SET for BRITAIN

Big Bang

Peak Oil

Annual Lunch

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The Journal of the Parliamentary and Scientific Committee

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£5 million of additional funding was allocated in the Budget to science and mathematics education and £750 million to a new Strategic Investment Fund, which will be focused on emerging technologies and regionally important sectors, such as advanced manufacturing, digital technologies and biotechnology.

A further £50 million has been set aside for the Technology Strategy Board and £250 million will be invested in low-carbon technologies. Set against these gains DFID has announced a cut of £10 million in its R&D budget, whilst the MoD's Nuclear Weapons Capability Sustainment Programme will lose £170 million.

On Budget day the Institute of Biology and the Biosciences Federation announced that their memberships have voted overwhelmingly in favour of unification to form a new 'Society of Biology'. We wish the new society well in its future work.

We report in this issue of SiP on the Big Bang, the UK's first annual national science fair celebrating young people's achievements in science and engineering, which will be held next year in Manchester (11-13th March), and on SET for BRITAIN, a poster session for young scientists and engineers whose careers are emerging, which the P&SC has now adopted. Thanks to all those who have organised and/or funded these important events for young people.

The US Research Advisory Committee established a strong dose-response link between Gulf War Illness and soldiers' exposure to pesticides, insect repellents and pyridostigmine bromide (used against nerve gases). Now, Professor Robert Haley at the University of Texas has used the new technique of 'arterial spin labelling' to establish differences between veterans with and without the illness. Slowly it is being revealed that this is not a psychological disorder but is based on physiological changes in the white matter region of the brain (see *Chemistry & Industry*, 2009, 13 April, p 5).

In the UK Patents Act 1977 provisions were made for employees named as inventors on patents to benefit from income to companies from patents of 'outstanding benefit'. In February this year the head of a research group and a bench chemist formerly at GE Healthcare were the first to benefit from this provision, when the English Patent Court awarded them £1 million and £0.5 million 'compensation' respectively.

Dr Brian Iddon MP
Chairman,
Editorial Board
Science in Parliament

SCIENCE IN PARLIAMENT

sip

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

Science in Parliament has two main objectives:
1. to inform the scientific and industrial communities of activities within Parliament of a scientific nature and of the progress of relevant legislation;
2. to keep Members of Parliament abreast of scientific affairs.

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Front Cover Image by Max Alexander

PAIRING OF MEMBERS OF PARLIAMENT WITH SCIENTISTS

Dr Brian Iddon with Dr Chris Knight, Faculty of Life Sciences, University of Manchester

Dr Brian Iddon, Member of Parliament for Bolton South East

It is becoming ever more important for scientists to communicate their work to the general public and to engage with Parliamentarians. A number of outside organisations, including learned societies and the Royal Society, have recognised this and have set up schemes to foster this engagement. Whether you are a member of the Parliamentary and Scientific Committee, someone who is engaged in the formation of science policy or a Member of Parliament (MP) with an interest in this policy area, I am sure that you will agree that those involved in making decisions about science related policy should be well informed.

Champions of science in Parliament are not in abundance, yet the science-related issues behind legislation before Parliament are becoming of increasing importance. Within the last 12 months MPs have dealt with the Human Fertilisation and Embryology Bill, the Climate Change Bill and the Energy Bill, all of which contain complex scientific issues that needed addressing.

For several years now I have taken part in the Royal Society's MPs 'pairing scheme', a scheme which aims to bridge the gap between Parliament and some of the best British young scientists. I have found this scheme invaluable for maintaining my links with the science community in my region and, for a small investment in my time, there are valuable rewards. The scheme has helped me, for example, with my work on the Innovation, Universities, Science and Skills (IUSS) Select Committee.

The policy process is not one-way. It is imperative that our young scientists have an understanding of how science policy is made within Parliament, when and how they can engage with the processes, and appreciate the work that goes into steering a Bill through Parliament. By giving those young scientists with whom we 'pair' an insight into Parliamentary procedures we will provide them with the knowledge to engage better in policy making in future, when they become the new leaders in our science community.

In the current session of Parliament I have been paired with Dr Chris Knight, an evolutionary biologist from the Faculty of Life Sciences at the University of Manchester. Dr Knight spent several days in Westminster, where he learned about the political processes by attending seminars organised by the Royal Society, attending our IUSS Select Committee meetings, attending Prime Minister's Question Time and shadowing me in my day-to-day work. He has visited my constituency office and attended one of my busy Advice Surgeries. I think he was surprised by the variety of the work that I undertake and the many skills that we have to have as MPs in moving quickly from one subject to another.

I have visited Dr Knight's laboratories to find out about his work and to give a talk to his colleagues on 'Science in Parliament'. Dr Knight uses yeasts, which grow extremely rapidly, to investigate their evolution, especially in a toxic alcoholic environment. By growing yeast in increasing concentrations of alcohol he investigates how successive generations of yeast can develop a tolerance to it, ie how they evolve. Dr Knight's research has important applications, for example in teaching us how superbugs evolve in hospital environments, with a view to interfering with their evolution.

If, like me, you believe that all MPs, not just those with a scientific background, should learn more about the importance of science in our policy making processes, then I encourage you to join the Royal Society's MPs 'pairing scheme'. I can assure you that you will find this a rewarding experience. Invitations to join the scheme in the next Parliamentary session will be sent to you by the Royal Society.

The Royal Society's MP-Scientist pairing scheme has been running since 2001, with over 150 pairs taking part to date. Previous pairs have gone on to work together on local environmental issues, take part in events and write joint articles. A number of scientists have also gone on to have an active involvement in policy making through secondments to the Parliamentary Office of Science and Technology and Government Departments.

Next year the scheme will be expanded to include a civil-servant scientist pairing scheme, which will run alongside the existing MP-Scientist pairing scheme, as part of the Royal Society's aim to get independent scientific advice to the heart of Government.

If you are interested in taking part in the scheme or would like some more information, please contact us at public.affairs@royalsociety.org

THOUGHTS ON BECOMING CHAIRMAN

Ian Taylor MP

Raising awareness of science issues in the House of Commons is vital. I remember that from long ago when, as Science Minister, I had to encourage colleagues to ask me questions. "Anything – even hostile, but do not ignore me!" Since 1997, scrutiny has not been helped by two of my otherwise impressive successors being in the House of Lords, as there is little Ministerial encouragement for science to be debated in the Commons.

The Royal Society is hosting a debate in May on whether the 'two cultures' represents a divide in Parliament. This is over-hyped in politics where debates do not show a complete breakdown of communication between MPs with backgrounds in the sciences and the humanities. Yet there is a lack of scientific confidence in the Commons to tackle 'evidence-based' enquiries relating to some key topics such as climate change actions, decisions of the NICE committee, viruses, embryo research, GM foods, biological/moral issues, energy security and nuclear, mobile phone risks, forensics, etc... My policy report to the Shadow Cabinet suggested scientific (and engineering) literacy lessons should be available for all MPs – with which the Royal Society and Royal Academy could assist.

Apart from the tenacious 'usual suspects', there is a narrow base of scientific expertise in the Commons (as opposed to the Lords). This is worrying, not only given the importance of the issues, but at the potential fragile Parliamentary support for protecting science budgets from being 'squeezed' in forthcoming public expenditure battles. We must invest in science if Britain is to compete effectively in the global market place and improve the quality of life at home. The Science Minister will need help! He will need even greater enthusiasm if any Government beyond the next election is to share the vision and action of President Obama, who seems to be emulating one of his predecessors. During the Depression, President Roosevelt tripled research funding and took advice from the National Academy of Sciences. He sent veritable armies of researchers and engineers to the South, a region then long-neglected and undeveloped. From them came electricity, improved water management, better farming practices, erosion-preventing crops, reforestation, water quality improvements and reductions in water-borne diseases. Science pushed the region into the 20th century. Can we unleash scientists and engineers to have an impact of equivalent magnitude in the UK during the next decade?

Giving money to scientific and engineering endeavour may be a tough message to sell when people are losing their jobs, homes and hopes. We should not be too sure that research budgets are as robust as they appear. Despite the welcome and justified doubling of funds received by the Research Councils since 1997, it is salutary to note that overall government expenditure on R&D is no greater as a percentage of GDP than when I was Minister, according to the Sainsbury Review 'Race for the Top'. The casualty is funding for mission driven research. Yet particularly in a recession, we really need to show that applied scientists and creative engineers can provide the under-pinning necessary for new products and wealth creation. They should be raised to the status already rightly accorded to our basic scientists.

So the opportunity to become Chairman of the Parliamentary and Scientific Committee in its 70th year is very exciting and enables me to do what I can to help raise the profile of science in both Houses. The Committee brings together an impressive range of academic and science based industries and institutes as well as Whitehall advisers – all of whom can have an effective input into policy formation on often contentious and topical issues. The publication 'Science in Parliament' has developed an authoritative reputation. I am also co-chair of the Parliamentary Space Committee and involved with POST as well as with several technology committees. So my commitment to the cause is evident! In a way, the P&S Committee should assist in pulling together some of the otherwise fragmented efforts of too many subject specific all-Party committees in both Houses – a view I share with my illustrious predecessor Dr Doug Naysmith.

It is also vital that we look outwards. Both scientists and politicians have the responsibility of explaining the benefits of the advancement of science. I am delighted that one of our first meetings is to be about 'TAKING SCIENCE TO THE STREET'. Indeed, if the public appreciated the importance of science more, they might lobby MPs to take more interest. A virtuous circle.

Ian Taylor MP

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> . . . We must invest in science if Britain is to compete effectively in the global market place and improve the quality of life at home. . .

UK FUSION IN THE ERA OF FUSION BURN

Professor Steve Cowley
Director, UKAEA Culham

The Presidential Address by Arthur Stanley Eddington to the 1920 meeting of the British Association in Cardiff is perhaps one of the greatest examples of scientific deduction on record. Using simple arguments based on a wide range of observations, Eddington pieced together much of the modern theory of the sun and stars. Despite the fact that little was known about the nuclei of atoms at the time, he posited that the sun was being powered by converting hydrogen to helium – and indeed it is. Using $E = mc^2$ and the recently measured masses of hydrogen and helium, he calculated the sun had enough energy to shine for 15 billion years. He had deduced the existence of what we now call nuclear fusion.

Eddington went on to state (in delightfully dated language) that *"This reservoir can scarcely be other than the sub-atomic energy which, it is known, exists abundantly in all matter; we sometimes dream that man will one day learn how to release it and use it for his service."* The quest for fusion energy – Eddington's dream – has not been easy but the era of fusion burning experiments has arrived. What then needs to be done to make fusion a commercial power source? How should the UK position itself if it is to participate in a future fusion economy?

Perhaps the first question should be: why bother to develop fusion? The answer is simple. There are only three energy sources with sufficient resource to replace fossil fuels as a base load for the long term – solar, nuclear fission with uranium or thorium breeders… and nuclear fusion. Each technology requires significant research and development before it is ready to be deployed at large scale. Arguably, fusion has the greatest promise and the toughest challenges. It has practically unlimited fuel (millions of years of lithium and deuterium); low waste; no CO_2 production; attractive safety features and insignificant land use. These features are sufficient reason to develop fusion urgently even if success is not 100% certain.

To initiate fusion, an ionized gas (plasma) of deuterium (heavy hydrogen) and tritium (super heavy hydrogen) must be heated to above 100 million degrees C. This is ten times hotter than the centre of the sun. Remarkably, these conditions have been achieved. In 1997, the Joint European Torus (JET) at Culham Science Centre in Oxfordshire produced 16 megawatts of fusion power. Strong magnetic fields held the plasma together while the deuterium and tritium fused to form helium and release an energetic neutron. Admittedly, 25 megawatts of input power was needed to sustain the reaction. In 1997 a larger, more powerful device was already on the drawing board. Seven international partners, representing more than half the world's population, are now building this device, called ITER, at Cadarache in Southern France. The baseline performance is to produce 500 megawatts of fusion power with less than 50 megawatts of input power – a ten-fold amplification, at least. The ITER plasma will then be largely self-heated by the energetic helium produced in fusion reactions. Although the target is to sustain this power level for only 400 seconds at a time, recent experiments on JET and other machines suggest that it should be possible to sustain this almost indefinitely. During the run up to ITER the focus of worldwide fusion research is still in the UK. JET is continuing to find new regimes and to define improved ITER operating scenarios. In 2013 or 2014 JET will resume tritium operation and is predicted to beat all previous fusion power records. It is therefore expected that the UK will continue to operate JET for EURATOM until at least 2014-15. If successful, ITER will generate industrial levels of fusion power and demonstrate the scientific feasibility of high gain fusion devices. This is a critical step on the road to fusion power. UK

. . . A compact, affordable fusion device that can deliver reactor-level neutron flux over many square metres is needed. . .

expertise gleaned from years of running JET will be decisive to that success.

As any nuclear engineer knows, however, there is much more to commercial power generation than a demonstration of scientific feasibility. Critical components of the future fusion reactor – in particular the systems that convert neutron power to electrical power – have yet to be tested at any scale. In a reactor, a blanket of lithium surrounds the fusing plasma. The blanket is a complex system to absorb the neutrons, extract heat and 'breed' tritium from lithium. Tritium is extracted from the blanket and used to fuel the plasma. For economic viability, the blanket must operate robustly at high temperature in a harsh neutron environment for many years. (This need will hold whether we commercialise magnetic fusion, currently the most practical approach, or discover scalable techniques for other fusion schemes such as laser driven fusion.) Blankets will contain much of the intellectual property associated with the commercial development of fusion. The UK fusion programme is therefore beginning a strategic shift of effort into the technologies of the blanket and the wall.

First, we must develop the blanket and wall materials: structural materials, breeder materials and high heat flux materials are needed. These materials must not only retain structural integrity in very challenging conditions, they must also be made of elements that do not become long-lived radioactive waste under neutron bombardment. Progress is being made and several promising candidate materials have been proposed. For example theoretical calculations and ion beam tests by UKAEA Culham and UK Universities suggest that special steels are suitable structural materials. The International Fusion Materials Irradiation Facility (IFMIF) is being developed by the international community to test small samples of the promising materials. They will be irradiated in a beam of neutrons for several years to evaluate the changes in structural properties.

But materials development is not enough: an integrated wall and blanket system is needed. Promising blanket designs are being developed but much needs to be done to ensure a commercially viable system. If ITER proves as successful as expected, then this is probably the critical path for fusion. The central issue is how to test blanket and wall designs. In the later stages of ITER, operation test blanket modules will be placed in the walls. However, a continuous fusion neutron flux of 1-2 megawatts per square metre for several years is required for a definitive test. Even the ITER tests will not deliver this flux. In the Culham 'fast-track to fusion' study, the first generation of reactors ('DEMOs') will be built thirty years from now. Leaving blanket testing to this stage is probably too late from a licensing point of view. It certainly carries a high level of risk and would surely slow progress.

A compact, affordable fusion device that can deliver reactor-level neutron flux over many square metres is needed to lessen the risk and significantly accelerate the development of blanket and wall structures. Fortunately the 'spherical tokamak' – a compact plasma configuration – is just such a device. In the last decade, Culham has pioneered spherical tokamaks. MAST (the MegaAmp Spherical Tokamak) at Culham has achieved near-fusion plasma conditions at very modest scale and cost. Both Culham and Oak Ridge Laboratory in the US have developed conceptual designs of component test facilities based on spherical tokamaks. Whole components of the blanket and wall could be tested at full power for many years in these facilities. Both designs are compact and require only a modest investment in comparison to ITER. An upgrade to MAST is needed to demonstrate that the plasma performance of the component test facility can be achieved – this upgrade is a central part of Culham's ten-year plan. If the upgrade is successful then a component test facility could be built in parallel to ITER. A vigorous programme of wall and blanket development coupled with ITER's programme could pave the way for the first demonstration reactors (DEMOs) in the 2030s. The component test facility is also key to positioning the UK in the critical technologies of a future fusion economy.

Reducing the time scale to commercial fusion by a full decade has enormous consequences for a world that is hungry for energy. Predictions of the timescale of fusion's entry into the energy market are necessarily imprecise while blanket development is untested. It is time to recognise this reality and begin development of a component test facility. The UK is leading efforts to persuade the international fusion community of this view. Eddington's dream may need such a pragmatic vision.

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RETROFITTING THE EXISTING BUILDINGS TO OVERCOME THE TRIPLE CHALLENGE OF CLIMATE, ENERGY AND SUSTAINABILITY

Professor Michael Kelly
Department of Engineering,
University of Cambridge, and
Chief Scientific Adviser,
Department for Communities and
Local Government

Three great challenges are upon us, the need to adapt to and mitigate against future climate change, to reduce energy consumption to help maintain national security, and to consume resources in a manner that is sustainable in the long term. In each case about half the problem (45% of our carbon emissions) is associated with energy and resource within existing buildings, and a third (27%) of the problem concerns our homes. Since 87% of the buildings here now will still be present and form about 70% of the building stock in 2050, we will see off or succumb to the three challenges by what we do, or fail to do, with existing buildings, and especially our homes. Since the urban buildings dominate, it will be the response of our towns, cities and metropolitan areas that will be decisive in winning or losing the battle.

THE TWO PERIODS 1990-2005 AND 2005-2020:

Over the period 1990-2005, the carbon emissions from domestic buildings dropped by a net 4% from 154MtCO_2e (e = equivalent) to 147MtCO_2e. This reduction came, in the main, from steady progress in measures to improve the thermal envelope in houses. Taking a basket of interventions, ie installing 3" or more of loft insulation, double glazing more than 60% of the windows by area, draught-proofing over 60% of rooms by volume, and installing cavity wall insulation where appropriate: in 1990, about 35% of all houses already had this standard of insulation and were capturing the energy savings benefits, and this figure rose to about 65% by 2005. The reduction in CO_2 emissions might have been 10% or more without countervailing factors: during that time there was a 10% rise in house numbers, a 4% increase in population, and a sharp rise from a very low base of the electricity consumed by electronic appliances for IT and entertainment (eg computers and plasma screens). At the current rate the basket of measures will be fully installed by 2015, and all the carbon reduction savings exhausted.

When we note that the 2008 Climate Change Bill sets a 26% reduction target for 2022, we can see that the building sector is going to have to work on its existing stock to achieve SIX times the net reduction in carbon emissions in the current 15 year period. We have indicated a limited capacity of the thermal envelope to contribute, unless there is a major R&D project to bring forward new thermal insulation materials and products with new and more effective means of installation. This factor SIX sets the scale of the challenge that faces us for housing, let alone any other part of the national infrastructure – non-domestic buildings, energy supplies, transport etc.

MEASURES TO 2050

There are four ways in principle by which the operation of buildings can contribute their full share of an 80% reduction, and all are needed:

New measures to improve the thermal envelope of buildings – materials, installation processes, controls, etc

Decarbonising the grid and other sources of energy

Improving the energy efficiency of appliances and

Changes in personal attitudes and behaviour concerning profligate energy use and resource consumption (especially water).

