu/health/opinions/en/energy-saving-lamps/index.htm.

In December 2008, the Government prepared an impact assessment, including health aspects, relating to regulation 244/2009. The impact assessment was published on the Department of Business Enterprise and Regulatory Reform website and is being transferred to the Business Innovation and Skills Department website.

SCIENCE POLICY

Science, Technology and Engineering

Debate in the House of Lords on Thursday 4 June

Lord Haskel: We look to science, technology and engineering to solve our problems, such as coping with climate change, looking after an ageing population, feeding a growing population, finding new sources of energy, lifting billions out of poverty, competing in today's globalised knowledge economy and even fighting terrorism. Although an economy leaning heavily towards financial services served us well for a number of years, it has turned out to be unreliable. The economy emerging from this crisis needs to be more evenly balanced and spread. A balanced economy requires a culture that accepts new knowledge and technological progress as well as the institutions that seek it. It requires us to create and nurture businesses and companies that use science, technology and engineering to bring about economic and commercial progress. We also have a number of charities devoted to developing science, technology and engineering and they have to be brought together by institutions such as the Technology Strategy Board as well as the knowledge transfer networks that bring a new and different focus on innovation. We also have to bring different cultures together. Science, technology and engineering need the social sciences to help us to solve our problems.

Baroness Greenfield: A good first step could be to identify some of the bottlenecks in scientific culture that are preventing UK plc from making the most of the current opportunities. First, there is the relationship of science with the media. There is still a long way to go before we can consign to the past the all too familiar demonisation of science and scientists, the sensationalist, oversimplified reportage of facts and the wariness and aversion many scientists have of talking to the press. I see the difficulty lying in a conflict of different cultures between scientists, journalists and politicians. The ensuing clash is one of very different agendas and timescales. Ways forward for building bridges between such otherwise disparate sectors are starting to make their mark. For example, Sense About Science, an initiative started by Lord Taverne and the Science Media Centre at the Royal Institution, has done much over the past few decades to create a common forum where different agendas and timescales can be reconciled.

Lord Bhattacharyya: I have long believed that science and technology are central to almost every issue we face as a nation. Over the past decade, science and technology issues have become frontline news and academic research has increased in prestige. At the same time, the increase in higher education funding has meant expansion, a growth visible in the new buildings we see on every university. This increased funding, as well as our growing understanding of the world means there is hardly any aspect of our national life where scientific research is not making a vital contribution.

Viscount Montgomery of Alamein: It is clear that science and engineering are taken quite seriously in this Parliament, particularly within the various all-party groups on this subject, such as the Parliamentary and Scientific Committee, which has been ably chaired to date by Doug Naysmith and has now been taken over by Ian Taylor. I have always thought that government would be improved with more engineers trained to produce solutions that work, and fewer economists.

Lord Jenkin of Roding: I happen to be the president of the Parliamentary and Scientific Committee, to which reference has been made, and chairman of the Foundation for Science and Technology. I was struck by the journalists' insistence on the need for good communication. It has been a subject close to my own heart ever since the House issued our Select Committee report, Science and Society, an inquiry which I had the honour to chair. If, indeed, science and technology are essential – I believe that they are – to meeting the challenges with which we as a world are faced, particularly in this nation, those engaged in promoting this must secure and retain the trust of the public.

Lord Rees of Ludlow: To retain our international competitiveness, we must raise our game. That is because the Obama Administration have given America's scientific community a massive boost in morale and in substance. The new President has eased the ban on stem cell research and has appointed a "dream team" of science advisers. Moreover, his economic stimulus package includes new, one-off investments in federal R&D worth more than $13 billion for the NSF and NIH, and a much larger sum for R&D in energy. Our success in attracting and retaining mobile talent will be at risk unless we respond.

Lord Drayson, Minister of State, Department for Innovation, Universities and Skills: Our only hope in dealing with the major challenges facing the United Kingdom and the rest of the world – clean energy, disease, sufficient food and water – is to address them through science, technology and engineering. For our economy to achieve sustainable growth, it requires a constant stream of top-quality research to generate new ideas, products and processes so that we can compete in the next-generation industries in the modern world. It also requires us to ensure proper recognition of our scientists, our engineers and our science entrepreneurs. This Government, I believe, have done that and are doing it. This Government have treated science as one of their highest priorities for public investment and they will continue to do so.

Forensic Science Service

Debate in Westminster Hall on Tuesday 30 June

David Amess (Southend West): Unlike the last debate, when we did not have enough colleagues to fill the time, it appears that we now have a number of colleagues who wish to participate in this debate.

Lindsay Hoyle (Chorley): The Forensic Science Service states that as a consequence of the reorganisation, there is likely to be a headcount reduction of some 30 to 40 per cent of the total work force. That change will take place over the next 18 months. It is against that backdrop that I applied for the debate, and I want to highlight my concerns about the Chorley site and the impact on the whole of the Forensic Science Service.

The Forensic Science Service is a leading provider of analysis and interpretation of evidence from crime scenes. It provides a comprehensive service from crime scene to courtroom and analyses more than 120,000 cases each year. It is the market leader in the supply of forensic science to the police and coroners in England and Wales. It is also a supplier to places such as the Isle of Man, the overseas territories and other Commonwealth countries. It has a global reputation for excellence in the development and deployment of new and advanced techniques. Its heritage and expertise also provide the basis for world-class training services.

James Brokenshire, Shadow Minister, Home Affairs (Hornchurch): I congratulate Mr Hoyle not just on securing the debate, but on the passionate, powerful way in which he highlighted the concerns of the 200 members of staff at the Forensic Science Service base at Washington Hall in his constituency, and the concerns about the wider issues arising from the changes to the service and the proposed cuts that will, potentially, lead to the loss of 800 jobs over the next two years. The debate is important, not only in terms of the jobs at risk, and not only because of the future of the FSS, but because of the questions that it raises about the forensic science capabilities for law enforcement to solve increasingly complex crimes, where the use of forensic data is becoming ever more essential in bringing serious crimes to justice.

The catalyst for the debate was the Minister's written ministerial statement on 8 June 2009, and the proposed changes that underlay it, which raised more questions than it answered. In his statement, the Minister confirmed that the FSS is embarking on a Government-backed transformation programme after six months of wranglings between the Home Office and the Treasury, which he elegantly described as "rigorous consultation". The upshot is a reduction of 40 per cent of the skilled work force, the closure of a number of facilities and the adoption of what is described as a new business model. As we have heard, there has been a lack of discussion and certainty surrounding the announcement.

Alan Campbell, Parliamentary Under-Secretary of State, Home Office: The announcement on 8 June was an attempt by the Forensic Science Service to bring Members of Parliament and others into the loop of consultation and to seek their views on management's proposed model for the future of the FSS which has been discussed with Ministers. It was not about informing Members of Parliament or anyone else about decisions that have been made, because no decisions have been made. That is the point of the consultation exercise.

Cyberspace

Question and Written Answer on Tuesday 21 July

Mrs Curtis-Thomas (Crosby): To ask the Secretary of State for the Home Department what recent discussions he has held with his US and European counterparts on a multilateral approach to securing cyberspace.

Mr Hanson: The Cabinet Office currently provides the lead for policy on cyber security and has, supported by representatives from across Government, continued to engage closely with international partners during the development of the UK's recently published Cyber Security Strategy.

As the strategy explains, the security of cyberspace is a transnational issue and, as such, working with international partners and organisations, including those in the US and Europe, is essential to achieving the UK's strategic cyber security objectives.

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/cmwib.htm

EURO-NEWS

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

SCIENCE & TECHNOLOGY/RESEARCH

"It has been estimated that the European Union produces almost one third of the world's scientific knowledge. The research and innovation underpinning this knowledge help deliver the prosperity and quality of life our citizens expect." – Janez Potočnik, EU Science & Research Commissioner

Europe has a long tradition of excellence in research and innovation. Two centuries ago it launched the industrial revolution. Today, the EU is at the cutting edge of leading technology: be it mobile telephones or aircraft, all the flagship products of European endeavour and imagination. Through co-operation among Member States and with other nations and through the continued work of the EU's independent Joint Research Centre (JRC), the EU has established itself as a leading force in the movement to use cross-border collaboration and the sharing of ideas to drive innovation to even greater heights.

European Goals

Since the 2000 adoption of the Lisbon Strategy, the EU has committed itself to building a European Research Area (ERA) to overcome outdated geographical, institutional, disciplinary and sectoral boundaries. The ERA extends the single European market to the world of research and technological development – ensuring open and transparent trade in scientific and technical skills, ideas and know-how. The goal is to create a space free from boundaries in which open discussion and research can benefit the entire European community.

In addition, the globalisation of trade and knowledge – and the emergence of new global threats to the environment, human health and international security – demands that European research look outward. International co-operation forms an integral part of EU scientific policy, which includes programmes that enhance Europe's access to worldwide scientific expertise, attract top scientists to work in Europe, contribute to international responses to shared problems and put research at the service of EU external and development policies.

How is research funded in the European Union?

Most European research is funded on the national level, by private and public sources, in the 25 EU Member States. However there is also a European-level approach to research to strengthen the scientific and technological bases of European industry and ensure competitiveness at an international level.