Three of these have an engineering focus, and the fourth is a matter of psychology and sociology. Of these only the second is widely accepted in the public debate and measures are being taken in relation to renewable sources of energy, a nuclear rebuilding programme and a renewal of a more efficient grid.

THE BUILDING SECTOR AND THE SCALE OF THE CHALLENGES

Although we see the noble efforts of a few to green their homes at great personal cost in terms of money and time, this has little impact on the problem just described. We have 22M homes, and if we might get at most two chances per household to intervene between now and 2050, we need whole-house interventions (on energy, water, waste and air quality systems) at a rate of the order of 1M a year. This is about 4-5 times the rate at which homes

undergo some form of renovation at present. The advice I have been giving focuses on the scale of that problem, and the place from where we are starting a 40-year journey.

The real problem is that there is no retrofit market. The renovation market, such as it exists, is totally balkanised with small firms or single traders offering limited services. There are many suppliers of different products with no large market leaders. Many players are keen to play a role, but all are looking for clear leadership – none are willing to risk their own businesses on going out alone and ahead on the green agenda while others continue to cut corners on products and services.

There is a further structural problem that needs fixing. In recent years, much public and some private money has been committed to R&D towards solving the problems of energy inefficiency, climate change and sustainability. Funding agencies can be assured of a route to market of successful R&D in nuclear rebuild, renewable energy, and carbon capture and storage. Someone bidding to research on new external cladding materials cannot get the support from big players that do not exist, and that person is at a disadvantage. Indeed there are some novel technologies sitting on the shelf for want of a clear order for ten thousand pieces that would justify the tooling up for manufacture.

The new building sector is better off, with demanding targets of zero carbon new buildings by 2016 and 2018. The new materials and products are likely to be closely coupled to new methods of construction that will not be applicable to retrofitting the existing buildings, which are constrained by older methods of construction and designed in an era of cheaper energy.

MY ADVICE

The core of the advice I have been giving colleagues within CLG (with responsibility for planning and buildings regulations and codes) and across Whitehall emphasises the scale of the problem, and it has five elements, three on engineering systems, and one each on attitudes and planning.

1. If the higher and further education sector were tasked (or better volunteered) to help lead the national attack on these challenges, they could start by getting their own estates to the 2050 standards by 2035 to show the rest of us the way. Campuses have buildings that are proxies for private dwellings, public buildings, offices and factories. Some of the brightest minds in engineering and psychology are on campus, and if they cannot succeed at their place of work, who else can we expect to succeed? Let's inspire the students, who are the leaders of tomorrow, to participate. The skilled personnel needed for the transformation of existing buildings can be recruited and trained within the FE and HE sectors. The scale is big enough to engage the building sector in bringing new products and services to market. Knowledge exchange is a core skill of academics, and they can be articulate advocates of what works and critics of what fails in the journey towards a new national built infrastructure. Many universities are doing experiments at present, but they are not to the scale needed to impact the whole country, but would like to be in that position.

2. Public procurement could be used to create and drive a UK retrofit market by working together and specifying aggressive improvements in the performance of future thermal materials, products, and installation processes, and better and more efficient appliances. The model is the California legislature which drove the market for the reduction in vehicle emissions from the 1980s. Between them, the health, education, defence, social housing and local government sectors spend in the order of £10B pa on renovation: they could use their combined muscle to help pull through the new products and services that are needed, at the required scale. In ten years the individual home owner would find only superior products on the market and at competitive prices, with possible reductions on household insurance if retrofit improvements are carried out by approved installers.

3. Central Government ambitions for the nation are actually delivered at a local level within local authorities. Few universities, companies, local authorities or other bodies that espouse their green credentials have any vision that extends beyond 2015. I would like to see model trajectories developed at the local authority level that will tell us how Cambridge, Bristol, Manchester and London are going to work in each of the eight five-year periods from 2010 to 2050 to meet the 2050 targets and the interim targets. There is no need to rush at everything indiscriminately. Some model trajectories, engineering equivalents of the economic arguments of Stern would add immensely to the quality of policy formation and action plans.

4. Over the last four decades, public attitudes and behaviour have changed with respect to wearing seatbelts in cars, not drinking and driving and not smoking in public confined spaces. We have to reach a position where the profligate use of any forms of energy is considered deeply antisocial, and personal behaviour tends to exploit any technology interventions rather than circumvent them. A commonly accepted redefinition of comfort at home and at work is an essential first ingredient.

5. The planning system will need to evolve so that it becomes an enabler, and not a barrier to meeting the targets of the Climate Change Bill. For example, with 15% of buildings in the South West being either listed or in conservation areas, wherein most current methods of saving energy (solar panels on roofs, double glazing, external cladding etc) are not allowed, we can admit defeat now if there is no change to planning.

CONCLUSION

I know of no previous era in history where a global problem, or in our case now a set of global problems, have come to the fore with a timeline of 3-4 decades for making serious inroads. If we soon see a six-fold increase in the rate of improvement of the energy consumption of buildings in the current 15 years to 2020, compared with the period 1990-2005 above, we may continue with the heightened sense of urgency. If not, the cries for a Manhattan style project, or the move by non-democratic bodies to launch geo-engineering projects, will gather force.

ACKNOWLEDGEMENTS

I have benefited greatly from conversations with, and information from, hundreds of specialists in the energy-in-buildings sector over the last three years.

CELEBRATING FOUR CENTURIES OF MODERN ASTRONOMY

Dr Robert Massey
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2009 is very much a year of science. Alongside the Darwin celebrations, astronomers also have much to say this year. 2009 marks the 400th anniversary of Galileo Galilei's first use of the telescope to study the night sky, an inspired decision that began a scientific revolution by bolstering the Copernican idea that the Earth moved around the Sun. Under the auspices of the UN, his work and the whole field of modern astronomy is being celebrated worldwide this year as the International Year of Astronomy (IYA2009), with active participation by almost 140 nations.

Astronomers ask the 'big questions' about our origin and fate. This group of scientists tries to establish how our Universe began, how it allows life to exist and how it will end. The field encompasses the entire cosmos, from the visible and familiar planets, stars and galaxies to the dust and gas they formed from. And even this amounts to just 4% of the content of the Universe, with the rest made up of invisible 'dark matter' and the even more mysterious 'dark energy', whose very existence is inferred by the effect they have on their surroundings.

Such questions have a powerful impact on the public, arguably more so than most other sciences. Children, adolescents and adults alike have a large appetite for astronomy and space science and show this by their direct engagement with the subject. Public participation ranges from attendance at lectures and organised events to visits to astronomical attractions like the Royal Observatory Greenwich (more than a million people visited there last year), the National Space Centre in Leicester and the Jodrell Bank radio observatory.

Unlike other sciences, astronomy has thousands of amateurs who work alongside the professional community, organised into hundreds of local societies and clubs. These same groups form the backbone of IYA2009 in the UK, running more than 1000 events over more than 3000 days at venues from universities and observatories to shopping precincts and community centres. IYA2009's UK activities are backed by the Royal Astronomical Society (RAS), the Institute of Physics (IoP) and the Science and Technology Facilities Council (STFC).

In April tens of thousands of people got their first look at the Moon through a telescope in the Spring Moonwatch, with similar weeks taking place in the autumn and for schools. In the same week 'Around the World in 80 Telescopes' saw live webcasts from observatories across the globe and in space. And at the end of July the 'Telescope 400' celebrations take place at Syon House in west London, commemorating the 400th anniversary of Thomas Harriot, the English astronomer whose drawings of the Moon through a telescope predate even those of Galileo.

Earlier this year one in four UK secondary schools were given a telescope, for use by pupils and teachers in after school science clubs. This 'Telescopes for Schools' project recognises that young people are excited by space and astronomy and encouraged into studying Science, Technology, Engineering and Mathematics (STEM) subjects, especially physics and maths, at school and university. IYA2009 has inspired a set of exhibitions too, not just in museums and galleries but in less traditional places. Throughout 2009 'From the Earth to the Universe' will

. . .'Around the World in 80 Telescopes' saw live webcasts from observatories across the globe and in space. . .

bring 50 of the highest quality images of the night sky to venues throughout the UK. Photographer Max Alexander's portraits of contemporary astronomers will begin a similar run in the Royal Albert Hall in September and using a rich collection of objects, the 'Cosmos and Culture' exhibition at the Science Museum will explain how astronomy has shaped the way we see our Universe over thousands of years.

IYA2009 is very much about bringing the achievements of contemporary research in astronomy and space science to a wider audience. British scientists have a great record in these subjects, ranking second only to the US for the number of published research papers. The UK is a world leader in areas such as radio astronomy (like Jodrell Bank and its associated MERLIN array of radio telescopes); theoretical astrophysics and cosmology (with prominent contributors like Lord Rees of Ludlow and Professor Stephen Hawking); the study of planets around other stars (UCL scientist Giovanna Tinetti found the first evidence for water on one of these worlds); imaging technology like the SCUBA camera installed on the James Clerk Maxwell Telescope in Hawaii; and space missions from the earliest X-ray observatories of the 1970s to probes exploring comets and other planets (for example the Cassini-Huygens mission to Saturn).

Our astronomers and space scientists work closely with their counterparts in Europe and across the world. The UK is a key partner in the European Space Agency, the European Organisation for Research in the Southern Hemisphere (ESO – which includes the world's largest optical telescope and the proposed next generation of giant telescopes), the Atacama Large Millimetre Array and forthcoming Square Kilometre Array radio observatories, the Herschel and Planck space observatories and the Aurora programme centred on the exploration of Mars.

UK astronomers feature prominently as recipients of the most prestigious science prizes. Recent examples include Lord Rees of Ludlow (awarded the Crafoord Prize in 2005 for his work on the large-scale structure of the Universe), Professor Donald Lynden-Bell (who received the Kavli prize in 2008 for his seminal contribution to understanding the nature of quasars – objects powered by material falling into black holes), Professor Stephen Hawking (the 2006 Copley medal for his work on cosmology) and Professor Andy Fabian (the 2008 Dannie Heineman prize).

But does this world-leading research in astronomy deliver a direct benefit to the taxpayer? Yes! Their lives are enriched and their outlook is changed by knowing about the 'Big Bang' or the possibility of life on other planets. In a more direct way the work of solar terrestrial physicists is vital in satellite and communication systems and in understanding the impact of the Sun on our climate.

Then, as mentioned, there's the 'STEM attractor' effect. If the UK is to develop as a knowledge based economy and a scientifically literate society more young people need to study science. Dr Maggie Aderin-Pocock, a senior engineer at EADS Astrium, one of the UK's biggest space companies, was 'turned on' to science by her early exposure to astronomy. (During IYA2009 Dr Aderin-Pocock is leading the 'She is an astronomer' project in the UK, which aims to promote the science to girls and encourage them into the £7 billion space industry).

. . .the 'Cosmos and Culture' exhibition at the Science Museum will explain how astronomy has shaped the way we see our Universe over thousands of years. . .

Most recipients of astronomy PhDs move into careers outside the field, but make good use of the training and transferrable skills they acquire during their time in academia. Dr Peter Newman, who now heads an operational research team for the Home Office, draws on experience gained during the first part of his career as an astrophysics postgraduate and postdoctoral researcher. At that time he had to produce research that could stand up to peer review and then had to explain often highly technical subjects to a lay audience (or a grants panel). These abilities have served him well in his current role.

Excellence in applied science depends on support for pure science, as recognised by successive Science Ministers. The UK's reputation in this area has brought in talented people from across the globe and directly assists in our recruitment of overseas students. A vibrant, dynamic, science-led economy depends on continuing to attract and retain the very best researchers in our universities and industry. However, while astronomy research is driven by curiosity it has led to a large number of spin-offs such as the terahertz imaging cameras used at airports; a precision camera, developed for gamma-ray astronomy, now used to screen for radioactive materials in cargo containers and superconducting tunnel junctions that are used on telescopes to detect low levels of radiation but now used in the DNA identification needed in forensic science and medicine. While these applications were at least partly serendipitous they reinforce the conclusions of the economist Professor Edwin Mansfield [see Research policy 20(1991)1] who estimated a 28% rate of return on basic research (based on the profits from innovations, savings from new processes and benefits to users from new products and processes).

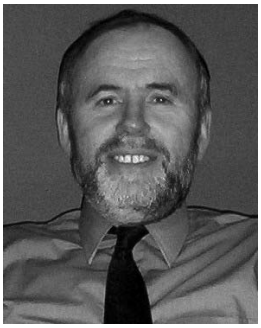
Four centuries after the seminal work of Galileo and Harriot, the UK is undoubtedly a world leader in astronomy and space science. The challenge is to ensure this continues and that we do not lose sight of the benefits of curiosity-driven research. Long-term investment in pure science should be a key part of the quest for a rebalanced economy – IYA2009 should remind everyone of its importance.

ACKNOWLEDGEMENTS

The article was prepared with the assistance of Steve Owens, the UK co-ordinator for IYA2009 and Professor Ian Robson, Director of the Astronomy Technology Centre at the Royal Observatory Edinburgh and the UK chair of IYA2009.

Front Cover Image
by Max Alexander
Observing the moon at sunset, at Cardiff Astronomical Society's Spring Moonwatch event in the Brecon Beacons National Park

THE INSTITUTE OF CORROSION – A RUSTY PAST, A GOLDEN PRESENT AND A SUSTAINABLE FUTURE



Paul Lambert
President,
Institute of Corrosion

Douglas Mills
Technical Secretary,
Institute of Corrosion

With the notable exception of gold and the occasional chunk of meteoric iron, metals are as artificial as plastic bags. This is because most metals only exist in stable combined states with other elements. So iron, as an example, can be found as an oxide such as haematite or a sulphide as in pyrites or 'Fool's Gold'. Once the artificial nature of metals is accepted it is perhaps easier to understand why we have problems of oxidation and corrosion. Corrosion is a natural and normal process, returning the metals to their lowest energy state. Most commonly employed metals have a similar life-cycle to their masters. Once 'born' their lifespan is dependant upon the job they are given and how well they are looked after. Put to good use and properly cared for they can last to 100 years and beyond. However in this context gold remains all but immortal and is treated accordingly.

There is something wonderfully appropriate about an organisation committed to the study and control of metallic degradation celebrating a milestone named after a metal renowned for its durability. The membership certainly appears to be more durable than the metals they strive to protect, with many of the original founders still active in the Institute and ready to join in the celebrations, which include a special event at the Thames Barrier, fifty years to the day after the first British organisation dedicated to corrosion was founded.

The birth of the Institute can be traced back to the British Association of Corrosion Engineers (BACE), founded on 21st May 1959. It was the brainchild of Dr John Tiratsoo who was the then owner and driving force of a publication entitled Corrosion Prevention and Control. An announcement was made to the national press at a social event at the Rembrandt Hotel which stated that the Objects of the Association would be:

"to generally promote the dissemination of technical information about corrosion activities and to develop, by means of social activities the free interchange of information among members. In due course the Association which is essentially non profit making will progress towards the establishment and acceptance of suitable qualifications for corrosion engineers and promotion of standardisation in the terminology and techniques of corrosion control.

When the Association is in full operation, it is intended to hold full scale meetings with papers, films and discussions which should be of great benefit to the corrosion engineering profession as a whole and which will promote and foster its growth and development as well as being a general service to industry".

BACE was clearly aimed at practising corrosion engineers, already active in the immediate post-war period. At around the same time another society aimed squarely at academia where the fundamentals and processes of corrosion were being studied was founded under the banner of the Corrosion Science Society. The society initiated and organised an annual conference called the Corrosion Science Symposium, still an annual event and also in its 50th anniversary year. From inception, the Symposium has been an event where mainly academic papers are presented, often by young researchers making their first presentations to an informed though generally benign audience of fellow students and academics.

The Corrosion Science Society became the Corrosion and Protection Association (CAPA) in the mid 60s and BACE eventually became the

Institute of Corrosion Technology (ICorrT). The latter amalgamated with CAPA on 1st January 1975 to become the Institute of Corrosion Science and Technology which later in 1988 became the Institute of Corrosion. The Institute still maintains two divisions, the Corrosion Science Division (CSD) and Corrosion Engineering Division (CED), representing the interests of the largely academic or predominantly engineering membership.

As far as corrosion science and engineering is concerned, probably the most significant single event of the past half century was the commissioning by Tony Benn in 1969 of the Hoar Report. This key document was the product of a committee chaired by the late T P Hoar who was one of the doyens of corrosion science and had greatly contributed to the understanding of corrosion processes while working with U R Evans at Cambridge University.

The committee was asked to estimate the cost of corrosion in various industry sectors and finally reported in 1971 under the title Report of the Committee on Corrosion and Protection. Costs to the nation as a direct result of corrosion were judged to be approximately 4% of GDP, a figure that has proved to be remarkably robust both in this country and the developed world in general. Equally importantly, it was estimated that at least 25% (ie 1% of GDP) of this enormous loss to the nation could be saved in a cost effective manner simply by the immediate application of known technologies. The equivalent monetary figures for the USA are truly eye watering, exceeded only by those recently quoted with respect to the present 'economic difficulties'.

Direct outcomes of the Hoar Report included the establishment of a National Corrosion Advisory Service at NPL, the founding of the Corrosion and Protection Centre at the former UMIST and the provision of commercial testing and consultancy by the Corrosion and Protection Centre Industrial Service (CAPCIS). During the following decades there have been significant new developments and refinements of materials and methods for the control and avoidance of corrosion. For example, cathodic protection which can be traced all the way back to Sir Humphry Davy FRS and his work on preventing the corrosion of the iron nails used to attach the copper sheeting to the bottom of Royal Navy ships, ably aided by his humble lab assistant, Michael Faraday.

Over the last 50 years cathodic protection has developed into a primary method of protecting submerged and buried metallic structures including ships, pipelines and oil rigs and has contributed hugely to the success and safety of the oil and gas industries. Through major contributions by UK based scientists and engineers, cathodic protection is now also used to protect major reinforced concrete structures such as bridges and tunnels and many of the historic steel framed masonry building to be found in city centre locations such as Regent Street and Fleet Street in London and Deansgate in Manchester. Should you ever be outside Gloucester Road Underground Station, take note of the carefully restored teapot red faïence finish and consider that since 1997 the wrought iron structural frame hidden within has been protected by a modern variation of Humphry's technique.

. . . The replacement of a tonne of steel lost to corrosion results in the generation of two tonnes of carbon dioxide. . .

The next 50 years will bring their own challenges, chief amongst them being an increasing need to be aware of sustainability issues and avoiding waste. In this area the Institute and its membership are well positioned to assist. The replacement of a tonne of steel lost to corrosion results in the generation of two tonnes of carbon dioxide. We have been acting to enhance sustainability for decades without even realising – we just thought we were saving money and enhancing safety. Through the application of techniques such as cathodic protection, enhanced protective coating systems, intelligent design and optimised manufacturing procedures it is already possible to ensure durability in service without risk to people, the environment or the economy.