While there are several Directorates General in the EU's European Commission that have direct links to issues of research, the Framework Programme (FP) is the European Union's main instrument for funding research and development and fostering the ERA's growth. FPs have been implemented since 1984 and up to now have each covered a period of 5 years.

The 7th Research Framework Programme (FP-7), starting in 2007, continues for 7 years. It was designed as a cornerstone in the EU's knowledge and growth policy and plays a fundamental role in stimulating sustainable competitiveness and welfare in Europe.

What are the key research areas defined by the European Commission?

FP-7 comprises 4 programmes:

The co-operation programme accounts for over 60% of the available funding and allows European researchers to work together on collaborative research projects to advance knowledge, to propose solutions to some of the major issues facing us today and to develop new technologies for the future. It promotes co-operation among universities, industry and research centres across the European Union, as well as with the rest of the world. This programme focuses on research in: health; food, agriculture and biotechnology; information and communication technologies; nanosciences, materials and production technologies; energy; environment; transport; social and economic sciences; space; and security.

The ideas programme is implemented through a new body, the European Research Council (ERC), and provides on average €1 billion per year for investigator-driven frontier research in cutting-edge, "risky" areas. The first call for proposals focuses on early-stage independent investigators – those ready to set up their own team for the first time. Future calls will cater to all experience levels. Applicants do not have to be in Europe to submit a proposal – but the work must be done in Europe if selected.

The people programme provides increased funding for Marie Curie actions, which promote the training and mobility of researchers at all research career stages. This includes fellowships for Europeans wanting to work in another European country; specific international activities to fund non-European researchers to work in Europe and to fund Europeans to work outside Europe; and re-integration grants for European researchers to return to Europe from abroad. European researchers in the US will be eligible for most actions.

The capacities programme enhances research and innovation capacity in Europe through activities such as funding access for researchers to major European infrastructures; support for small and medium-sized enterprises (SMEs) to develop their research potential or to outsource their research; international co-operation and science and society.

SCIENCE DIRECTORY

DIRECTORY INDEX

IT, Internet, Telecommunications, Computing and Electronics
EPSRC
Institution of Civil Engineers
Institution of Engineering and Technology
National Physical Laboratory
Newcastle University
STFC

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

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Newcastle University
Plymouth Marine Sciences Partnership
Society of Biology
UFAW

Motor Vehicles
London Metropolitan Polymer Centre
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National Physical Laboratory
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LGC

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Physical Sciences
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Physics
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STFC

Pollution and Waste
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Royal Society of Chemistry
STFC
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LGC
National Physical Laboratory

Radiation Hazards
Health Protection Agency
LGC

Retail
Marks and Spencer

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Royal Institution
The Royal Society
Royal Society of Chemistry
Semta
STFC
Society of Biology
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
The British Ecological Society
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Tropical Medicine
Health Protection Agency
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Royal Society of Chemistry
Society for General Microbiology
Society of Biology

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

Research Councils UK

Contact: Alexandra Saxon
Head of Communications
Research Councils UK
Polaris House
North Star Avenue
Swindon SN2 1ET

Tel: 01793 444592
E-mail: communications@rcuk.ac.uk
Website: www.rcuk.ac.uk

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

Research 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

Contact: Jake Gilmore
Communications Manager
AHRC, Whitefriars, Lewins Mead, Bristol, BS1 2AE
Tel: 0117 9876500
E-mail: enquiries@ahrc.ac.uk
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)

Contact: Dr Monica Winstanley
Head of External Relations
BBSRC, Polaris House, North Star Avenue
Swindon SN2 1UH. Tel: 01793 413204
E-mail: external.relations@bbsrc.ac.uk
Website: www.bbsrc.ac.uk

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

Contact: Lesley Lilley, Senior Policy Manager, Knowledge Transfer,
Economic and Social Research Council,
Polaris House, North Star Avenue,
Swindon SN2 1UJ
Tel: 01793 413033
lesley.lilley@esrc.ac.uk
http://www.esrc.ac.uk

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

Contact: Jenny Aranha,
Public Affairs Manager,
EPSRC, Polaris House,
North Star Avenue, Swindon SN2 1ET
Tel: 01793 442892 Fax: 01793 444005
E-mail: jenny.aranha@epsrc.ac.uk
Website:www.epsrc.ac.uk

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

Contact: Pauline Mullin
20 Park Crescent, London W1B 1AL.
Tel: 020 7636 5422 Fax: 020 7436 2665
E-mail: pauline.mullin@headoffice.mrc.ac.uk
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

Contact: Judy Parker
Head of Communications
Polaris House, North Star Avenue
Swindon SN2 1EU
Tel: 01793 411646 Fax: 01793 411510
E-mail: requests@nerc.ac.uk
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