Regarding the Institute of Corrosion's recent connections with Government, we have been a member of the Parliamentary and Scientific Committee for about the last ten years. Meetings are regularly attended by the Technical Secretary and, whenever possible, the current President. Matters where corrosion is of importance have been raised many times in that period with topics ranging from nuclear waste disposal to ageing aircraft and in December 2006 one of our now Past-Presidents, Professor Stuart Lyon of the University of Manchester, made a keynote presentation on the role of the science of corrosion in extending the useful life of materials as part of the programme entitled Materials, Minerals and Mining – Innovation, Conservation and Wealth Creation. We look forward to our continuing active association with the Committee and expect to be able to offer other significant contributions in the coming years.

Returning to our 50th anniversary celebrations on 21st May, the Thames Barrier was a natural choice for the location as many of the Institute's original founder members were directly involved with the successful corrosion prevention of this prestigious structure. 2009 is also the Thames Barrier's 25th anniversary year. A full technical and social programme including presentations on the Thames Barrier and Forth Road Bridge plus a panel discussion on the developments in pipeline protection over the last half century have been prepared. All current members and past supporters have been invited. The Institute is very aware of its past, particularly this year, but its membership is already looking ahead with a determination to deliver a safer, more durable and far more sustainable future.

EDUCATION AT THE WELLCOME TRUST

Professor Derek Bell
Head of Education,
The Wellcome Trust

The Wellcome Trust, referred to as the Trust in this article, is the largest charity in the UK, best known for its substantial funding and promotion of biomedical research to improve the health of humans and animals. As well as tackling immediate priorities, the independence and long-term perspective of the Trust enables it to support research that will benefit future generations. The Trust also seeks to improve understanding of the ways science and medicine have developed, and how research affects people and society today. It is in the latter context that the Trust has proactively developed its extensive programme of activities encouraging public engagement with science.

The Trust has always had an interest in science education and about seven years ago decided that it could make a major contribution to improving the quality of science education by making available high quality continuing professional development (CPD) for science teachers across the UK. This decision was particularly influenced by the Council for Science and Technology's report[1] on science teaching in 2000 which stated that good quality teaching depends on the opportunity for teachers to develop subject related pedagogical skills and competence but that most teachers do not up-date their skills.

Subsequent negotiations led to the setting up of the network of Science Learning Centres in partnership with the then Department for Education and Skills (DFES), now Department for Children Schools and Families (DCSF). The network consists of the National Science Learning Centre (NSLC), based in York and funded by the Trust, and nine regional science learning centres, one per government region and funded by DCSF, with an overall aim to *improve the quality of science teaching and learning through effective continuing professional development for all those involved in science education*. The network, which is now in its second phase and with additional funding support through Project ENTHUSE, a unique partnership in science education between Government, industry and the Trust, has to date exceeded its targets for teachers and technicians engaging in CPD.

As a research based organisation the Trust has always endeavoured to build on evidence, drawing on existing research and commissioning studies in areas of particular interest and concern. For example during the development of the science learning centres it became obvious that little was known about teachers' attitudes to CPD or their engagement with it. A study was initiated and the findings published in the report *Believers, Seekers and Sceptics*[2], which, among other things, found that approximately 50% of the science teachers had received no subject specific CPD in the previous five years. More recently the Trust published a report on *Primary Science* in its Perspectives Series[3] and is about to publish a second on *Transition from Primary to Secondary Education*. It has also commissioned a study, which is ongoing, into the attitudes of parents and pupils on testing at Key Stage 2 (pupils aged 11) in England.

Through its grant funding mechanisms the Trust also enables others to develop their own activities which support science education directly and indirectly. Importantly the Trust is able to take a more holistic view of education and bring together what might be considered the 'formal' and 'informal' areas of science education. This has been done, for example, on a national scale through the Trust's contribution to the Darwin 200 celebrations, when among other things the Trust instigated two ambitious initiatives with the aim of providing a practical experiment in science for every child of school age. This is currently being put into practice through *The Great Plant Hunt*[4] for primary schools and *Survival Rivals*[5] for secondary schools both of which are providing materials to enable young

. . .good quality teaching depends on the opportunity for teachers to develop subject related pedagogical skills and competence . . .

people to carry out investigations that have been derived from Darwin's own experiments. Although linked to curriculum requirements the experiments provide scope for teachers and their students to engage with a wider range of activities thereby enriching and enhancing their learning experiences.

Building on these foundations the Trust is looking towards the future and exploring ways in which, working with partners from Government, industry, professional bodies and other charitable foundations, the Trust can increase and improve its contribution to the development of high quality science education for all young people. Indeed the Trust is currently working locally, nationally and internationally to address four key areas.

A) THE SCIENCE EDUCATION AGENDA

Science education and related subjects (technology, engineering and mathematics) have received a great deal of scrutiny in recent years and some progress has been made in trying to bring about greater coherence to the way in which these subjects are supported. Much effort has also gone into encouraging young people to continue to study these subjects beyond the age of 16. Although there is evidence of some success, tensions have arisen between the more traditional approaches to science education and recent developments which explore science in a more contemporary manner. In part this reflects the need to provide a programme of scientific understanding for all pupils, regardless of whether they progress into careers in science, as well as preparing those students who will be the scientists, technologists, engineers, mathematicians and medics of the future.

. . . experiments provide scope for teachers and their students to engage with a wider range of activities thereby enriching and enhancing their learning experiences. . .

Against this background the Trust has just commenced the development of a science education policy 'roadmap' which will look ahead to what science education might look like in 5-10 years and, importantly, what needs to be done to get there. We will be looking to consult widely during preparation of the report to be published in early 2010.

B) CONTINUING PROFESSIONAL DEVELOPMENT FOR TEACHERS

The Trust remains totally committed to the improvement of the quality of science education through effective professional development of teachers, technicians and other related staff. The success of the science learning centres to date has been a major contribution to raising the profile and quality of subject-related CPD. There is still much to do and the Trust is working with its partners and through Project ENTHUSE to explore ways of further strengthening the commitment to and uptake of CPD. A key element of this is through the development of an accreditation framework which allows teachers to gain recognition for their enhanced expertise. It also involves finding ways of identifying, supporting and encouraging future leaders of science education be they researchers, curriculum developers or excellent practitioners. The ultimate test of the initiative will be the impact it has on pupils and there is already evidence of positive effects but a major evaluation has been commissioned in which this will be a key focus.

C) INFORMATION ON CONTEMPORARY SCIENCE

Science, as we all know, is a rapidly evolving subject and science education needs to keep abreast of these developments. One of the challenges is to find ways in which young people and their teachers are informed about contemporary science as part of their learning. The Trust is constantly looking to provide information in ways which are engaging to young people, as well as adults, through its public engagement activities, outreach work and publications such as Big Picture [6] which is designed specifically for those in schools and colleges post 16.

D) SCIENCE EDUCATION RESEARCH AND DEVELOPMENT

Science education research provides some very useful evidence on which to base both policy and practice. However there are three main challenges which need to be tackled. The first is the identification of gaps in the evidence base and what should be prioritised for investigation. The second is more fundamental and related to the methodologies used in educational research which often fail to demonstrate a genuine effect that can be applied beyond the project which generated the evidence. This raises the question as to whether a new methodology needs to be developed or applied to research in education. The third, arguably the most challenging, is how can research evidence be used more effectively to inform policy and improve curriculum development and pedagogy. The Trust is currently considering these issues with a view to establishing a programme to support better science education research and its influence on both policy and practice locally, nationally and internationally.

The Trust recognises that, like developments in science and medicine, educational change takes time, requires substantial thought and, where necessary, extensive piloting before being implemented system-wide. As such it requires medium to long term commitments and planning cycles which go beyond most political timescales. Taking advantage of its independence and its ability to take a medium to long term view, the Trust is willing to make such a commitment and as the (relatively) new Head of Education I look forward to taking up these challenges.

If you have any views on the future of science education or comments on the content of this article please contact me at d.bell@wellcome.ac.uk

1. Available at: http://www2.cst.gov.uk/cst/reports/
2. Available at: http://www.wellcome.ac.uk/About-us/Publications/Reports/Education/index.htm
3. Available at: http://www.wellcome.ac.uk/About-us/Publications/Reports/Education/index.htm
4. More information at: www.greatplanthunt.org
5. More information at: www.survivalrivals.org
6. Available at: http://www.wellcome.ac.uk/Professional-resources/Education-resources/index.htm

PUBLIC INVESTMENT IN R&D DURING THE DOWNTURN

Nick Dusic
Director, Campaign for Science & Engineering (CaSE)

Politicians of all stripes have highlighted the importance of science and engineering to the nation's economic future. Most notably, the Prime Minister said that *"we will not allow science to become a victim of the recession – but rather focus on developing it as a key element of our path to recovery."*

Although it is widely recognised that science and engineering will be critical to ensuring that the UK emerges stronger from the recession tough decisions will have to be made to do this. The economic crisis will impact policy decisions about spending on science and engineering and how it is focused. There have to be constructive debates now if science and engineering is going to help make the UK economy more balanced and resilient in the future.

BUDGET 2009

In advance of this year's Budget, the Campaign for Science & Engineering (CaSE) and others argued there should be targeted investments to complement and build upon the Government's long-term strategy for science and engineering. There were two main reasons for this.

First, scientists and engineers will be critical to achieving the ambition for a more balanced economy. The implosion of the financial and housing sectors has meant that other parts of the economy from high value-added manufacturing to technology start-ups are now being given greater importance in policy circles. Many of these areas require people with science and engineering skills, so it is critical that those skills are developed, not lost, during the recession.

Second, the UK needs to remain internationally competitive through the downturn. Although absolute funding has gone up over the last decade, the UK still lags behind competitor countries in terms of the percentage of GDP spent on R&D. The inclusion of R&D investment in other countries' stimulus packages risks putting us at an even greater relative disadvantage. The USA has led the way here by putting an additional $21.5 billion of investment into R&D.

On Budget day there was additional support for key technology areas through a new £750 million Strategic Investment Fund. There was no additional funding for the research base. Instead the Budget report stated that £106 million would be reallocated within the science budget to support key areas of economic potential. The debate started by ministers about focusing research on priority areas is now being implemented.

PRIORITY AREAS

The Science and Innovation Minister, Lord Drayson, started this 'debate' when he suggested Government investment in research funding should be focused on strategic areas to improve its economic impact. It was unclear how a focusing agenda would be implemented. Would research funding be reallocated towards priority areas? Or would it be done by using other instruments within the policymaker's toolbox? The Budget made it clear that the Government is moving forward with both options.

Following the Budget, the Department for Innovation, Universities and Skills said Research Councils would have to refocus their work for 2010/11 to respond to priority areas, such as the green economy, life sciences, the digital economy, high-value manufacturing systems and services and cultural and creative industries. These are the priority areas identified in the Government's new industrial policy, Building Britain's Future – New Industry, New Jobs, launched days before the Budget.

Research Councils are supposed to operate at arm's length from Government so that their priorities are not directed by short-term political expediency. The Government does set the over-arching funding framework, but it is not meant to meddle. Meddling is inefficient, because it means widening up or down programmes to suit political rather than research objectives. It also erodes the independence of researchers to set new research directions, because funding is committed to priority areas.

The Government's admirable aim of creating a more balanced economy will not be achieved by unbalancing the UK's research effort. A strong and diverse research base is one of the nation's most important assets. It provides the space for developing innovative technologies and the ability to respond to new challenges.

CAN WE PICK THE RESEARCH WINNERS?

Trying to identify which areas of research have the most promise in terms of delivering an economic or social return isn't new. In 1986, an advisory council to the Government produced a list of scientific areas needed to support the development of communication technologies. They did not foresee that the major advance in that area – the World Wide Web – would come out of particle physics research just a few years later, in 1989.

The Council for Science and Technology (CST) looked at technology-priority setting in 2007. The CST recognised the importance of the breadth of the research and technology base and suggested that priority areas should not be supported at the expense of others. Rather, the Government could provide support for particular areas through procurement, regulation and facilitating collaborative working. Where it was available, financial support could be used for R&D investment, demonstration projects and public engagement. The Government should learn from past attempts and recent reports, before it continues down the path of focusing research funding to support priority sectors.

SUPPORTING TECHNOLOGY AREAS

Although the Government is getting it wrong in terms of focusing the UK's research funding, it is moving in the right direction by providing other types of support for key technology areas. The Budget included £750 million for a new Strategic Investment Fund aimed at supporting advanced industrial projects. £50 million is set aside for the Technology Strategy Board and £250 million will go towards low-carbon investments. More information is needed about the operation of the Fund before a proper assessment of it can be made, but it has the potential to provide much needed support for emerging technologies.

The new industrial policy is meant to spur departments to ensure that various Government activities, including procurement and regulation, better support particular sectors. One of the key initiatives was the creation of the Government Office of Life Sciences, intended to bring various departments together to create greater coherence between policies affecting the pharmaceutical and biotechnology sector. If this proves to be a successful model, it should be expanded to other sectors. The Treasury has said that it will assess potential reforms to the tax system to see if they can help ensure that the UK is a good place for companies to locate R&D and register their intellectual property rights.

GOVERNMENT R&D

There has been little discussion about how Government departmental R&D budgets will contribute to priority areas. Will the Department for Energy and Climate Change's R&D budget be sufficient to support its ambition of a low-carbon economy? Departmental R&D budgets have remained relatively constant in real terms over the last ten years while funding for the research base has gone up. Departments need to start thinking about how they could use their R&D budgets to contribute to their priority areas.

The only mention of departmental R&D within the Budget was with reference to cost savings. £10 million of savings were to be found within the Department for International Development's research budget. £170 million will be cut from the Ministry of Defence's Nuclear Weapons Capability Sustainment Programme, which sustains key skills, research and manufacturing facilities. The Government needs to implement the Sainsbury Review recommendation to protect departmental R&D budgets from cuts. So far only the Department of Heath has done so.

. . . Will the Department for Energy and Climate Change's R&D budget be sufficient to support its ambition of a low-carbon economy? . . .

GOING FORWARD

The Budget did not contain a US-style boost for science and engineering that many hoped for. It did show that the Government is moving forward with its plans for aligning the research base with its new industrial policy. The Government needs to pause and have a proper consultation about this move before it continues along this path. Refocusing resources will mean that there will be cuts to non-priority areas. It is difficult to reconcile this with the Prime Minister's recent commitment to increase investment in science across the board.

Through the 10-Year Science and Innovation Investment Framework the Government has provided policy clarity and continuity for science and engineering. The Government should build upon this record and not undermine it by creating instability in research funding, which could risk losing talented researchers and mobile corporate R&D to other countries who are making considerable investments in R&D through the economic downturn.

The Government is right that science and engineering are central to the nation's prosperity. Through sustained investment over the last ten years it has put the UK in a much better position to build upon the strength of the research base. However, it needs to take a step back and think through its focus agenda. Instead, it should provide support for key technology areas through better co-ordination across Government, the Technology Strategy Board and utilising departmental R&D budgets. Narrowing the focus of the research base is not going to make the UK economy more balanced and resilient in the future.

GLOBAL OIL PRODUCTION PREDICTED TO PEAK AT 2040

Steven E Koonin
Under Secretary for Science,
US Department of Energy
formerly Chief Scientist BP plc

"The term 'Peak Oil' refers to the maximum rate of oil production in any area under consideration, recognising that it is a finite natural resource, subject to depletion." Colin Campbell, Founder of the Association for the Study of Peak Oil and Gas (ASPO).

King Hubbert, a geophysicist at the Shell laboratory in Houston, Texas, wrote a paper in 1956, with predictions for the peak year of US oil production. This estimate is shown in Figure 1 and has subsequently been shown to be essentially correct, based on information available at that time. The only significant modification to this was due to the subsequent discovery of Alaskan oil which peaked in 1985 (see Figure 2).

At the world scale oil production depends upon six primary factors which are summarised here:

1 Resource size (how much of it is there in the ground?)

2 Access to the resource (are you able to produce it?)

3 Technology (how much of it can you recover and at what cost?)

4 Investment (will the equipment be installed?)

5 Market imperfections, these include:
OPEC Cartel
Government Regulations and duties
Revenues, security of supply, CO_2 emissions

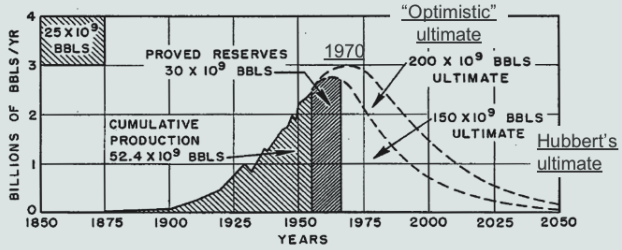
6 Demand (price, technology, fuel substitution)

In 2006 the world produced more oil than ever before; by 2006 a total of about1 Trillion bbl (10^{12} bbl) of oil had been consumed (Figure 3) and reserves of about another 1Trillion bbl had been identified. This figure gives no indication whether the peak has been reached already, or when it will be reached in say, 10 or 30 years time, or provide information on the likely breadth or extent of the peak into the latter part of the 21st century.

The likely future supply of oil will be dependent on the economic price and availability, discussed below in Figures 4,5 and 6.

Oil resources differ widely as a function of their economic price and availability, with oil shales representing the highest values in both economic price and availability (Figure 4). The economic price will mean that they are exploited only as a last resort and especially in view of the large requirement for water

Figure 1



- Large fields are discovered first and produced rapidly;
- All fields unavoidably decline

Figure 2

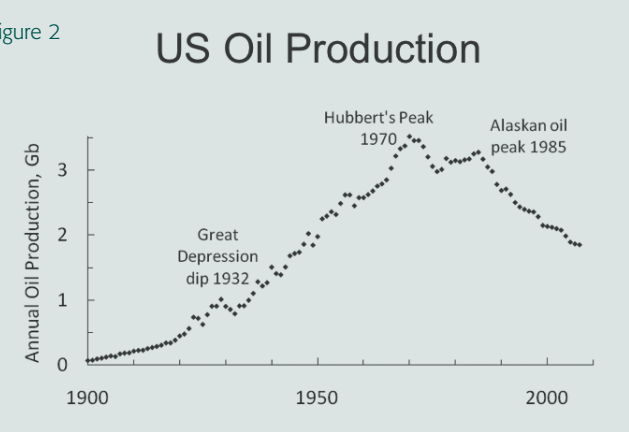


Figure 3

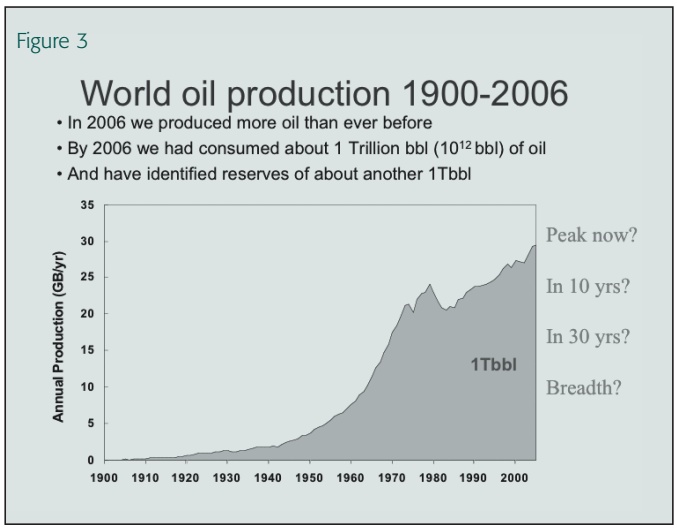
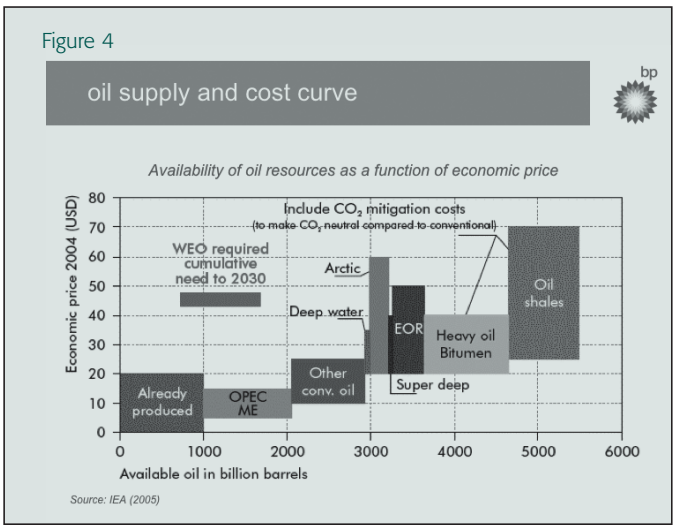


Figure 4

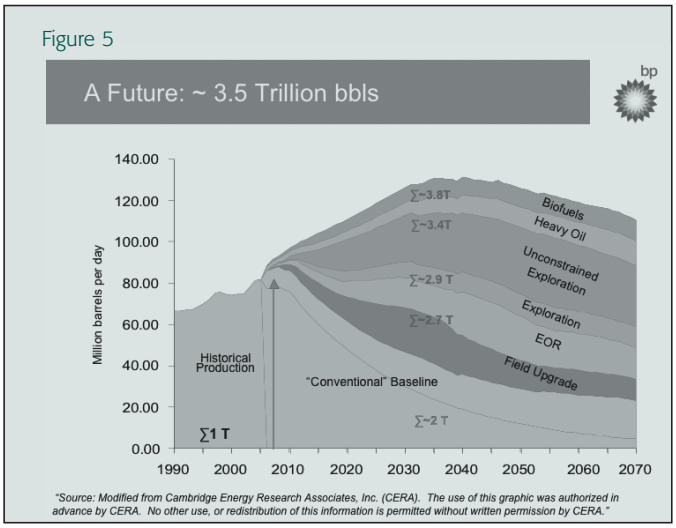


and the environmental damage associated with recovery of oil from this source of supply.

The future estimates of the results of further exploration, notably including "Unconstrained Exploration", are indicated in Figure 5, indicative of an upper maximum potential supply scenario, based on work by Cambridge Energy Research Associates Inc (CERA). This summarises potential contributions to the future supply of oil beyond 2006. This is over and above an estimated 'conventional' baseline of a total of 2 Trillion bbls, generating an estimated maximum of 3.5 Trillion bbls by 2070, peaking at 2040.

Unconventional liquids shown in Figure 6 also have potential to replace conventional sources of oil up to a maximum of 118 Mbd by 2030, dependent on their price and availability.

Figure 5



IN SUMMARY THE FOLLOWING POINTS ARE EMPHASISED:

Sufficient liquid hydrocarbons can be produced to meet projected demand for many decades;

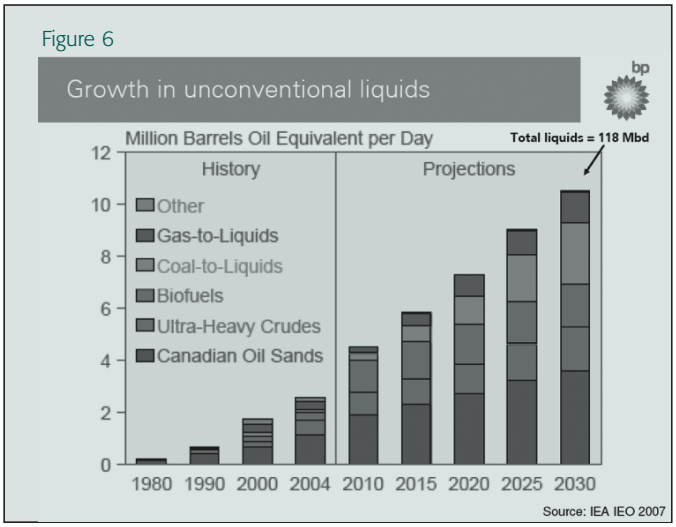
Conventional crude production may well peak at some point in the next several decades

- If so, political, social, and economic reasons will be as important as resource or technology;

Conventional crude will be supplemented by alternative sources of liquid hydrocarbons:

- Heavy oil, tar sands, shale oil, biofuels, coal-to-liquids, gas-to-liquids;
- The extent will depend upon technology, economics, and regulation, driven by security of supply and CO_2 concerns;
- Long timelines are involved to develop significant capacity;
- A peaking in total liquids will be demand-driven, not supply driven.

Figure 6



Sufficient liquid hydrocarbons can be produced to meet projected demand for many decades

PEAK OIL

Steven Sorrell
Sussex Energy Group,
Science Policy Research Unit,
University of Sussex

Commentators have been predicting an imminent peak and terminal decline in the global production of conventional oil, resulting in major economic dislocation, with non-conventional sources being unable to 'fill the gap' in the time available, although forecasts of this type have proved incorrect. The combination of extreme price volatility, declining production in key regions and ominous warnings from market analysts, have also increased concerns about oil security. The 2008 World Energy Outlook from the International Energy Agency (IEA, 2008) has looked closely at production trends for individual fields. They concluded that to offset depletion and meet anticipated demand, new capacity equivalent to 64 million barrels/day (mbd) will be needed before 2030 – or six times the current output of Saudi Arabia. While the IEA do not forecast a peak in global supply before 2030, they express serious reservations about whether the required investment will be forthcoming. Many commentators are equally sceptical about whether the required resources exist, or whether they can be accessed over the next 20 years.

The pessimism of the IEA contrasts with a lack of concern by the UK Government. The possibility of a peak in global oil production was not mentioned in the first report of the Committee on Climate Change. Most oil companies are dismissive of this idea, while environmental NGOs appear reluctant to discuss it for fear of being discredited if forecasts of an imminent peak prove incorrect. This reluctance may be traced to the 1972 'Limits to Growth' report which gave over-simplistic forecasts of imminent resource depletion that failed to take account of the potential for substitution and technical change. As a result, depletion has become a secondary concern, with most attention focused on climate change. A peak in global oil supply would have serious economic and social implications and make it more difficult to manage climate change and also provide strong incentives to develop coal-to-liquid technologies.

ASSESSING RESERVES

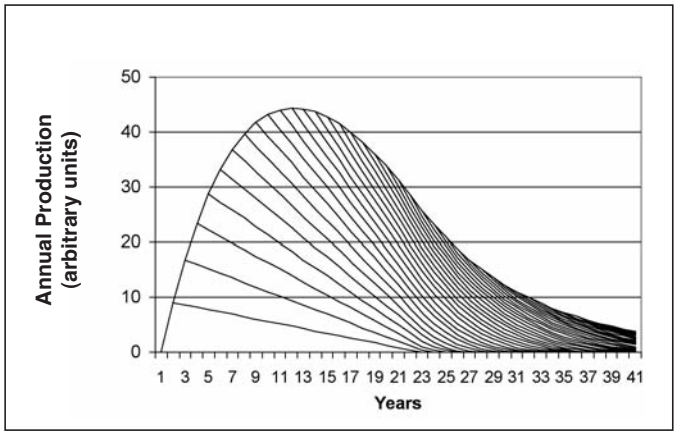
The assessment of oil depletion is handicapped by poor data. Reserve estimates are inherently uncertain, and are complicated by inconsistent definitions and the lack of third-party verification. OPEC figures are mistrusted, but account for the bulk of the world's remaining reserves and form the basis of authoritative publications such as the BP Statistical Review of World Energy. Most sources in the public domain provide estimates of 'proved' reserves which are highly conservative and provide little warning of resource depletion. Proved reserves for the UK have changed little since 1988, although production has halved since 1999. The BP Statistical Review shows global proved reserves increasing steadily over the past 25 years although a widely-cited independent database maintained by IHS Energy shows 'proved and probable' reserves declining since the mid-1980s. As the BP 'proved' reserves are now comparable to the IHS 'proved and probable' reserves, one of them is incorrect. These sources also present differing global conclusions about the future security of supply.

UNDERSTANDING PEAKING

The mechanisms underlying the 'peaking' of oil supply from a region are well understood. Production from individual oil fields peaks and declines as a result of falling pressure. Most of the oil tends to be located in a small number of large fields which are discovered early in the exploration process, with subsequent discoveries being smaller and requiring greater effort. The production from the small fields that were discovered late is insufficient to compensate for the decline in production from the large fields that were discovered early – leading to a regional peak in production (Figure 1). Comparable patterns have been observed in 54 of the 65 largest oil-producing regions, including the North Sea, although numerous technical, economic and political factors complicate the trend.

The same skewed distribution of oil resources is observed at the global level. The IEA estimates that there are 70,000 oilfields in production

Figure 1 Stylised model of a regional peak in oil production



Note: Each triangle represents the production from a single field. It is assumed that fields are developed in declining order of size, with each field being 10% smaller than the previous.

worldwide, but in 2007 approximately half of global production derived from 110 fields, one quarter from 20 fields and as much as one fifth from 10 fields, with 7% of production derived from a single field – Ghawar in Saudi Arabia. Most of the 20 largest fields have been in production for several decades and 16 of them have passed their production peak.

About 80% of today's oil flows from fields discovered before 1973, the majority of which are in decline. Globally, production from existing fields is declining at 4.5% to 7% per year, implying that 3-4.5mbd of new capacity must be commissioned every two years simply to keep production flat (eg a new North Sea). Annual production has exceeded annual discoveries every year since the early 1980s and the gap is growing progressively larger. Most regions have been extensively explored, the average size of new discoveries has substantially declined and the remaining prospective areas are either inaccessible (eg the Arctic) or politically sensitive (eg Iraq). All forecasts suggest an increasing dependence upon OPEC, but reserve estimates for key countries such as Saudi Arabia are disputed (Simmons, 2005). The decline in new discoveries is partly compensated by 'reserve growth' at existing fields, but the causes of reserve growth are poorly understood and the growth observed in the past may not continue into the future.

FORECASTING PEAKING

Forecasts of a peak in conventional oil production rely on methods pioneered by M King Hubbert, a former employee of the Shell research laboratories. Hubbert assumed that the oil production from a region over time could be approximated by a 'bell shaped' curve, with the area under the curve representing the total quantity of oil that would ever be extracted. In the mid-1950s, when US oil production was rapidly increasing, Hubbert used this simple model to forecast that production would peak between 1965 and 1970 and decline rapidly thereafter. This forecast has since proved remarkably accurate – US production peaked in 1970 and has fallen every year since, despite discoveries in the Gulf of Mexico and Alaska.

However, Hubbert's forecast was partly a lucky accident and his methods have numerous weaknesses. For example, they neglect economic and other variables that influence oil discovery and production and are applied to regions that are not geologically homogeneous. As a result, they can underestimate the recoverable resources for a region and provide overly pessimistic forecasts of future supply. Many studies that rely upon these methods lack adequate statistical support and use proprietary databases which are difficult for others to check. Given these difficulties, the best response is to use simulations to test the sensitivity of the results to key assumptions. For example, Kaufmann and Shiers (2008) examined how the predicted date for a global peak depends upon assumptions about the quantity of oil remaining and the rates of production increase and decrease. In 85% of their simulations, they found the peak occurring sometime between 2010 and 2032, with the latter requiring highly optimistic assumptions about the amount of oil remaining.

PRICES AND ALTERNATIVES

The lack of transparency in the global market, the uncertainty over the size of the resource and the concentration of production in a small number of large fields all suggest that the time profile of prices could be discontinuous, with costs increasing rapidly only when the large fields are depleted. Higher prices will encourage exploration and improvements in technology, but given the scale and the required investment in the associated lead times, depletion could easily outpace technical change. Higher oil prices will also provide incentives for exploiting non-conventional oil resources, such as tar sands, as well as the development of alternatives such as biofuels, coal to liquids and gas to liquids. While the technical and economic potential for these is subject to debate, each requires much more energy to extract, refine and distribute than conventional oil. A more immediate question is how quickly these alternatives can be developed, since the size, capital intensity and longevity of any fuel supply infrastructure means that a long lead time is required for the development of alternatives. Since this also applies to fuel-using equipment and infrastructure, the scope for rapid demand reduction is also constrained. A widely-cited report for the US Department of Energy concluded that major shortfalls and economic disruption can only be avoided by initiating a 'crash programme' to develop alternatives some twenty years *before* a peak.

IMPLICATIONS

If a peaking of conventional oil supply is likely within the next twenty years, then investment in demand reduction and supply alternatives needs to begin now. Failure to do so could lead to significant economic disruptions – although premature action could also prove costly if the peak is delayed. Much of the risk will need to be borne by governments since price signals are unlikely to stimulate the investment needed. The current economic recession worsens the situation, since it has led to many supply projects being cancelled or delayed, creating the risk of supply shortfalls when demand recovers.

Developed economies are entirely dependent upon low-cost transportation, with the potential for serious disruption if prices rise rapidly. Transport is almost entirely oil dependent, with little prospect of diversification in the immediate future. Natural gas liquids offer a temporary way forward, but would increase overall gas dependency, while electric/hybrids offer another, but would require substantial increases in renewable generation and/or nuclear power if carbon emissions are to be contained. Global food production is also heavily reliant upon oil-based mechanisation, petrochemicals and fertilisers. While peak oil advocates may be excessively pessimistic about possible solutions, to neglect the risks altogether is highly irresponsible.

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DURING DISCUSSION THE FOLLOWING POINTS WERE RAISED:

Electrification of motor transport is uneconomic; it would be better in the short term to improve the efficiency of combustion engines. The displacement of oil for use in transport by electric vehicles would require a massive investment. In order to be able to rely on the introduction of more electric vehicles in the future we should have decided to renew our nuclear power stations very much earlier. We no longer have this option available to us in the short term. The availability of oil is not the issue, the availability of energy is. Two approaches have been presented, the macro approach discussing estimates of the likely total amount of oil available and the micro approach concerned with an explanation of the contradictions between differing company estimates for peak oil. These estimates drive the science agenda since if oil is going to run out in the short term this will impact on geopolitical issues such as the need for sequestration which will be less important in the absence of oil. However, there is a massive disconnect between the current rate of oil depletion and the need to minimise climate change. Oil should be reserved exclusively for transport where it is responsible for 14% of greenhouse gas emissions and stationary supplies of energy should come from other sources.

Energy comes in many forms but there is an essential requirement for fuel in a liquid form. For example, in the USA corn ethanol is a very popular fuel. Price control should be used to help to reserve the use of oil for transportation and thus help to extend its availability further into the future. Peak oil is only the peak of what has been discovered, however the peak of the ultimately recoverable resources of oil is ultimately of more importance. OPEC do not insist on the production of relevant data and it is not possible to interpret the data they produce reliably. Peak oil is therefore currently based on what is actually produced. The Middle East is currently producing less than the rest of the world. Two decades hence most oil will be coming from that region. If we wait for oil to run out before reacting this will be a disaster.

In addition to actions driven by Climate Change many other initiatives are currently required such as investment in biofuels, battery technology for electric vehicles, renewable energy (wind, wave, solar), nuclear power and unconventional resources (tar sands). However better data are required to a common reporting standard.

DO WE NEED MORE MULTI-SKILLED SCIENTISTS AND ENGINEERS TO MANAGE ECONOMIC RECOVERY AND CHANGE?

National Science and Engineering Week Seminar on Thursday 12th March

The Parliamentary and Scientific Committee joined with the Department for Innovation, Universities and Skills to host the Seminar, which was jointly chaired by Dr Douglas Naysmith MP and Lord Drayson.

Every year in March a week is set aside to enable scientists and engineers, and the scientific, commercial and industrial organisations they are associated with, to celebrate their national achievements in Science and Engineering. The objective is to inform the public about the important and innovative work being done at present and to encourage the young to follow a career which will enable them to join in and become part of these achievements in the future. The Committee's contribution to this week was an afternoon of presentations by scientists, industrialists and entrepreneurs who are leading the way, followed by informed discussion.

The Rt Hon Lord Drayson
Minister of State for Science and Innovation

The first speaker was Lord Drayson, Minister of State for Science and Innovation in the Department of Innovation, Universities and Skills (DIUS), who is himself an engineer, the only one in the present Government.

Introducing Lord Drayson, Dr Douglas Naysmith MP, Chairman of the Parliamentary and Scientific Committee, thanked him for coming and reminded him that the wings of the Airbus are made in Bristol, his own constituency, and as an engineer Lord Drayson would appreciate and understand the value of the aircraft industry and of the work being done there.

In his introduction to the seminar and in response to questions from the floor, Lord Drayson made three main points:

Science and technology are at the heart of the national response to global recession and our strategy for long-term competitiveness. The country has never had a greater need for innovative scientists and engineers. The Government will not allow science to become a victim of the recession; instead, it will develop science – which includes engineering, social and physical sciences– as a means to economic recovery.

Government and the science community must identify priority sectors and where the best prospects for economic growth exist. They then need to decide where scientists and engineers will be

most needed and how best to invest in a UK research base with sufficient skills, breadth and scale. The minister stressed the importance of both pure and applied research.

Scientist and engineers need complementary skills that will help them to engage with policy makers, communicate with the general public, and pursue commercial possibilities arising from their research. Scientists with managerial skills, for example, are crucial at major sites like Diamond synchrotron and in conducting large-scale clinical trials. They also need an appreciation of the social context in which they operate. Lord Drayson recalled how wide-ranging, integrated training during his own PhD in robotics has benefited him in his subsequent career.