Mark Foster
Public Affairs Manager
Rutherford Appleton Laboratory
Harwell Science & Innovation Campus
Didcot OX11 0QX
Tel: 01235 778328 Fax: 01235 445 808
E-mail: mark.foster@stfc.ac.uk
Website: www.stfc.ac.uk

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

Contact: Dr Philip Wright
Director of Science & Technology
12 Whitehall, London SW1A 2DY
Tel: 020 7747 1408
Fax: 020 7747 1417
E-mail: pwright@abpi.org.uk
Website: www.abpi.org.uk

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

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

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

Contact: Dr Helen Munn,
Executive Director
Academy of Medical Sciences
10 Carlton House Terrace
London SW1Y 5AH
Tel: 020 7969 5288
Fax: 020 7969 5298
E-mail: info@acmedsci.ac.uk
Website: www.acmedsci.ac.uk

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

Contact: Professor Richard Brook OBE FREng
AIRTO Ltd: Association of Independent Research & Technology Organisations Limited
c/o Campden BRI, Station Road,
Chipping Campden,
Gloucestershire GL55 6LD.
Tel: 01386 842247
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

Contact: Dr Chris Kirk
Chief Executive,
16 Procter Street,
London WC1V 6NX
Tel: 020 7280 4133 Fax: 020 7280 4170
Email: chris.kirk@biochemistry.org
Website: www.biochemistry.org

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.

British Science Association

Contact: Sir Roland Jackson Bt,
Chief Executive
British Science Association,
Wellcome Wolfson Building, 165 Queen's Gate,
London SW7 5HD.
E-mail:
Roland.Jackson@britishscienceassociation.org
Website: www.britishscienceassociation.org

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

Contact: Ceri Margerison, Policy Officer
British Ecological Society
26 Blades Court, Deodar Road, Putney,
London, SW15 2NU
Tel: 020 8877 4908 Fax : 020 8871 9779
Website: www.BritishEcologicalSociety.org
Ecology into Policy Blog
http://britishecologicalsociety.org/blog/

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

Contact: Professor Judy Buttriss,
Director General
52-54 High Holborn, London WC1V 6RQ
Tel: 020 7404 6504
Fax: 020 7404 6747
Email: c.price@nutrition.org.uk
Websites: www.nutrition.org.uk
www.foodafactoflife.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

Contact: Kate Baillie
Chief Executive
British Pharmacological Society
16 Angel Gate, City Road
London EC1V 2PT
Tel: 020 7417 0113
Fax: 020 7417 0114
Email: kb@bps.ac.uk
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

Contact: Dr Ana Padilla
Parliamentary Officer
The British Psychological Society
30 Tabernacle Street
London EC2A 4UE
Tel: 020 7330 0893
Fax: 020 7330 0896
Email: ana.padilla@bps.org.uk
Website: www.bps.org.uk

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

Mrs Tracey Guise
Executive Director
British Society for Antimicrobial Chemotherapy
Griffin House
53 Regent Place
Birmingham B1 3NJ
T: 0121 236 1988
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

Contact: Dr Joan Kelley, Executive Director, Global Operations, CABI
Bakeham Lane, Egham, Surrey TW20 9TY
Tel: 01491 829306 Fax: 01491 829100
Email: t.davis@cabi.org
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,
J J Thomson Avenue, Cambridge CB3 0HE, UK.
E-mail: dhp24@cam.ac.uk
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
The Chartered Institute of Patent Attorneys
95 Chancery Lane, London WC2A 1DT
Tel: 020 7405 9450
Fax: 020 7430 0471
E-mail: michael.ralph@cipa.org.uk
Website: www.cipa.org.uk

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

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

Science for 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 notivation, 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

Contact: Paul Radage
Capenhurst Technology Park,
Capenhurst, Chester, Cheshire CH1 6EH
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

Contact: Gareth Lyon
Communications Executive
The Engineering and Technology Board
Weston House, 246 High Holborn
London WC1V 7EX
Tel: 020 3206 0445
Fax: 020 3206 0401
E-mail: glyon@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

Contact: Professor Nicola Spence
Chief Scientist
The Food and Environment Research Agency
Sand Hutton, York, YO41 1 LZ
Tel: 01904 462415
Fax: 01904 462256
E-mail: nicola.spence@fera.gsi.gov.uk
Website: www.defra.gov.uk/fera

The Food and Environment Research Agency's 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.

Health Protection Agency

Contact: Justin McCracken, Chief Executive
Health Protection Agency Central Office
7th Floor, Holborn Gate, 330 High Holborn
London WC1V 7PP
Tel: 020 7759 2700/2701
Fax: 020 7759 2733
Email: webteam@hpa.org.uk
Web: www.hpa.org.uk

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

Contact: Peter Thompson
Director Strategy and Information
21 Bloomsbury St
London WC1B 3HF
Tel: 020 7291 8200
Fax: 020 7291 8201
Email: Peter.Thompson@hfea.gov.uk
Website: www.hfea.gov.uk

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.