ENGINEERING THE FUTURE!

Dr John Wood CBE FREng
Chair of European Research Area Board, Chair of International Steering Committee European XFEL

Dr Wood said we need to revise our university structure to educate engineers for the 21st Century; the motivation is that in a changing world we need to change engineering and recognise that engineering is a verb as well as an adjective.

As the Prime Minister had already said:
"Engineers built our history and they will build our future"
Gordon Brown – Romaines Lecture, Oxford University, March 2009

The nature of engineering jobs is changing, they are becoming more complex as management becomes more complex with increasing globalisation. The number of engineers in the UK is static at about 24,000 but as a percentage of the UK undergraduate population it is low and falling.

A recent industry study concluded that, although our best engineers are competitive with the best elsewhere, we need more high calibre people and that the shortages are costing us money.

The conclusions of an academic survey agreed with industry that there is a need for more industry involvement, for instance, more opportunities to get your hands dirty, and this should have a higher priority.

Of greater concern, and perhaps more frightening, is the declining motivation of engineering students. To counter this and provide the vision we need to promote our flagship projects such as Racing Green, new medical developments and the new holistic approach to engineering.

The opportunity for the young to meet people who have made a difference is also important. We also hope the increasing number of female students will make a difference. The training of research engineers and PhDs needs to develop in a holistic way; the new teaching models start with practice. This new approach is a whole body problem to develop students with the calibre to deal with information around the world.

Open innovation is important as the scope of innovation continues to change; we are now progressing from closed to open innovation. Philips research at Eindhoven is now an open campus.

Research in the laboratory now starts with the needs of the end user. Open innovation and clustering is successful but under-funded. Today's engineers work in multi-disciplinary teams and the concept of clustering in major projects has been important in making something happen, transforming innovative ideas into reality, by identifying strategic priorities and in solving major engineering problems.

Massive projects with major design problems such as Airbus, ITER and CERN were undertaken in this way. And in these projects the UK are world experts in data management. The relationship between engineers, data and science is changing. The world of engineering is changing and university education must change also to continue to contribute to the innovative process. We are looking for quality, not quantity.

. . . The nature of engineering jobs is changing, they are becoming more complex . . .

THE SCIENCE AND TECHNOLOGY FACILITIES COUNCIL

Dr Andrew Taylor OBE FRSE
Director, Facility Development and Operations; Head ISIS, Science and Technology Facilities Council, Rutherford Appleton Laboratory

Science and engineering can provide a strong foundation for economic growth in the UK as we begin to move out of recession. As the Business Secretary Lord Mandelson has pointed out, the investment we maintain now in skills, transport and science is not only the ladder by which we will climb out of the downturn – it is also critical to our success in the upturn.

But to keep the UK at the forefront of the knowledge economy we will need to have the appropriate breadth and depth of technical skills in our workforce.

STFC is one of Europe's largest multidisciplinary research organisations. It operates a diverse set of world-class large-scale research facilities for universities, industry and other research councils. STFC also runs multidisciplinary centres of excellence and provides grant funding to universities in disciplines including particle and nuclear physics, space science and astronomy.

We are the UK partner in CERN, developing the Large Hadron Collider to probe the fundamental forces of nature. Through our telescopes around the world, we explore the heavens across a multitude of wavelengths. Our satellites look down on the earth and monitor its environment, and in the UK we have developed world-leading facilities to explore the molecular world.

HOW DOES STFC CONTRIBUTE TO THE UK SKILLS BASE?

To deliver these capabilities, we require world-leading technologies – making us a significant provider of advanced technology and engineering skills. So investment in this science base automatically delivers investment in skills.

Our training of PhD and post-doctoral researchers is one of the best forms of knowledge transfer. Attracting the best young minds into research creates new innovative applications for exploitation, some of which deliver the breakthrough technologies needed to keep this country at the forefront of the knowledge economy in the longer term. Training and retaining more UK-based researchers, and attracting researchers from overseas, is crucial for a science-led economic recovery.

But a truly unique factor which STFC can offer is the outstanding training environment provided by its UK facilities and the science and innovation campuses on which they sit.

At Daresbury we have unique capabilities in both accelerator and computational science and in detector technologies. At the Rutherford Appleton Laboratory we have world-leading facilities such as the ISIS neutron spallation source, the Diamond Light Source and VULCAN, the petawatt high power laser facility.

More than 4,000 university researchers use these facilities each year – at least half of them under thirty. As well as developing and maintaining the skills required for our own research programmes, we help the academic community to build its own research skills. And we help develop talented and experienced people for industry.

We therefore provide people who come to work at STFC – both staff and university researchers – with a unique training environment and outstanding learning and development programmes which enhance the national skills base.

Research centres like those operated by STFC are a melting pot of different disciplines that make them a creative hub of innovation. At ISIS, for example, we have technicians and engineers working alongside neutron scientists, biologists, chemists and physicists. This leads to the regular and efficient flow of ideas and knowledge and the sharing of different experiences, which enables new collaborations and projects to be developed – an outstanding example of knowledge transfer in practice.

Our engineers and scientists work at the very frontiers of technical knowledge and human ingenuity. We give our user communities access to equipment and capabilities that are often not available anywhere else in the world. Our people confront and solve extreme engineering and physics challenges every day, and many

of them then take this experience into other parts of the UK economy such as high-value engineering, aerospace, computing and the telecommunications industry.

APPRENTICESHIPS AND GRADUATE TRAINING

Our facilities on the science and innovation campuses at Daresbury and Harwell have a highly-regarded apprenticeship scheme and popular graduate training programmes. These graduate training schemes are accredited by the Institution of Mechanical Engineers, the Institution of Engineering and Technology and the Institute of Physics and are an accelerated route to achieving Chartered status.

The best evidence of a successful skills and training scheme is, of course, what people do afterwards. One former member of my team joined us as a technician. He showed real potential and we sent him to study in Germany. When we needed a very technically demanding development, he had the skills and knowledge to make it work, and today he is head of our linear accelerator programme. There are many stories like this.

At the ISIS second target station (TS2) we have a project manager who first joined STFC as a craftsman, and a project scientist who joined our organisation from school and is now a visiting professor at Oxford University.

The whole TS2 project would not have happened without the recruitment and training of talented young engineers and scientists through STFC's graduate programme.

While some of those we train stay to help maintain STFC's cutting-edge research capabilities, many of them go on to have impact elsewhere. Of the 11 graduate engineers we employed to work on TS2, for example, one now works on UK's fusion energy programme, one works in France on the ITER research facility and three have taken their skills into UK industry. The rest remain with STFC, helping to keep ISIS at the forefront of its field.

ECONOMIC RECOVERY

UK scientists, and the skilled engineers and technologists who develop and maintain their facilities and research tools, have a significant part to play in delivering economic recovery and continued prosperity to the UK.

During a recent consultation on STFC's strategy, we asked leading academics what they would do in the short-term with an increased UK science budget. They told us to spend it on training, skills and people.

This supports the prime minister's recently-stated view that the winners in globalisation will be the countries which train people with the skills to create value-added products and services.

It is only by increasing the number of skilled people that the UK will be able to address challenges such as energy, climate change and healthcare. These economic, societal and environmental challenges cannot be tackled without bright and committed people who are equipped with the right skills and knowledge, and provided with suitable resources.

In conclusion I would like to stress the link between scientific research and the UK's skills base. Investment in science is an investment in skills. Whether these skills stay in science or go and make an impact elsewhere in the economy, we need more of both.

THE ROLE OF A NATIONAL LABORATORY IN HELPING ECONOMIC RECOVERY

Professor John Pethica FRS
Chief Science Advisor,
National Physical Laboratory

The National Physical Laboratory (NPL) works at the interface of research, industry innovation and regulation. This position grants us a unique insight into how science and engineering can pave the road to economic recovery.

NPL was founded in 1900 to promote links between science and industry. At this time the UK Government was concerned about the economic impact of its competitors in rising new economies such as the US and Germany setting up national laboratories.

So there is nothing new about our concerns, and the issues we have to deal with today are effectively the same. There are now only a few national laboratories in the UK, but the Government needs to invest more in them if we are to stay ahead of the game.

National laboratories provide trusted, impartial reference points based on leading, openly published research. This engenders trust in technologies for both industry and the public at large, and in the policy decisions and regulation arising from new technologies. National laboratories have the ability to sustain a capability over a long period of time. For example, if the planet is warming at 0.1 degrees every 50 years, we need to have thermometers and radiometers to measure accurately to that level of absolute temperature reference. Otherwise we have a potentially very large investment policy we

are uncertain about.

NPL's process of doing research is planned and influenced by industry. Panels that set work programmes have industrial representation.

We operate with tightly defined deliverables and schedules, on a spectrum of short and long-term projects that are based on our core research expertise. Leading research is vital, and NPL is known for a number of key innovations including the atomic clock (the basis of GPS), packet-switching, and the world's first Local Area Network, the basis of the internet.

A rising percentage of our income (around 30-40%) is from industry – indicating the exceptional value for money we provide to the UK, and our high return on investment.

NPL is extremely effective in boosting UK industry. In terms of value for money, we provide a greater than 10:1 return on investment. We work with more than 4,000 companies from SMEs to multinationals, and determine our science areas according to industry needs. A customer survey of 1,200 companies shows a profitability gain of £700m from National Measurement System investment of £60m. NPL has short-term, real impact on the economy.

It is essential that we look at this with an international perspective. If the UK invests more, but the competition abroad is investing twice as much again, then we should be concerned.

The US National Institute of Standards and Technology (NIST) has received US$610m in funds as part of the American Recovery and Reinvestment Act of 2009. The agency says it will use the funds for programmes that support US innovation and industrial competitiveness to spur economic growth.

This is the scale of what we are up against. The UK has very few national laboratories and less investment compared to our competition. We could have a much greater impact, and need to rise to the challenge.

NPL has demonstrated immediate economic impact and high return on investment. We can do even more by increasing activities and moving into new technical areas.

Specifically there are three projects where NPL can make a tangible and immediate difference to ensure that the UK is primed to recover and prepare for future growth.

We urge increased investment in Measurement for Innovators, a programme in which the first 200 participants had a total annual sales increase of £5.3m and a total annual profit increase of £5m. The programme provides rapid assistance for companies close to market, that need additional support to prove a concept or make the step change from idea to product.

Secondly, there is a high risk that talent will be lost during the recession, creating skill shortages for industry once economic stability returns and new business opportunities emerge. NPL could offer research opportunities that will nurture a 'hothouse of talent' in critically important areas for future growth, such as data security, climate change, energy generation and advanced materials. Scientists at NPL acquire key skills at the interface between research and business.

Finally, we propose a Centre for Carbon Metrology to establish the infrastructure required for the UK to remain at the forefront of the global carbon market. The centre would provide confidence in environmental data and regulation, underpin carbon trading and validate low carbon technology. By building skills in this area, the UK can lead in a key future marketplace.

National laboratories have a unique position on the boundary of research, industry innovation and regulation. The UK needs to compete and rise to the challenge of increased funding for national laboratories overseas. This will ensure the UK's national laboratories continue to make a real economic impact and pave the road to economic recovery.

THE BUSINESS OF SHAPING OUR WORLD

Dr David Bott
Director of Innovation Programmes,
Technology Strategy Board

The world faces serious challenges. The sheer number of people, quadrupled in the last century, only tells part of the story. In the same time our requirements for food have gone up nine-fold, our use of energy has risen 16-fold and our manufacturing output 40-fold. That increased number of people also has to live somewhere, and travel. Over the last 100 years the number of vehicles on UK roads has risen from a handful to over 33 million, and air transport, which didn't exist at the turn of the last century, has reached almost 1.5 trillion passenger miles globally. Better healthcare also means that we live longer; in the next 40 years there will be almost twice as many over 65s and almost three times as many over 85s as there are now.

All these changes challenge the way we live and must be addressed. The complication is that we have now realised that we are using up the resources of our planet and putting a strain on its climate system, so these problems must be solved within a finite resource. Our almost insatiable desire for energy means that we are consuming natural resources such as coal and oil many thousands of times faster than they can be replenished, and in the process generating the

greenhouse gases that are affecting the climate system.

These challenges can be addressed, but it takes co-ordinated action at a national level to have real impact. Government is already taking action, and the policies being implemented are starting to cause market shifts that innovative companies can take advantage of to develop new products and services.

The Technology Strategy Board was "spun out" of Government in mid 2007 with the purpose of stimulating innovation in UK business. We have a wide range of tools and approaches to make this happen, from networks to research and development funding. To connect these Government programmes with business, we are currently running 'Innovation Platforms' in the areas of Intelligent Transport Systems and Services, Network Security, Low Carbon Vehicles, Assisted Living and Low Impact Buildings. We are constantly adding to this list by working with government departments to understand their policy goals and the actions they are taking to implement them.

The answers to these societal problems usually start with science and engineering – but that only goes so far towards providing the solutions that will be used in the real world. Psychologists and sociologists can help us understand the motivation of customers and others who will be needed to make these ideas work. Designers apply that understanding to make the solutions more attractive and more likely to be used. Economists bring understanding of potential impacts at the regional and national level. And most of all, entrepreneurs and business people can bring new ideas to life as real world products and services.

We have involved all these groups in our Innovation Platforms approach, and although a new organisation we are already seeing areas where we are making a real impact.

In a difficult economic climate it may sometimes seem difficult to justify investment in innovation. But that is exactly what is needed to help us find new market solutions which will help power the recovery and keep the UK competitive in the upturn.

Multi-skilled scientists and engineers will be vital to address the challenges we face, but it will take a holistic approach integrating science, innovation and business to bring solutions to bear which will really make a difference.

RENEWABLE ENERGY
A WEALTH OF OPPORTUNITY FOR SCIENTISTS, ENGINEERS AND THE UK ECONOMY

Philip Wolfe FEI, FRSA
Director General,
Renewable Energy Association

The renewable energy industry is undoubtedly a 'sunrise' sector of the economy with growth potential for many decades to come. Opportunities are particularly strong here in the UK as we have been slower than most countries to exploit our renewable energy potential even though openings are plentiful – indeed the UK has the best wind, wave and tidal regime in Europe.

A QUANTUM CHANGE IN RENEWABLE ENERGY DEPLOYMENT

The strong regulatory impetus provided by the new European Renewable Energy Directive should transform the situation. We have a binding obligation to increase the contribution of renewables from under 2% of the nation's energy today (held off the bottom of the European league table by Malta and Luxembourg) to 15% by 2020. At that level, renewables will have overtaken nuclear energy and coal, and be competing with oil for second place behind gas.

Apart from the scale of the change this will also present a wealth of opportunities by broadening the mix into a wide range of renewable technologies not commonly used in the UK today.

NEW OPPORTUNITY AREAS FOR SCIENTISTS AND ENGINEERS

The presentation highlighted some of the main engineering and technological opportunities in renewable energy production under three main headings:

New approaches in established technologies

Even proven and well-established technologies offer new technological opportunities

when deployed in novel ways or configured specifically to suit the UK market. Several elemental renewables technologies were identified, including:

- Offshore wind
- Tidal barrages and lagoons
- Building-integrated photovoltaics and solar thermal

Bioenergy technologies similarly offer opportunities of this type, including:

- Sustainable biofuels
- Bio-methane for injection into the gas grid

Higher volumes and efficiencies

Some renewable energy technologies are well established, but either not widely used in the UK or not yet optimised for application here. The following were specifically highlighted:

- Heat pumps
- Micro-hydro
- Biomass boilers and combined heat and power
- Anaerobic digestion

Emerging renewable technologies

Finally, and of self-evident interest to technologists are those approaches which are at an earlier stage of development. Of those listed in this category, several are areas where the UK already has an 'early mover' advantage:

- Wave energy conversion
- Tidal stream energy
- Second generation biofuels
- Microbial energy

A NEW ENERGY SYSTEM

It is also important to note that the whole infrastructure will change, for example, as we move to a higher proportion of decentralised energy. This will lead to new technological opportunities in areas such as:

- Heat networks
- Intelligent distribution systems
- Smart metering, incorporating improved user interfaces and real-time pricing
- Active load management and non-traditional storage options

A SUSTAINABLE 'NEW ENERGY DEAL'

To close, Philip Wolfe suggested that the pathway to recovery from the economic downturn must take us in a new direction, not return to the unsustainable model of the late 20th century. Extreme energy price volatility, climatic disasters and an unsustainable financial system have led to the present crisis and shown what we need to avoid in future.

That is why experts like Professor Lord Stern have called[1] for at least 20% of the economic stimulus packages now being put forward to be deployed on 'green' initiatives. Analysis[2] shows that President Obama's recent package delivers about 12%, the Asia Pacific region led by China achieves 23% while France and Germany average 15%.

He called for an equivalent UK green stimulus package of which a major part should be deployed in the energy sector, led by energy efficiency. Four specific areas were identified for immediate investment in renewable energy:

Decentralised energy, and in particular a bridge to the introduction of the new renewable energy tariffs, through an extension of the Low Carbon Buildings Programme to 2011, creating some 10,000 jobs and establishing a trajectory to make DECC's 2020 target of 7m sustainable homes realistic. This should be combined with a similar extension to Bioenergy Capital Grants to stimulate new biomass heat projects and anaerobic digestion facilities.

Bulk energy supply and transport energy should be supported through an interim increase of the multiple for offshore wind in the Renewables Obligation, restoration of the Renewable Transport Fuel targets, demonstration of heat networks, biogas injection into the grid and bioenergy fuels and vehicles.

Energy infrastructure is a further area which would benefit from seed-funding through the recession for systematic smart metering roll-out trials, initial development of intelligent distribution networks and related services.

Skills, training and awareness was also a rich area for short-term investment in skills training and jobs for workers in the energy, building services and bio-energy sectors.

1 *An outline of the case for a 'green' stimulus;* Alex Bowen, Nicholas Stern et al.; February 2009

2 *A Climate of Recovery? The Green Dimension to Economic Stimulus Plans;* HSBC; February 2009

DURING DISCUSSION THE FOLLOWING POINTS WERE RAISED:

In brief sessions immediately after each presentation:

Time is now short; do we have sufficient time to increase the amount of effort required for change? Action is urgently needed to develop vitally important skills in conjunction with university training to help take us through the current economic downturn in conjunction with investment in innovative projects. However, it is difficult to unravel and understand the amorphous spaghetti-like mass of different organisations and agencies involved, and how to tap into them. There is a plethora of schemes available and it is important to raise the profile of one's own group and where necessary pool resources with other groups in order to make an impact. Part of the problem is due to the rigid structure of the UK university system. If it was more flexible this would enable some students to develop a wider range of essential skills for business management, in addition to academic studies. For example, Government support for one year Masters degrees, which take students to the point where they are employable immediately on graduation as engineering specialists and without additional training, has been withdrawn just when it is most needed, on the basis that this type of specialisation is too near market and the responsibility of industry to provide.

Careers advice in schools and universities is generally lacking in the sciences or very ill informed and of very poor quality. This discourages many young people from undertaking engineering where interdisciplinary training, involving the integration of SET subjects with management skills, is vitally important for industry. Engineering medicine for example is an area where radical new developments are offering scope for engineers with interdisciplinary skills.

We also have to deal with a throwaway society in which it could become economic to mine waste dumps for raw materials in the future. Broadband technology has the potential to transform working patterns, turning every home into a workplace, thus reducing the need for transportation.

We are dealing with global problems including the developing world, which is particularly affected by climate change and where the agricultural economy is very important. Part of the problem is that Government has already decided on priorities, however people will need to decide on priorities.

Capital funding sources in the High Tech sector are drying up. Although £1 billion may be available to invest, this is not sufficient as venture capital partners are needed, since SMEs can't operate directly with support from banks. It's all about survival.

In more general discussion following all presentations:

We need to use this economic recession as an opportunity to shout from the rooftops the need for more scientists. The opportunity should be taken by Imperial College, for example, to re-employ scientists coming back from the City with real life skills using an Intern scheme set up for this purpose. In China big projects greatly helped with the generation of more engineers. The funding for Masters Degrees should be reinstated. Scientists should be retrained in the management of people as well as ideas, by learning how to interact with other people. The UK equivalent to the US President's Stimulus Package for recovery would amount to about £20 billion. What chance is there for such a package in the UK? The experience gained from such a programme should be recycled back into university training. This would need hands to be taken off bureaucratic accreditation procedures and letting the scientists and engineers get on with managing the job themselves.

UNCHARTERED TERRITORY: NICE, BIOSIMILARS AND GROWTH HORMONE

Dr Justin Warner
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Honorary Senior Lecturer
University Hospital of Wales

In February a summit was convened in Parliament to discuss the introduction of 'biosimilar' medicines to the treatment area of restricted growth in children and the implications this might have on the current review by the National Institute for Health and Clinical Excellence (NICE) on the use of growth hormone (GH) in children (2009). GH prescribing in children was originally appraised and approved by NICE in 2002 prior to the introduction of 'biosimilar' medications. This summit provided an opportunity to explore the implications for NICE in its reappraisal of the use of GH in children, which for the first time will include a 'biosimilar' medicine.

Human GH is manufactured using recombinant biotechnology and has been used to treat restricted growth in children for over 25 years, when it was first introduced to clinical practice. Many hundreds of thousands of children have been treated with recombinant human GH (rhGH) worldwide, and through continuing pharmacosurveillance, to date, such technology has been demonstrated to be remarkably safe. This has been a great success but only achieved by strict monitoring as no medicine or treatment should ever be considered completely risk free. Prescribers still have a significant number of responsibilities in counselling and advising parents and children about the possibilities of adverse effects whilst reassuring them of the benefits of treatments. Furthermore, doctors prescribing rhGH have ultimate responsibility for patient outcomes and a statutory responsibility of reporting Adverse Drugs Reactions (ADRs). In the UK it is important that prescribers are fully supported in this role. To date, regulatory bodies have taken a rigorous and robust approach to the use of biotechnology treatments. Current regulation in the UK is through the European Medicines Agency (EMEA), who have responsibility for licensing treatments and the Medicines and Healthcare products Regulatory Agency (MHRA), the 'health watchdog' who are responsible for monitoring quality and safety of treatments.

The patent for many of the rhGH brands has now expired and today we face an issue that has yet to become relevant to most other health areas, that of 'follow-on' or 'copy' biotechnology treatments. Due to the nature of biotechnology these treatments can only ever be similar, and never the same as the reference products. As such, they are referred to as 'biosimilars' under European guidance.

For the prescriber, 'biosimilar' medicines pose difficult questions for a number of reasons. As with any new treatment, and particularly any new biotechnology treatment, it is essential that rigorous and robust safety procedures are put in place as they are introduced. This is particularly important as, despite being unique biotechnology products in their own right, due to their similar nature to originator products, the manufacturers of 'biosimilar' treatments have negotiated a different route to market. The EMEA has introduced a unique pathway for 'biosimilars', relinquishing their robust stance on the need for extensive studies on long term efficacy and allowing the use of new rhGH preparations without submitting them to their standard trials of efficacy and safety. Whilst requiring less data to prove quality, safety and efficacy, this 'biosimilar pathway' is robust and rigorous enough to meet the safety requirements of the EMEA. Despite this, a number of European countries, including France and Spain, have introduced additional precautions in the form of legislation to safeguard patients during the introduction of 'biosimilars'.

A number of steps have been taken at a national level to ensure patient safety whilst we learn the similarities and differences of these medicines,

. . . with any new treatment, and particularly any new biotechnology treatment, it is essential that rigorous and robust safety procedures are put in place . . .

such as any potential difference in efficacy or dosage. Actions taken in the UK include: inclusion of guidance about 'biosimilar' medicines in the 'general guidance' section of the British National Formulary (BNF) and the flagging of all 'biosimilars' with a black triangle, highlighting that the treatment is new and is being intensely monitored; strict guidance on non-substitution and non-switching from originally prescribed products; inclusion of the issue in the MHRA Drug Safety Update; and heightened campaigns on pharmacovigilance protocols such as the yellow card system.

Dr Brian Iddon MP invited Professor Peter Littlejohns, Clinical and Public Health Director of NICE, to attend the recent Parliamentary Summit on 'biosimilar' rhGH and to discuss the forthcoming review. Professor Littlejohns highlighted how the remit of NICE is to look at clinical and cost effectiveness of treatments and as such, safety recommendations fall outside of their remit. Despite this, there remains a significant need among clinicians to understand the new 'biosimilar' technology. Currently, there is a distinct lack of knowledge in this area and it is essential that this be considered by the NICE appraisal committee and that every avenue is taken to explain to users the safety issues related to any treatment in a clear, frank and up front way. Many of the concerns arise from a lack of information or understanding about the differences between 'biosimilar' and originator medicines, and this opinion was voiced at the meeting.

Michael Ranke[1] (a paediatric endocrinologist based in Germany) advocates a *'premium nihil nocere'* (first do no harm) stance be taken requiring strict pharmacovgilance and collection of more robust research data before 'biosimilars' are used in growth disorders. Ranke argues that the 'biosimilar' label just denotes that it is a treatment which has been approved by a unique process and the final prescription of any treatment must be made from an independent and informed position[1]. It is now crucial that all sectors of the community responsible for treating growth disorders with rhGH including 'biosimilars' are fully informed so that information is freely made available to clinicians, patients and their carers.

Taking this advice into consideration, there are a number of steps that should be taken to ensure the safe introduction of 'biosimilars' to the treatment of growth disorders, as follows:

Do not switch: In the treatment of growth disorders, switching between different brands of rhGH is not recommended. This becomes more pertinent with the introduction of 'biosimilars', as there is no certainty that the dosage or efficacy will be equal between the originator product and any 'biosimilar'. For this reason strict, non-switching regulations must be maintained. It is important that all prescribers are made aware of this.

Prescription by brand name only: Similar to the strict regulations on non-switching, prescribers must be made aware that prescription by brand name is essential and prescribing by the International Nonproprietary Name (INN) must always be avoided. Due to the possible and unforeseen differences, we cannot afford to take the same approach to biotechnology products as we do with generic medicines.

Patient education and Patient Information Leaflets: Currently, there is no information easily available to patients about 'biosimilars' and their unique route to market. Such information should be made available on Patient Information Leaflets for any 'biosimilar' treatment, in a noticeable and easily understandable way. This is particularly important in helping patients to understand the importance of reporting ADRs. Additionally, patient information should be made available, through the prescriber, at the time at which treatment is chosen and agreed.

Clear and distinct packaging: Each biotechnology treatment is unique and, as such, this information should be easily visible to the pharmacist, patient and prescriber to avoid inadvertent switching.

Clinician awareness: Everyone who is either able to prescribe or dispense 'biosimilar' treatments needs to be fully aware of the difference in technology from originator products and the regulatory process. It is also important that clinicians using 'shared care' arrangements with GPs for rhGH prescribing, need to ensure that GPs are familiar with such treatments being received by patients under their care as they are the people most likely to be on the front line when patients present with ADRs.

The yellow card system: This system is crucial in raising awareness is the role of the MHRA in ensuring there are high levels of awareness around the yellow card and reporting mechanisms for ADRs.

Pharmacovigilance: Currently a number of manufacturers of rhGH have invested in a rigorous post marketing surveillance scheme to collect and share data. All producers of 'biosimilar' medicines should put in place their own post marketing surveillance schemes and publish their findings.

Inclusion in NICE: Whilst we have a number of avenues through which awareness of 'biosimilar' treatments is increased it is clear that a major part of the community remains unfamiliar with 'biosimilars'. To ameliorate this situation, the NICE appraisal committee should consider including information about 'biosimilar' technology and this should be reflected in any final recommendations on the use of products.

It is important that our patients receive the very best levels of care. Essential in this is awareness of all of the treatments available, what is different, what is the same; understanding how and why regulatory agencies have taken the steps they have to date and what role we have as prescribers and users in ensuring a safe introduction of these unique, but similar, biotechnology treatments to clinical practice. Whilst it is not within the remit of NICE to consider safety, they should reflect the regulations already in place, at least until we know a good deal more about these new products. In examining 'biosimilar' medicines alongside other biotechnology treatments, NICE are in unchartered territory. Whilst this should not hold any of us back from exploring all possible courses of action, we should proceed with caution and from a fully informed position.

Footnote

1 Ranke, M. B. (2008) New Preparations Comprising Recombinant Human Growth Hormone: Deliberations on the Issue of Biosimilars. Hormone Research [online]. 69 (1) 22-28. Available at: http://content.karger.com/ProdukteDB/produkte.asp?typ=pdf&doi=111791

ANNUAL LUNCHEON OF THE PARLIAMENTARY AND SCIENTIFIC COMMITTEE

The Annual Lunch was held on Tuesday 3rd February 2009 in the Cholmondeley Room and Terrace, House of Lords

The Rt Hon Lord Jenkin of Roding, the President, welcomed everyone to the Annual Lunch and thanked those who had made special efforts to attend in spite of a snowfall. He reminded us that we represent the first All Party Group to be created in this, the Committee's 70th year, while MPs, on election, now often proceed to form an All Party Group as a matter of course.

Last year we welcomed Sir David King the Chief Scientific Adviser as our Guest of Honour prior to relinquishing his office. He had made a particular effort to persuade people that the science of Climate Change was genuine and it was his own efforts, more than any other, that persuaded Government to take this advice seriously. The current economic downturn must not be allowed to ignore our commitments to Climate Change targets, whilst it is also an opportunity for innovative scientists and engineers, many of them already members of this Committee, to help develop economically desirable and environmentally friendly technologies as a sound basis, leading on to sustainable economic recovery. This will also need support from the market, backed up by Government.

Patrick Jenkin introduced Lord Taverne as a very distinguished speaker. "He lists among his personal interests both Science and Technology and Economic Policy. Perhaps he is just the man to tell us what to do next! He was a junior Treasury Minister, Financial Secretary to the Treasury, and I followed him into that office. In his time he has been a member of several parties and of both Houses, and an author and a journalist. We all look forward to what Lord Taverne has to say. Dick, over to you!"

Dick Taverne then launched into a lightly veiled attack on the public understanding of science which follows:

"Attitude surveys tell us that most people think science benefits mankind. However the popularity of alternative medicine and the history of the MMR vaccine also show how little the public understands the evidence-based approach, and one poll suggests only half the population accept evolution.

The NHS is so short of funds that it cannot afford expensive life-saving drugs, yet several Primary Care Trusts finance homeopathic therapy, which has no proven efficacy except as a placebo. Most homeopathic products are diluted by 10^{30} so that none of the original substance remains. There is no way homeopathy can work, other than as a placebo, without repealing the laws of science. Yet the Medical and Healthcare products Regulatory Agency has allowed homeopathic products to claim efficacy solely by homeopathic provings. Of course, placebos can and do work, as can witchcraft!

One of the most prominent supporters of alternative medicine, who shall be nameless but who has influence because of his pre-eminent social position, has recently launched through his company, Duchy Originals, a product comprising a mixture of artichoke and dandelion extracts, which has no efficacy for any medical condition whatsoever, costing £10 for 50ml, not a bad price for a dud product! The same person has also argued that the NHS would save costs if asthma was treated by homeopathic therapy. And it would, as some people would die and no longer need treatment! To advocate homeopathy for treating serious diseases is as beneficial as President Mbeki's policy of treating AIDS with traditional African medicine. It should also be noted that sixteen universities award science degrees in Ayurveda and reflexology as well as homeopathy, with a Chair in Parapsychology in Edinburgh.

I now come to agriculture and the fashion for organic farming which is based on an elementary scientific howler – that synthetic chemicals are bad, natural ones good. Arsenic and ricin are natural chemicals, antibiotics are synthetic. The distinction is complete nonsense but a fundamental principle of the organic movement. The Food Standards Agency and the Advertising Standards Authority have rejected the claims made for organic food. It does not taste better, is not more nutritious and according to DEFRA is no better for the

environment than conventional farming. Organic food costs more because it is less efficient with yields 20-50% lower than conventional crops and according to a quotation from C J Prakash, 'The only way organic farming is sustainable is that it sustains poverty and malnutrition.' DEFRA supports organic farming, with a subsidy for farmers wishing to convert to it that has cost £30 million annually, while public research in agricultural science has declined to £20 million. Ministers do not reply to questions in the House of Lords concerning the inefficient use of land, possibly so as not to offend the Soil Association.

The most damaging example of disregard for scientific evidence is displayed in relation to genetically modified crops by other European countries. Huge benefits have been obtained in India and China with the use of GM pest-resistant cotton. GM soya and maize in conjunction with no-till or low-till agriculture have reduced the use of herbicides and pesticides in the US with environmental benefits equivalent to removing 4 million cars from the roads.

However, the main benefits of GM are still to come with a Gene Revolution to succeed the Green Revolution, currently severely delayed by opposition from Greenpeace and Friends of the Earth. Crops that will resist stress from cold, heat, salt and drought, and can grow in soil where no plants grow today, are near commercial cultivation. Other GM staple crops for the developing world that require less water and are protected against diseases are in the pipeline. Every National Academy of Sciences, the WHO, the FAO and the EU Commission have found no evidence that GM crops are harmful to health or the environment. The former director of Greenpeace, when asked some years ago in a House of Lords inquiry if there was any evidence that could change his opposition to GM crops, replied, 'It is a permanent and definite and complete opposition.' Ideological rejection of GM crops resulted in delays caused by opposition from NGOs to golden rice, modified to contain pro-vitamin A which could have saved many of the 500,000 children who go blind from vitamin A deficiency every year and half of whom die within 12 months.

In conclusion I wish to make two further points:

1) If research results stand up and are reproducible, they are good, even though the worker works for Monsanto. If they are not good they do not become so because the researcher is trying to save the planet.

2) Big business has often behaved unethically. However, Greenpeace is also a big business with its own agenda, namely to promote membership, and for this there is nothing like a good scare story. They can be as cavalier in their treatment of evidence as drug companies, indeed more so.

Industry needs regulation although profits depend on products that benefit the public. On the other hand, for Greenpeace, the more sensational the scare story, however unproven – such as "Frankenfoods", for example – the better for increasing their membership. The important questions are: Has the research been peer reviewed in a reputable journal? Have the results been replicated?

Finally, Mr President, I believe that respect for evidence and a wider knowledge of how science works is not only important because science brings innovation and prosperity, since the Enlightenment saw both the birth of modern science and the first steps towards liberal democracy. Science has gradually eroded the hold on our beliefs that superstition has had, and still has. Science is the enemy of dogma, because scientific knowledge is tentative knowledge. It promotes tolerance, because it does not deal in certainties. It is the enemy of chauvinism and racial prejudice and the suppression of women's rights, attitudes based on ignorance and beliefs about human characteristics that science has shown to have no evidential basis. Science is the search for truth and the only path that leads to better knowledge about the world. In fact, I believe science is vital to a civilised society. We should all be more robust in its defence and more active in the propagation and practice of its virtues."

IN DISCUSSION THE FOLLOWING POINTS WERE MADE:

As someone who was a chemist would not presume to address such an audience about the details of ancient history, it is also clear that someone with a background in ancient history should be wary about discussing science, especially where that involves a basic understanding of chemistry. It was clear, for example, that there had been a failure to understand the difference between chemicals used in organic farming and those used in conventional farming. Whereas in the former case chemicals such as copper sulphate are used at a dose high enough to be toxic, they have simple linear or threshold dose-response curves and are harmless when diluted. Life has co-existed with such chemicals throughout most of earth history. On the other hand many of the pesticide formulations used by conventional farming contain synthetic molecules that can have harmful effects even at tiny doses, because many have a biphasic dose-response curve. In response it was stated that copper sulphate is very poisonous.

A speaker who gave a talk to schoolchildren about nuclear power asked them where they had previously obtained information on this topic. The answer they gave was from the comic cartoon strip "The Simpsons". How can we compete with the comics? Methods include "Sense about Science" which includes 3000 scientists actively involved with scientific issues; and scientists who are willing to speak in public about their work. Education provides the basis for openness and transparency. The Food Standards Agency sets standards making no concessions on its science. The Research Defence Society (now Understanding Animal Research) is open for discussion about experiments on animals. Transparency is important.

The President then closed the formal proceedings by thanking Dick Taverne for his splendid address.

SET FOR BRITAIN 2009

On Monday 9th March 2009 Dr Douglas Naysmith MP and Dr Brian Iddon MP, Chairman and Vice-President of the Parliamentary and Scientific Committee, acted as hosts for SET for BRITAIN, a poster competition and exhibition for early-career researchers. The competition had attracted nearly six hundred entries in three separate sections and the top sixty entrants in each section brought their posters to Westminster to display in the House of Commons Terrace Marquee.

The idea for the SET for BRITAIN series of exhibitions had been conceived by Dr Eric Wharton and organised by him and his team since 1997 but had ended with his sudden and untimely death in 2007. The 2009 event was run by a working party which included Mrs Sue Wharton and representatives of the Royal Academy of Engineering, the Royal Society of Chemistry, the Institute of Physics, the Association of the British Pharmaceutical Industry and the Parliamentary and Scientific Committee. Additional support was received from the Institute of Biology, the International Agri-Technology Centre, LGC and Plant Impact plc.

The competitors came from all over the country and during the course of the day over sixty Members of the House of Commons and House of Lords visited the exhibitions in the Marquee to meet the presenters and see at first hand the high quality of research being carried out in British universities.

Each section of the competition was judged separately by a different panel of experts in the relevant scientific discipline. All agreed that the standard of entries was extremely high. In each section the winner received a medal and a cash prize and there were further prizes for the runners up. At the end of the evening an overall winner, selected from the winners of all three sections, was awarded the Westminster Medal in memory of Dr Eric Wharton. The prizewinners in each session are featured here.