IOP Institute of Physics

Contact: Joseph Winters
76 Portland Place, London W1B 1NT
Tel: 020 7470 4815
E-mail: joseph.winters@iop.org
Website: www.iop.org

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

Contact: Robert Neilson, General Secretary
Fairmount House, 230 Tadcaster Road,
York, YO24 1ES
Tel: 01904 610821 Fax: 01904 612279
E-mail: r.w.neilson@ipem.ac.uk
Website: www.ipem.ac.uk

IPEM is a registered, incorporated charity for the advancement, in the public interest, of physics and engineering applied to medicine and biology. 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.

Contact: Andrew Furlong, Director
t: +44 (0)1788 534484
f: +44 (0)1788 560833
e: afurlong@icheme.org
www.icheme.org

Institution of Civil Engineers

Contact: Vernon Hunte,
Senior Public Affairs Executive ,
One Great George Street, Westminster,
London SW1P 3AA, UK
Tel: 020 7665 2265
Fax: 020 7222 0973
E-mail: vernon.hunte@ice.org.uk
Website: www.ice.org.uk

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

Contact: Mary Donovan
Institution of Engineering and Technology
Savoy Place, London WC2R 0BL
Tel: 01438 765587
E-mail: mdonovan@theiet.org.
Website: www.theiet.org

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

PLANTS PEOPLE POSSIBILITIES

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
Fax: 020 8332 5109
Email: s.owens@kew.org
Website: www.kew.org

Two stunning gardens-devoted to building and sharing knowledge

LGC

Setting standards in analytical science

Queens Road, Teddington
Middlesex, TW11 0LY
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Fax: +44 (0)20 8943 2767
E-mail: info@lgc.co.uk
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.

With headquarters in Teddington, South West London, LGC has 26 laboratories and centres across Europe and in China and India.

Lilly and Company Limited

Answers That Matter.

Contact: Dr Karin Briner,
Managing Director,
Eli Lilly & Company, Erl Wood Manor,
Windlesham, Surrey, GU20 6PH
Tel: 01256 315000
Fax: 01276 483307
E-mail:k.briner@lilly.com
Website:www.lilly.com or www.lilly.co.uk

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

Contact: Alison Green,
London Metropolitan University
166-220 Holloway Road, London N7 8DB
Tel: 020 7133 2189
E-mail: alison@polymers.org.uk
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

Contact:
Paul Willgoss
Waterside House
35 North Wharf Road
London W2 1NW.
Tel: 020 8718 8247
E-mail: paul.willgoss@marks-and-spencer.com

Main Business Activities
Retailer – Clothing, Food, Home and Financial Services

We have over 600 UK stores, employing over 75,000 people - 285 stores internationally in 40 territories.

We are one of the UK's leading retailers, with over 21 million people visiting our stores each week. We offer stylish, high quality, great value Clothing and Home products, as well as outstanding quality foods, responsibly sourced from around 2,000 suppliers globally.

MERCK SHARP & DOHME

UK Subsidiary of Merck & Co., Inc

Contact: Margaret Beer/Rob Pinnock
Licensing & External Research, Europe
Hertford Road
Hoddesdon
Herts EN11 9BU
Tel: 01992 452837
Fax: 01992 441907
e-mail: margaret_beer@merck.com /
rob_pinnock@merck.com
www.merck.com

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

NESTA Making Innovation Flourish

Contact: Nicholas Bojas
Head of Government Relations
1 Plough Place
London EC4A1DE
Tel: 020 7438 2500
Fax: 020 7438 2501
Email: nicholas.bojas@nesta.org.uk
Website: www.nesta.org.uk

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

NPL National Physical Laboratory

National Physical Laboratory
Hampton Road, Teddington
Middlesex TW11 0LW
Tel: 020 8943 6880 Fax: 020 8614 1446
E-mail: enquiry@npl.co.uk
Website: www.npl.co.uk

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

NATURAL ENGLAND

Contact: Dr Tom Tew
Chief Scientist
Natural England
Northminster House
Peterborough
PE1 1UA
Tel: 01733 455056
Fax: 01733 568834
Email: tom.tew@naturalengland.org.uk
Website: www.naturalengland.org.uk

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

NATURAL HISTORY MUSEUM
The Science of Nature

Contact: Joe Baker
Special Adviser to the Director
Natural History Museum
Cromwell Road
London SW7 5BD
Tel: +44 (0)20 7942 5478
Fax: +44 (0)20 7942 5075
E-mail: joe.baker@nhm.ac.uk
Website: www.nhm.ac.uk

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.

Newcastle University

Contact: Dr Douglas Robertson
Newcastle upon Tyne NE1 7RU
Tel: 0191 222 5347 Fax: 0191 222 5219
E-mail: business@ncl.ac.uk
Website: www.ncl.ac.uk

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

Contact: Frederick Wentworth-Bowyer,
Chief Executive, The Nutrition Society,
10 Cambridge Court, 210 Shepherds Bush Road
London W6 7NJ
Tel: +44 (0)20 7602 0228
Fax: +44 (0)20 7602 1756
Email: f.wentworth-bowyer@nutsoc.org.uk

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 Ltd

Contact: Dr Lydia A Brown
PHARMAQ Ltd
Unit 15 Sandleheath Industrial Estate,
Fordingbridge
Hants SP6 1PA.
Tel: 01425 656081
Fax: 01425 655309
E-mail: lydia.brown@pharmaq.no
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Veterinary pharmaceuticals specialising in aquatic veterinary products. Fish vaccines, anaesthetics, antibiotics and other products.

Plymouth Marine Sciences Partnership

Contact: Rosie Carr
The Laboratory, Citadel Hill
Plymouth PL1 2PB

Tel: +44 (0)1752 633 234
Fax: +44 (0)1752 633 102
E-mail: forinfo@pmsp.org.uk
Website: www.pmsp.org.uk

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

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

Prospect is an independent, thriving and forward-looking trade union with 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.

The Royal Academy of Engineering

Contact: Philip Greenish CBE,
Chief Executive
3 Carlton House Terrace
London SW1Y 5DG
Tel: 020 7766 0600
E-mail: philip.greenish@raeng.org.uk
Website: www.raeng.org.uk

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

Contact: Dr Gail Cardew
Head of Programmes
The Royal Institution
21 Albemarle Street, London W1S 4BS
Tel: 020 7409 2992 Fax: 020 7670 2920
E-mail: gail@ri.ac.uk Website:
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

Contact: Dr Peter Cotgreave
Director of Public Affairs
The Royal Society, 6-9 Carlton House Terrace
London SW1Y 5AG.
Tel: 020 7451 2502 Fax: 020 7930 2170
Email: peter.cotgreave@royalsociety.org
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.

The Royal Society of Chemistry

Contact: Dr Stephen Benn
Parliamentary Affairs
The Royal Society of Chemistry
Burlington House, Piccadilly, London W1J 0BA
Tel: 020 7437 8656 Fax: 020 7734 1227
E-mail: benns@rsc.org or parliament@rsc.org
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

Contact: Mr Andrew Garratt
Press and Public Affairs Officer
The Royal Statistical Society
12 Errol Sreet, London EC1Y 8LX.
Tel: +44 20 7614 3920
Fax: +44 20 7614 3905
E-mail: a.garratt@rss.org.uk
Website: www.rss.org.uk

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.

Contact: Semta Customer Services
Wynyard Park House, Wynyard,
Billingham, TS22 5TB
Tel: 0845 643 9001
Fax: 01740 644799
Email: customerservices@semta.org.uk
Website: www.semta.org.uk

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

Contact: Janet Hurst
Marlborough House, Basingstoke Road,
Spencers Wood, Reading RG7 1AG.
Tel: 0118 988 1809 Fax: 0118 988 5656
E-mail: pa@sgm.ac.uk
Website: www.sgm.ac.uk

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 Biology

Contact: Dr Mark Downs, Chief Executive
9, Red Lion Court,
London EC4A 3EF
Tel: 020 7936 5900
E-mail: markdowns@societyofbiology.org
Website www.societyofbiology.org

The Society of Biology is a single unified voice for biology: advising Government and influencing policy; advancing education and professional development; supporting our members, and engaging and encouraging public interest in the life sciences. The Society represents a diverse membership of over 80,000 - including, students, practising scientists and interested non-professionals - as individuals, or through learned societies and other organisations.

Society of Cosmetic Scientists

Contact: Lorna Weston,
Secretary General
Society of Cosmetic Scientists
Langham House East
Suite 6, Mill Street, Luton LU1 2NA
Tel: 01582 726661
Fax: 01582 405217
E-mail: ifscc.scs@btconnect.com
Website: www.scs.org.uk

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

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

Universities Federation for Animal Welfare

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

UFAW 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.