Biological and Biomedical Sciences

The first session, for entries in the Biological and Biomedical Sciences category, ran from 12.30 pm to 2.30 pm.

Winner of group: £3,000 and Mendel Medal: **Xiaoqi Feng**, University of Oxford
Male Meiotic Cells and their Tapetal Nurse Cells are Derived from Distinct Cell Lineages in Higher Plants

Presentation of the Mendel Medal: Winner Xaioqi Feng with Professor Alan Malcolm, Chairman of the judges for the Biosciences session, and Mrs Sue Wharton.

Three runner-up prizes of £1,000

James Bullock, University of Cambridge
Friction Forces in the Hairy Adhesive Pads in Beetles

Federico Dorati, University of Reading
A Threat to our Conkers? Characterisation of the Horse Chestnut Bleeding Canker Pathogen

Sue-Ann Watson, University of Southampton, National Oceanography Centre
Acid Oceans and Shellfish: Antarctic Animals and Larvae are Vulnerable to Ocean Acidification in a high-CO^2 World

James Bullock, Federico Dorati and Sue-Ann Watson, prizewinners in the Biosciences session, with Dr Douglas Naysmith MP and Dr Brian Iddon MP

The Westminster Medal in memory of Dr Eric Wharton was won by **Dr Marina Kuimova**, Imperial College London, winner of the Chemistry section, whose poster was judged to be the overall winner of SET for BRITAIN 2009.

Dr Doug Naysmith MP, Mrs Sue Wharton and Dr Marina Kuimova holding the Roscoe Medal for Chemistry (left) and the Westminster Medal.

Physical Sciences

The Physical Sciences session opened at 3.30 pm and finished at 5.30 pm. The entries were divided into Chemistry and Physics posters and were judged by separate judging panels.

Physics

Winner of group: £3,000 and Cavendish Medal: **Dr John Morton**, University of Oxford
Solid State Quantum Memory Using Nuclear Spins In Silicon

One runner-up prize of £1,000
Mark Rayner, University of Oxford
Making High Quality Muon Beams for Particle Physics

John Morton, winner of the Cavendish Medal, seen with Dr Cyril Isenberg, Chairman of the Physics Judging Panel, Dr Beth Taylor, Institute of Physics, Mrs Sue Wharton, Dr Simon Singh and Dr Brian Iddon MP

Mark Rayner receives his prize from Dr Simon Singh

Chemistry

Winner of group £3,000 and Roscoe Medal: **Dr Marina Kuimova**, Imperial College London
Microscale Viscosity and Disease: Intracellular Mobility Mapped

LGC prize for analytical chemistry
Sally Peyman, University of Hull
Lab-on-a-Chip Device for Performing Clinical Diagnostics within Seconds

Dr Marina Kuimova with Professor Dave Garner, President, and Dr Richard Pike, Chief Executive, The Royal Society of Chemistry

Sally Peyman receives her prize from Dr Julian Braybrook, Head of Measurement R&D Strategy, LGC

Engineering

The final session, for Engineering Posters, took place between 6.30 pm and 8.30 pm.

Winner of group: £3,000 and Engineering Medal: **Dr Eleanor Stride**, University College London
Engineering Microbubbles for Ultrasound Imaging and Therapy

The winners of the three runner-up prizes of £1,000:

Dan Allwood, University of Sheffield
Magnetic Nanowires in Engineering, Biology and Physics

Dr Rebecca Cain, University of Warwick
"Sounds of the City": Using Automotive Sound Quality Techniques to Engineer Positive Sounding Cities

Dr Ruth Oulton, University of Bristol
Spins and Light for Quantum Computing

Mrs Sue Wharton presents Dr Eleanor Stride with the Engineering Medal

Dr Rebecca Cain with Philip Greenish

Dan Allwood receives his prize from Philip Greenish, Chief Executive of the Royal Academy of Engineering

Dr Ruth Oulton with Dr Doug Naysmith MP and Philip Greenish

TRANSLATING THE VOICE OF ENGINEERING

Paul Davies
Head of Policy, Institution of Engineering and Technology

The recent IUSS report *Engineering: turning engineering into reality* touched on two interesting points. The first, which is self evident to all engineers, was that engineering is everywhere and is therefore vital to life as we live it. The second was that the diversity of engineering requires a multitude of disciplines and that many engineering institutions have grown up over the past 150 years to support this multiplicity. To add to this in reality many disciplines overlap and depend upon each other to produce a successful solution. For example, a railway would not work without structures, machines, energy and control systems – not to mention people.

The Institution of Engineering and Technology (IET) was created to take account of engineering diversity and has over 37 technical communities within its global membership, covering, amongst others, aerospace, healthcare, management, photonics, robotics and power generation. The question for the IET is how can the wealth of expertise and experience from over 152,000 members be tapped to provide high quality, unbiased, evidenced-based policy advice for the public good? Luckily not all members want to have a say in the IET's policy positions at the same time, but it is the depth of expertise within the membership that gives the IET a unique strength and it is important that a balanced view is offered.

The IET has a tried and tested method of funnelling all this expertise into a manageable form. Policy committees, known as Sector Panels, have been established backed up by the existing range of technical communities and educational resources to provide the IET with strategic policy advice. The Sector Panels take a pivotal role in shaping and presenting IET policy and are set up to reflect the IET's main policy interests:

- transport
- energy
- education
- communications
- information technology
- and manufacturing

A separate panel looks into emerging technologies and specialist groups cover issues such as the biological effects of mobile phones and general health and safety. The panels are made up of senior members and high level experts from industry and academia, and are authorised to issue comment on public policy on behalf of the IET.

The panels work with the IET's policy staff to help the IET respond to consultations, inquiries and direct requests for policy advice. When responding to a call for evidence or a Government consultation, the IET issues a call for input to the membership at large using the IET website, its communities and by issuing targeted *Policy Key* emails. All the contributions received are collated and a draft response is formulated by IET staff with advice from the Sector Panel. If the topic is out of the scope of a panel, then the advice from an expert in one of the technical communities is sought. The chair of the panel is the final arbiter of the submission. The Sector Panels also provide advice and support to the IET regarding media enquiries, press releases and public affairs work in Parliament and with Government departments.

The system works well, with a number of submissions of evidence to inquiries and consultations made each year. The aim is quality not quantity, for example last year the IET considered 139 consultations but responded to only 30, covering topics as diverse as the IUSS Committee *Inquiry into renewable energy,* the DCFS *Strategy for 14-19 qualifications* and the BERR consultation on *Improving outcomes for Health and Safety*. Over 25,000 IET members have registered an interest in policy issues and the global nature of this interest means we are able to take into account the experience of engineers living beyond the UK. Member response varies greatly from topic to topic and again the aim is to get informed contributions and to present alternative proposals if there is no obvious 'right answer'.

In addition to providing informed comment to Parliament and UK Government, the IET has set up similar systems to offer policy advice to the Scottish Parliament and the Northern Irish Assembly as well as targeted responses to the European Commission. The IET is an expanding global organisation and is now looking to provide local access to the knowledge of its members in, for instance, India, China and Hong Kong.

It is often stated that Government has difficulty in listening to the advice offered by the 36 engineering bodies. Through the various channels outlined above, the IET has found a successful way of funnelling the opinions of its 152,000 members into a single voice to help policymakers make informed decisions. Whether that advice is listened to is perhaps a question for another day.

The full searchable list of the 118 submissions made by the IET since 2005 can be found on the IET website at www.theiet.org/publicaffairs/submissions/index.cfm.

. . . The question for the IET is how can the wealth of expertise and experience from over 152,000 members be tapped . . .

BOOK REVIEW

DARWIN'S ISLAND – THE GALAPAGOS IN THE GARDEN OF ENGLAND

BY STEVE JONES

Little Brown Books Group £18

It is rare when reviewing a book to read it twice before putting pen to paper but that I have done. Why? This is a fascinating book which deals with the work of Charles Darwin following his Beagle excursion and observations in the Galapagos. We learn of his work on barnacles, insects, orchids and inbreeding amongst other subject areas as he criss-crosses great Britain. His description of how some plants capture their prey will fascinate any general reader and further explains the changes in carnivorous plant life over time. Jones updates many of his observations with a discussion of how DNA sequences ally with the concepts of evolution, natural selection of species and the questions we still ask about the function of many DNA sequences and without doubt their evolutionary significance. He points out the need for more research into DNA function at cell organism and population level.

Two other examples show how Darwin led the way in asking questions about dog evolutionary pathways and how that might give us an understanding of human mental illness as we begin to understand the protein receptors in brain cells. The fascination of human emotions and their basis in animals was another of Darwin's triumphs and Jones shows how much we gain from Darwin in our study of autism.

A lively chapter on the variation of animals and plants under domestication shows how our own evolution depends on the nature of farming and its products. Jones relates these studies to obesity and its causes and moreover how it might be addressed with evolutionary principles in mind.

Orchids and worms dominate in two later chapters in the book where Jones describes how Darwin again identified the mysteries of natural selection species preservation and evolution. Jones senses the acuity in Darwin's observations and makes sure the relevance of the experimental work is made meaningful to modern day problems in a practical way. Bees and their role in pollination, their decrease in numbers and the influence of climate change correlate with species disappearance and the emergence of new species demonstrate the author's appreciation of Planet Earth.

Jones is an engaging thoughtful writer with a wicked sense of humour and turn of phrase. But I finish with two pieces of fine writing in which he explains different concepts. Children once made necklaces from cowslips and in particular those with a long 'pin' which protrude from the flower and through which they could then thread plants together. "Cowslips or primroses with a short protrusion ('thrum' plants) were no use for juvenile jewellery" as Jones puts it. The 'purpose' of the pin structure is that it accepts pollen from certain male flowers. Similarly with thrum flowers. Plants accept certain pollen and there are therefore genetic implications. Like mates with unlike so this means that a sexual filter reduces the chances of interaction between plants that bear similar genes. It is a precaution against inbreeding. Nature thereby rejects the number of individuals with which genes can be shared.

This book is an excellent read beautifully written and researched. His final words say it all "The Earth as a result is a far less interesting place than it was when HMS Beagle set sail. Whether it becomes less so and whether it survives at all depends on the talents of the only creature ever to step beyond the limits of Darwinian evolution." It is good to see an author thinking beyond the small event and viewing the overall picture.

Dr Ian Gibson MP

PARLIAMENTARY AND SCIENTIFIC COMMITTEE NEWS

ANNUAL GENERAL MEETING

ELECTION OF OFFICE-HOLDERS

At the Committee's Annual General Meeting on Tuesday 21st April Dr Doug Naysmith MP retired as Chairman; Dr Desmond Turner MP and Mr Robert Key MP retired as Deputy Chairmen; Dr Evan Harris MP retired as Hon Secretary; Mr Andrew Miller MP, Mr Philip Greenish and Mr Ian Taylor MP retired as Vice-Presidents and Professor Alan Malcolm retired from the Advisory Panel.

The following office-holders were elected:

Chairman:	Mr Ian Taylor MBE MP
Deputy Chairmen:	Mr Andrew Miller MP
	Dr Evan Harris MP
Vice-Presidents:	Dr Douglas Naysmith MP
	Dr Desmond Turner MP
	Robert Key MP
	Professor Alan Malcolm
Advisory Panel:	Mr Philip Greenish

THE BIG BANG FAIR

Student experiments with orange goo at Ministry of Defence stand. The orange goo is an amazing shock absorbing material called D3o, which attracted a tremendous amount of attention on the day.

4th – 6th March 2009

Nearly 5,000 young people from across the country, supported by Parliamentarians and members of the business, engineering and science communities took part in The Big Bang, the UK's first national fair celebrating young people's achievements in science and engineering.

Students modelling a Sellafield biohazard suit

The Big Bang, which took place in Westminster from 4th to 6th March in the run up to National Science and Engineering Week, attracted nearly 6,500 students, teachers, politicians and exhibitors. Also present were the fair's sponsors: The Department for Innovation Universities and Skills (DIUS), The Department for Children, Schools and Families (DCSF), Lloyd's Register Educational Trust, Shell, BAE Systems, Rolls-Royce and Semta, as well as 46 other organisations from across Government, business, science and engineering.

The Big Bang was an unprecedented partnership of the science and engineering communities to inspire children to choose careers in science, technology, engineering and maths.

School groups arrived for half-day sessions and had the opportunity to participate in their choice of 33 different theatre shows and workshops. They had the chance to see the many real world applications of science and technology through hands-on investigations and exhibitions. Students participated in a variety of activities, including building their own hydraulically controlled arms, handling dinosaur fossils,

Student amazed at Sellafield stand

recording their own weather news reports, taking infrared photos of themselves, designing their own music venues, and planning, designing and building their own control towers – all in the name of science and engineering.

The Big Bang also included an entire floor dedicated to jobs in science and engineering. The careers hotel was a place where students could drop in and discuss the wide range of science, technology, engineering and mathematics careers available to them.

Over 200 schools from across the UK attended the event. While a majority came from the South East, London and the East of England regions, all English regions and socio-economic backgrounds were represented. There were also schools from Northern Ireland and Scotland that came out for the fair.


Students take part in The Learning Grid K'Nex Challenge

Students attending The Big Bang heard from professional engineers, scientists and celebrities, including Rachel Riley, Ben Fogle, Kate Bellingham, James Cracknell and Steve Leonard, who were on hand to discuss their experiences of working in the sector.

Political figures from all sides of the House were also in attendance, including the Rt Hon John Denham MP, Secretary of State for Innovation, Universities and Skills; the Rt Hon Lord Drayson, Minister of State for Science and Innovation; the Rt Hon Baroness Royall of Blaisdon, Leader of the House of Lords; Baroness Morgan of Drefelin, Parliamentary Under-Secretary of State for Children, Young People and Families; Adam Afriyie MP, Shadow Minister of State for Innovation, Universities and Skills and the Innovation, Universities Science and Skills Committee chaired by Phil Willis MP.

The Big Bang also featured the newly established National Science Competition. A number of prizes were awarded during the ceremony hosted by Kate Humble, presenter of BBC's Springwatch, including UK Young Scientist of the Year, Peter Hatfield, and UK Young Technologist of the Year, Chris Jefferies.

While the two top prizes given at The Big Bang were to individuals, many spectacular and substantial prizes were also awarded to teachers, teams and clubs.

One group of students who attended The Big Bang also had the chance to put a group of MPs in the hot seat. On 4th March pupils from London's Park View Academy science club quizzed members of the Innovation, Universities, Science and Skills Committee on the most pressing issues in science and technology in a mock committee session in a committee room of the House of Commons. Questions were put to members of the Committee from across the House – Chairman Phil Willis MP and members Tim Boswell MP, Dr Brian Iddon MP, and Dr Evan Harris MP – about the future of science funding, the use of human embryonic stem cells, and obesity.

Lord Drayson said that the National Science Competition was an important part of the Government drive to raise the profile of science and engineering.

"It is extremely encouraging to see the number of entrants that have taken part in this competition. It is great to see young scientists and engineers inspired to experiment with ideas and apply science and technology to real life scenarios. I really want to bust the myth that science is boring and geeky – it is far from it. This competition has highlighted the reality of science today, it's exciting, fascinating and shapes all our lives. Young scientists today will shape our future tomorrow – which is why competitions like this are so important to celebrate young British talent."

Sir Anthony Cleaver, Co-patron of The Big Bang, and Chairman of the Engineering and Technology Board said: "The Big Bang lived up to its name. To have been able to give 5,000 young people the opportunity to look at science and engineering with fresh eyes and explore the exciting opportunities on offer in the sector, is a tremendous achievement. I thank the nearly fifty organisations from the public and private sectors for coming together to give so many young people a boost towards something that might just change their lives."

The Big Bang will be an annual event and plans are under way for 2010. The Big Bang 2010 will take place in Manchester from 11th-13th March 2010.

Details of The Big Bang 2010 will be available soon at www.thebigbangfair.co.uk


Young Engineers Challenge

UK Young Technologist of the Year, Chris Jefferies from Pershore High School, Worcestershire.


UK Young Scientist of the Year, Peter Hatfield from Simon Langton Grammar School for Boys in Canterbury, Kent.

OBAMA – "WE WILL RESTORE SCIENCE TO ITS RIGHTFUL PLACE"

In his inauguration speech on 20 January, Barack Obama promised to *"restore science to its rightful place"* – a statement applauded by the science community in the US and worldwide. But what is behind the headline message? And can he deliver on his promises? Brian Ferrar, Head of the US Science and Innovation Network at the British Embassy in Washington reviews the campaign promises and the action taken so far.

Obama's commitment to science was a significant plank of his election campaign. Advised by a team of scientists including Nobel Prize winner Harold Varmus, he was the only Presidential candidate to produce a comprehensive science and innovation policy platform. He promised to restore scientific integrity to Government, substantially increase funding for science, and encourage innovation. This became apparent at an Economic Competitiveness Summit he hosted at Carnegie Mellon University, Pittsburg in June 2008. Moderating a discussion among 13 industry, education, community and scientific leaders, including Varmus, Obama showed his clear grasp of the issues at stake and his vision of science as a vital component in restoring US competitiveness in the face of competition from emerging economies. He also recognised the central role of science and technology in meeting the sustainability and resource challenges of the 21st Century, including energy and climate security.

Shortly after his election Obama announced that Prof John Holdren, renowned for his work on climate and energy, would become Assistant to the President for Science and Technology and Director of the Office of Science and Technology policy. The timing of the announcement was far in advance of previous Presidencies and widely welcomed by the US science community. The fact that Obama had restored the position as Assistant to the President was also taken as a sign that Obama was serious about science, as were his appointments of Holdren, Varmus, and MIT's Eric Lander as co-chairs of the President's Committee of Advisors on Science and Technology. Other appointments confirmed this trend with Nobel Prize winner Steve Chu becoming Energy Secretary and Royal Society member Jane Lubchenco heading the National Oceanic and Atmospheric Administration. There has, however, been some disappointment that Holdren is not at Cabinet level – a position held by his predecessors prior to Bush's presidency.

The appointments presaged new policies. Within 50 days of his inauguration Obama made two significant science announcements. First, he overturned President Bush's ban on Federal funding for embryonic stem cell research using lines created after August 2001. Second, he instructed Holdren to prepare a strategy for restoring scientific integrity to all aspects of the executive branch's involvement with scientific and technological issues. Whilst the change in stem cell policy took the limelight, arguably the science integrity proposal was more significant. It fulfilled a key plank of his election platform. The proposal asserts that all science posts be filled based on people's scientific credentials; that the scientific evidence underlying policy is developed using established scientific methods and made public; and that the necessary scientific processes within agencies are upheld.