PARLIAMENTARY AND SCIENTIFIC COMMITTEE NEWS

NEW MEMBERS

We are delighted to welcome the following new members:

Members of the European Parliament:
Mr Stuart Agnew MEP, Mr Ashley Fox MEP, Mrs Julie Girling MEP
Mrs Marina Yannakoudakis MEP

Industrial Member
Plant Impact Plc

BRITISH SCIENCE ASSOCIATION AWARD

The British Science Association has awarded an Honorary Fellowship to Professor Salim T S Al-Hassani, Professor of Mechanical Engineering for 35 years, Manchester University, and Chairman of the Foundation for Science Technology and Civilization, a member of the Committee. Professor Al-Hassani has spent the last two decades debunking the myth of "The Dark Ages" by raising awareness of the scientific achievements that took place in India, China, Muslim Spain and the Arab world between the 7th and 17th centuries.

Recent deaths

We remember with gratitude the enthusiastic support given to the Committee over many years by two former office-holders who have recently died.

Lord Gregson, who was President of the Committee from 1986 to 1989, died on 12th August 2009.

Lord Kennet, a former Vice-President, died on 7th May 2009.

We also note the passing on 12th September of **Dr Norman Borlaug**, 1970 Nobel Peace Prizewinner and father of the Green Revolution, for whom a special meeting was held in October 2005.

SCIENCE DIARY

THE PARLIAMENTARY AND SCIENTIFIC COMMITTEE

Contact: Annabel Lloyd
020 7222 7085:
lloyda@pandsctte.demon.co.uk
www.scienceinparliament.org.uk

Tuesday 10 November 17.30
Environmental Risks – how best to adapt to the impact of Global Warming?
Lord Broers FREng FRS, Chairman, Diamond Light Source Ltd

Professor Paul Ekins, Professor of Energy and Environment Policy, UCL Energy Institute, University College London

Tuesday 15 December 17.30
GM – come back all is forgiven
Speakers to be confirmed

Tuesday 19 January 2010 17.30
Brain Research – social implications of the latest 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.

Thursday 22 October 19.00–21.00
Price – No object?
Cultural heritage in the UK

Monday 26 October 19.00
Quiz night @ Time & Space bar

Thursday 29 October 19.00–21.00
Darwin, FitzRoy and the voyage of the Beagle: the untold story
Performance of Juliet Aykroyd's play The Ostrich and the Dolphin followed by discussion (chaired by Baroness Greenfield) between Juliet Lacey, Lord Hunt, former Chief Executive of the Met Office, and Prof Armand Leroi, an evolutionary developmental biologist.

Saturday 5 December
Tuesday 8 December
Thursday 10 December
Saturday 12 December
Wednesday 16 December
The Royal Institution Christmas Lectures
The 300 million years war
Professor Sue Hartley

For additional details of these and other events visit www.rigb.org

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:

Thursday 29 October 2009 18.30
The Lilliput Laboratory: Chemistry & biology on the small scale
Clifford Paterson Prize Lecture
Professor Andrew DeMello, Professor of Chemical Nanosciences, Imperial College London

Thursday 12 and Friday 13 November 2009 (all day)
Genetics and the causes of evolution: 150 years of progress since Darwin
A joint meeting with the Genetics Society

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. Details of all of these plus our forthcoming events programme can be found at royalsociety.org

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.
Tel: 0131 240 5000 Fax: 0131 240 5024
events@royalsoced.org.uk
www.royalsoced.org.uk
All events require registration and, unless otherwise indicated, take place at the RSE.

Monday 23 November 18.00
Henslow's legacy, Darwin's inheritance
by Professor John Parker, University of Cambridge

Tuesday 16 February 2010 18.00
ECRR Peter Wilson on Energy
by Professor James R McDonald FREng FRSE, Principal, University of Strathclyde

BRITISH SCIENCE ASSOCIATION

Please visit
www.britishscienceassociation.org for events programme.

PARLIAMENTARY OFFICE OF SCIENCE AND TECHNOLOGY

Monday 2 and Tuesday 3 November

POST 20th Anniversary Conference Images of the Future

For details please contact Nadine Walters at POST (waltersn@parliament.uk)

ROYAL PHARMACEUTICAL SOCIETY OF GREAT BRITAIN

Contact: events@rpsgb.org
www.rpsgb.org/events
Events are held at the Royal Pharmaceutical Society of Great Britain, London (RPSGB)

Friday 13 November 09.00-16.15

Practical advice on registering a traditional herbal medicine product (THMP)

A one day conference by the RPSGB

Monday 23 – Wednesday 25 November

Tabletting technology for the pharmaceutical industry

Three-day residential course organised by the RPSGB in partnership with the Academy of Pharmaceutical sciences

Friday 4 December 09.30-16.00

The role of natural products in drug discovery and development in the new millennium

One day conference organised by the RPSGB in partnership with the Academy of Pharmaceutical sciences

Monday 22 – Wednesday 24 February 2010

Stability testing of pharmaceuticals

Three-day residential course organised by the RPSGB in partnership with the Academy of Pharmaceutical sciences

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

SCIENCE IN PARLIAMENT sip

3 Birdcage Walk, London SW1H 9JJ
Tel: 020 7222 7085
Fax: 020 7222 7189

Editor: Professor Peter Simpson
Editorial Assistant: Mrs Annabel Lloyd

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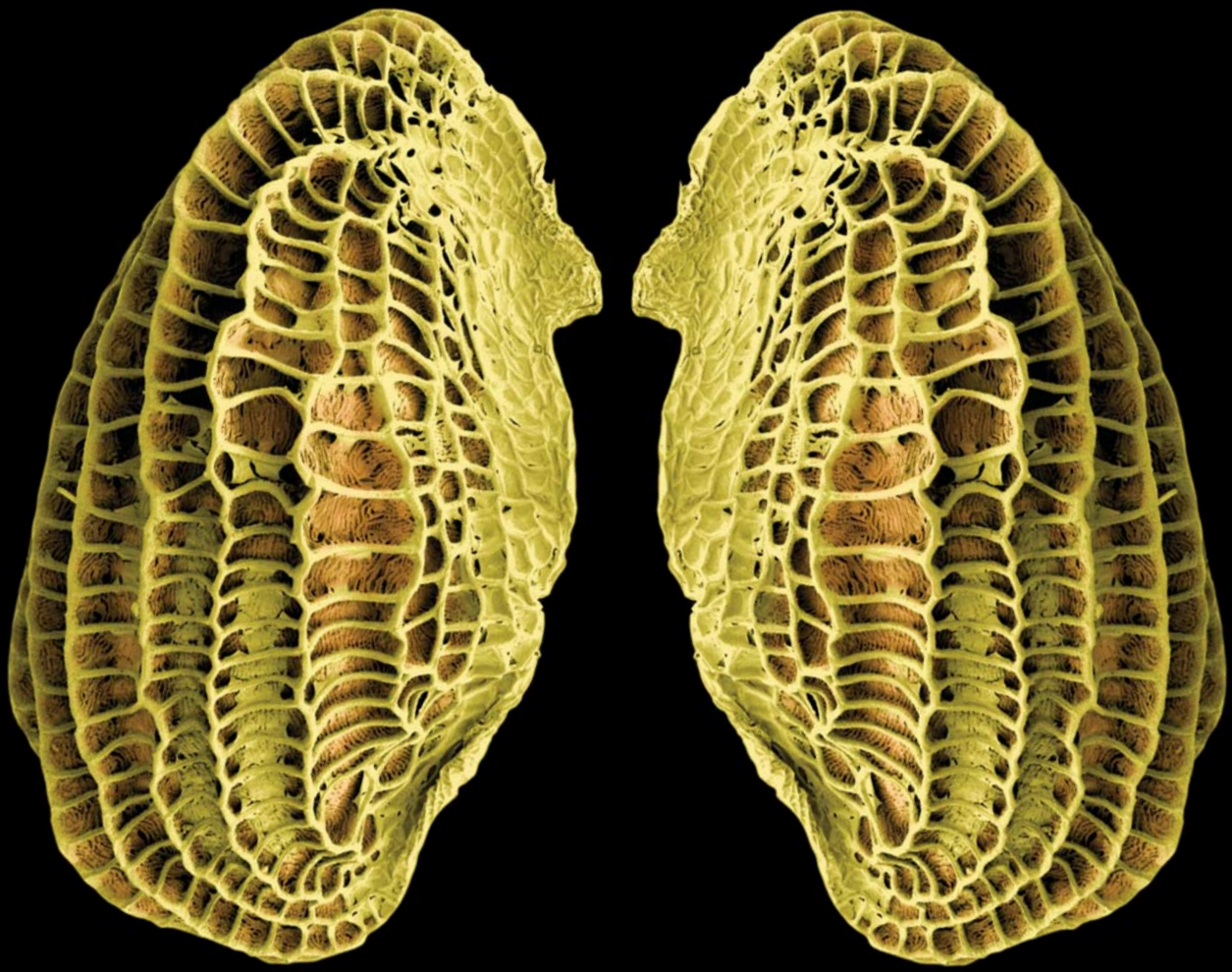
Save something you can't live without



Frozen in time, these seeds can stay alive for hundreds, possibly thousands, of years so that one day they can grow again, and help our planet to breathe. Collections are already being used to develop opportunities for the sustainable use of plants, and for research and conservation.

Call 0844 249 9270 or visit www.kew.org/save-a-species to make a monthly donation of £5 or £10. Thank you.

MILLENNIUM SEED BANK PROJECT
Kew