Obama has also promised to double basic research funding over ten years and has put this in his 2010 Budget proposed to Congress. Many US science agencies have languished with flat budgets in recent years. The National institutes of Health (NIH), the National Science Foundation and the National Institute of Science and Technology have been constrained in their funding due to the inability of Congress to deliver on increased funding promised in the America COMPETES Act. In addition, in the stimulus bill passed in February a one-off $21.5 billion was allocated for science, including $18.5 billion for research. Nearly half has gone to NIH, including $8.5 billion for research. This stimulus will enable NIH and NSF to fund previously submitted quality research proposals that were unfunded solely due to lack of funds. NIH has also issued some new calls for proposals, but in a change to its normal policy, and in line with the intentions of the stimulus bill, overseas researchers can only apply as minor partners of US researchers. Overseas researchers will, however, be able to continue to apply direct under normal funding calls.

The economic and financial crisis has deepened since Obama's ambitious funding proposals were first outlined, and will almost certainly undergo revision along with other spending programmes. Nonetheless, the overall signals on science are almost wholly positive. Obama has already begun to deliver on his promises. The US science community is excited. The FCO/DIUS Science and Innovation network and RCUK Office in the US are also ensuring that UK researchers can collaborate with US researchers and access US funding.

PUBLIC DIALOGUE ON STEM CELL RESEARCH

Karen Gooch

As US President Barack Obama ends restrictions on federal funding for new stem cell research, members of the largest ever public dialogue on stem cell research in the UK have been revealing their thoughts on the subject.

Results of the public dialogue, which involved workshops last summer in London, Cardiff, Bristol, Newcastle and Edinburgh, reveal high levels of public support for stem cell science and technology. The public is also keen for the UK to maintain a technological and regulatory lead in stem cell research.

Days after Barack Obama became President in January, the US Food and Drug Administration gave the go-ahead for the world's first study on human embryonic stem cell therapy, which will involve a clinical trial of a handful of patients paralysed due to spinal cord injury. The US biotech company behind the newly approved clinical trial, Geron Corporation, has welcomed the approval, which follows its development of stem cell treatment for spinal cord injury. The company had submitted a 21,000 page application which had been under consideration for several months.

Now Mr Obama has lifted restrictions on federal funding for research on new stem cell lines, pledging to 'vigorously support' new research. Using embryonic stem cells in research is controversial, but the cells have the ability to turn into any of the body's 200 cell types. However, scientists say one embryo, donated through IVF treatment, can provide a limitless supply because the cell lines can be grown indefinitely.

In Britain, the public dialogue exercise, which was funded by the Sciencewise Expert Resource Centre and commissioned by the Medical Research Council (MRC) and Biotechnology and Biological Sciences Research Council (BBSRC), revealed that both professionals and the public valued investment in basic research that could look at the development of treatments. As well as 200 members of the public, nearly 50 stakeholders from fields such as science, medicine, industry, ethics and religion took part.

Several members of the public in feedback after the sessions expressed strong support for giving priority to serious diseases where current treatments are limited. Some of those who took part did so, they explained, because a loved one was suffering from a disease for which stem cell research might hold out the prospect of a cure. One woman said: "My husband has MS and I am interested in future medical advancement." Another woman added: "I am extremely interested in stem cell research – my mother has Alzheimer's – and it is comforting to think that this kind of research will, eventually, produce a cure."

However, support for translating research into treatments was conditional on ensuring that public funding was focused on 'serious' medical conditions rather than cosmetic uses. The involvement of the private sector also raised some concerns, with many feeling that for public trust to be maintained, it was important that future treatments should reflect public rather than solely commercial interests.

The public would also like to see more emphasis on preventative medicine, through actual cures as a result of research, and individuals taking control of their own health. While some of the participants expressed concerns about using embryos, many said they had been reassured by the workshops with scientists.

There was also a general welcome for an informed, clear debate, rather than reliance on the media for news of developments. One person emphasised: "The issues involve society as a whole and not just the scientists doing the research. We need to be accurately informed about the actual research and what is happening without media hype or hindrance."

Present at the launch event for the results of the project was the Minister for Science and Innovation, Lord Drayson, who spoke of how seriously the Government takes public dialogue in areas such as stem cell science.

He said: "Initiatives such as Sciencewise provide us with the framework to do this and build on what we've achieved to date with open discussions on stem cell science. This project's findings highlight the public's acceptance of stem cell research – this is extremely encouraging and something I want to maintain through exchanges such as Sciencewise, as stem cell research progresses."

Sir Leszek Borysiewicz, Chief Executive of the MRC, said: "The passage through Parliament of the Human Fertilisation and Embryology Act earlier this year clearly demonstrated the importance that Research Councils must place on making sure that their research is able to take into account and respond to the concerns and aspirations of UK society. We have a responsibility to make sure that we maintain the high level of support for research shown in this report by engaging on issues such as commercialisation, co-ordination, and regulation."

Professor Douglas Kell, Chief Executive of the BBSRC, said: "Participants noted the importance of dialogue to the development of trust in stem cell science. BBSRC's Bioscience for Society Panel will help to embed the outcomes in policy development and strategic planning. We see this exercise very much as one step in a continuing process of communication and engagement."

The public dialogue sessions, commissioned by BBSRC and MRC and carried out by the British Market Research Bureau (BMRB), followed a recommendation in the 2005 UK Stem Cell Initiative Report (the Pattison Review) calling for a sustained dialogue with the public on stem cell research. Co-funded by the Government's Sciencewise-ERC programme,

which supports a number of other science and technology dialogue projects, the workshops took the form of structured conversations between experts, non-experts and policymakers.

The call for sustained dialogue is reflected in the final report from the study, and features as one of the main conclusions to have been made. There is a clear recognition that the public still want sustained dialogue in the area of stem cell study and that this is vital to the development of trust in this area of research. The report stresses the importance of using dialogue not as 'a set of one-off discussions to secure a licence to operate' but as a vital tool in the continued planning and development of stem cell research. The report concludes that dialogue needs to become a habitual feature of research and that, going forward, it will become an automatic aspect of the practices and culture of stem cell research.

The report following the public dialogue will feed into decisions that Research Councils and others will make as the research matures and more stem cell treatments move closer to clinical application. The full report, 'Stem Cells Public Dialogue' is available on the Medical Research Council website.

BBSRC

The BBSRC is the UK funding agency for research in the life sciences. BBSRC is one of seven Research Councils that work together as Research Councils UK (RCUK). It is funded from the Government's Department for Innovation, Universities & Skills (DIUS). www.bbsrc.ac.uk

MRC

The MRC is a publicly-funded organisation dedicated to improving human health. The MRC supports research across the biomedical spectrum, from fundamental lab-based science to clinical trials, and in all major disease areas. It is one of seven Research Councils funded by the Government's Department for Innovation, Universities & Skills (DIUS). www.mrc.ac.uk

Sciencewise-ERC

The Sciencewise Expert Resource Centre (ERC) for Public Dialogue In Science and Innovation, funded by the Department for Innovation, Universities & Skills (DIUS), helps policy makers commission and use public dialogue to inform policy decisions in emerging areas of science and technology. The Sciencewise-ERC provides co-funding to Government departments and agencies to develop and commission public dialogue activities. www.sciencewise-erc.org.uk

BMRB

The BMRB is one of the UK's leading market research agencies. It operates within the Millward Brown Group which, in turn, is part of Kantar, WPP's insight, information and consultancy division. www.bmrb.co.uk

Institute for Science and Society

Participant feedback and quotes were collected by the Institute for Science and Society (ISS) in response to an evaluation questionnaire. The ISS is the independent evaluator of the BBSRC/MRC stem cell dialogue project.

BOOK REVIEW

GLOBAL HEATING: ACTION REQUIRED - NOW

Review of The Vanishing Face of Gaia: A Final Warning by James Lovelock

Allen Lane, 2009, 178pp

This is without doubt the most frightening book that I have ever read. Not because the author is peddling green propaganda – but because he isn't. It is written in a very urbane and personal style, and Lovelock almost goes out of his way to avoid sensationalism. However, his stark message is that global heating is happening, that the cause is unequivocally humankind, and there's virtually nothing we can now do to stop it. We are on an ever steeper slippery slope. The primary cause is simply that there are too many people on the planet (about half of all human-generated greenhouse gas emission is caused simply by our existence – our breathing, eating, and other biological activity, plus those of our pets and livestock). This makes nonsense of any long range emission reduction targets

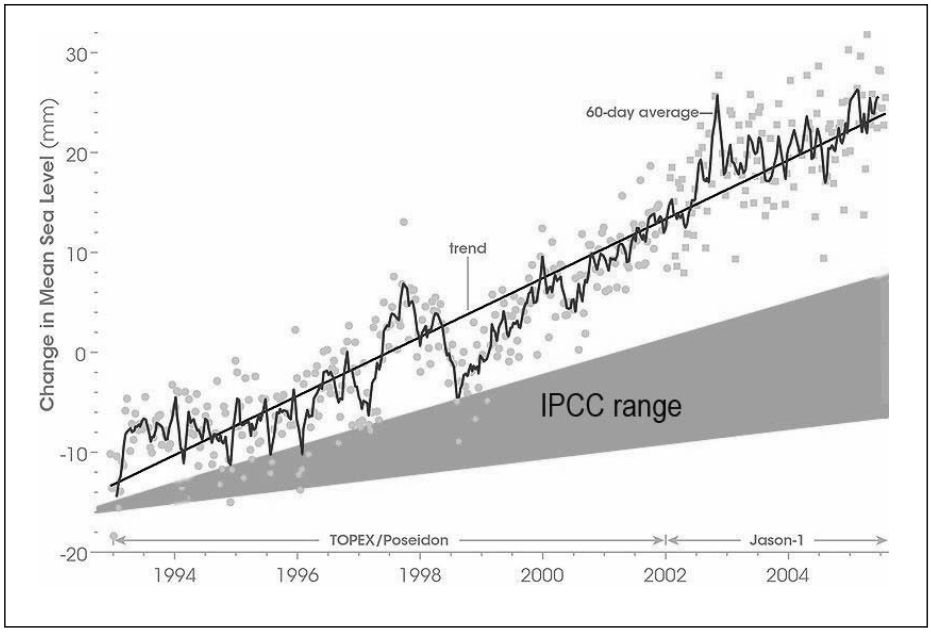


Figure 1 (reproduced by permission from James Lovelock). Observed changes in sea levels compared with predictions from the IPCC models. This is a simplified version of the upper part of Figure 1 included in the book. Sea level is a proxy for temperature change - and much more reliable as a global thermometer than trying directly to estimate average atmospheric temperatures.

for 2020 or 2050 which are unachievable without drastic reduction in the total numbers of people.

Lovelock points out that the world is heating up faster than the most pessimistic scenario from the IPCC models (Figure 1). He makes it crystal clear why the IPCC, even though it includes many excellent individual scientists among its membership, is incapable of presenting a model which actually bears any relationship with what is really happening. Consensus reached through a fundamentally political process is not a mechanism that will ever achieve scientific truth.

Entire sub-systems, such as the melting of Antarctic ice shelves, are omitted from the models because they are not yet well enough understood[1]. Furthermore, because of the nonlinear behaviour of many of the natural sub-systems involved in regulating our climate, it is certain that (as has been documented in geological history) there will be sudden shifts in temperature and other response variables. The transition to a hotter state is likely to be sudden rather than follow the smooth IPCC curve, but because the underlying factors are still poorly known, it is impossible to predict when this jump will occur.

One factor that has come to prominence recently, and which could cause such a rapid change, is the accelerated melting of Arctic ice. James Lovelock draws a useful analogy with a cold drink containing an ice cube. As long as some ice remains, the drink stays cold. Once all the ice has melted, the drink warms up rapidly.

The message is not wholly pessimistic, though. There are actions that we can take – and urgently should take – to slow this headlong rush to catastrophe even if we cannot halt or reverse it. Wholesale transition from fossil fuels to other sources of energy is necessary but not sufficient. He argues well the folly of wind power as even a partial solution, while enthusiastically supporting nuclear power. His clear presentation of the facts combined with his independence from the 'nuclear lobby' and from any green pressure group lend authority to his statements. Perhaps he understates the problems and risks of uranium/plutonium nuclear power – but at the same time he makes a convincing case that there is no alternative. He fails to mention the real potential of much safer thorium power – known for over 60 years but mostly ignored possibly because thorium cannot be used to make bombs – and the likelihood that fusion power may at last be just around the corner. Research in both of these fields urgently requires very much more funding. However, this is incidental to Lovelock's message, and should not divert us from the imperative – that we must take appropriate action now.

Lovelock also examines the prospects for various geo-engineering options though accepts that none are likely to be able to reverse global heating, and that none are risk-free. He identifies the burial of elemental carbon ('bio-char') as by far the most promising – but like all else, it will not happen unless there is a serious commitment and concerted effort. Similarly, the industrial synthesis of food and fuel from inorganic ingredients (mainly CO_2 and water), using nuclear power as an energy source, would have added benefits of reducing our demand for agricultural land and taking CO_2 out of the system.

His priority is that at least some of humanity will survive to evolve into a more intelligent component of the 'living earth' that is Gaia, and hence adaptation is actually more important than concentrating solely on reducing greenhouse gas emissions. However, he does warn that it is of crucial importance that we stop burning fossil fuels, as the survival of Earth itself as a living system could be threatened by continued burning of coal, oil, and gas in a hotter world with a more fragile ecosystem.

This is a book not only to be read but to be acted upon. Although private individuals can and should do whatever they can, many actions can be taken only at governmental level. Business, driven by short-term profit motives, cannot be expected to do anything without appropriate carrot-and-stick measures. It is vital, therefore, that parliamentarians read, understand, and accept the obligation that is theirs to ensure a long term future for humankind as an important component of our living planet. It is not good enough to wait for lengthy planning processes to run their course, even less to wait for 'lowest common denominator' international agreements. The UK is well placed to become an example for others to follow, as we shall probably be less affected by global heating than many regions especially in the tropics and continental interiors (these islands will become one of the few 'lifeboats' for humankind), and also we have the necessary science and technology expertise and infrastructure actually to achieve something. However, it will require a Churchillian statesman to galvanise Government and people into action.

Lovelock's headmaster warned him in 1938 against science as a career on the basis that it was only for "those of genius or with private means"[2]. He admitted he was not in the latter category, and modestly disclaimed the former. However, the key characteristic of genius is to recognise a fundamental and simple truth which nobody has noticed or understood before. By this standard, Lovelock is indeed a genius, and one whose message must be heeded:

The only near certain conclusion we can draw from the changing climate and people's response to it is that there is little time left in which to act. Therefore, my plea is that adaptation is made at least equal in importance to policy-driven attempts to reduce emissions. We cannot assume that because there is no way gently to reduce our numbers it is sufficient merely to improve our carbon footprints. Too many also think only of the profit to be made from carbon trading. It is not the carbon footprint alone that harms the Earth; the people's footprint is larger and more deadly.

Dr Stephen Henley FGS, FIMMM, CEng

The P&SC website manager, Stephen Henley, is an independent scientist, not affiliated to any political party or pressure group, and not beholden to any private or public sector employer.

A version of this review has been posted on the P&SC web forum for further discussion.

References

1. Fox, D., 2009: Driller thriller. New Scientist, 11 April, 2009, p.34-37

2. Lovelock, J., 1979: The independent practice of science. New Scientist, 6 Sept.1979, p.714-717

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

Under the Standing Orders, the Committee's terms of reference are to examine "the expenditure, administration and policy" of the Department for Innovation, Universities and Skills and its associated public bodies. This includes the Government Office for Science, headed by the Government Chief Scientific Adviser.

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

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

ORAL EVIDENCE

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

Science Question Time

On 26th January the Committee held Science Question Time with the Minister of State for Science and Innovation, Lord Drayson.

Follow-up evidence session on the Committee's Report on Science Budget Allocations

On 4th February the Committee held an evidence session with Professor Keith Mason, Chief Executive of the Science and Technology Facilities Council, to follow up the Committee's Fourth Report of Session 2007-08, *Science Budget Allocations*, HC 215-i.

Technology Strategy Board

On 1st April the Committee held a one-off evidence session with Iain Gray, Chief Executive, David Bott, Director, Innovation Programmes, and David Golding, Head of Strategy, Technology Strategy Board.

CURRENT INQUIRIES

Students and universities

On 30th October 2008 the Committee announced an inquiry into students and universities. The Committee has focused on admissions and widening participation, the balance between teaching and research, degree classification and student support and engagement. Oral evidence sessions started in January 2009 and the Committee has taken evidence from vice-chancellors, academics, students and their representative organisations. It is expected that the oral evidence sessions will conclude in May. The Committee also sought the views of students through an e-consultation which closed on 7th April.

Putting science and engineering at the heart of Government policy

On 13th November 2008 the Committee announced an inquiry, putting science and engineering at the heart of Government policy. On 24th March the Committee issued a supplementary call for evidence relating to Lord Drayson's proposals on strategic science funding. Oral evidence sessions started on 26th January when the Committee took evidence from Lord Drayson, Minister of State for Science and Innovation, Graeme Reid, Head of Economic Impact, Science and Research Group, and Jeremy Clayton, Deputy Head, Government Office for Science, Department for Innovation, Universities and Skills.

On 25th February the Committee took evidence from Professor David Fisk, Imperial College London, Professor Lord Krebs, University of Oxford, Professor Julia King, Aston University, Professor Lord Rees, President, Royal Society, Dr Tim Bradshaw, Confederation of British Industry, Professor Dame Janet Finch, Council for Science and Technology, and Judy Britton, Government Office for Science.

On 16th March the Committee took evidence from Professor Adrian Smith, Director General for Science and Research, Department for Innovation, Universities and Skills, Nick Dusic, Campaign for Science and Engineering, Professor David Edgerton, Imperial College London, Professor David Charles, Regional Studies Association, Sir Roland Jackson, British Science Association, Professor Iain Haines, UK Deans of Science, and Tracey Brown, Sense about Science.

On 1st April the Committee took evidence from Professor Chris Gaskell, Chair of the Science Advisory Council, Department for Environment, Food and Rural Affairs, Dame Deirdre Hutton, Chair of the Food Standards Agency, and Professor Sir Michael Rawlins, former Chairman of the Advisory Council on the Misuse of Drugs. It is expected that the oral evidence sessions will conclude in May.

REPORTS

Re-skilling for recovery: After Leitch, implementing skills and training policies

On 16th January the Committee published its First Report of Session 2008-09, *Re-skilling for recovery: After Leitch, implementing skills and training policies,* HC 48-I.

The work of the Committee in 2007-08

On 16th January the Committee published its Second Report of Session 2008-09, *The work of the Committee in 2007-08,* HC 49.

DIUS's Departmental Report 2008

On 20th January the Committee published its Third Report of Session 2008-09, *DIUS's Departmental Report 2008,* HC 51-I.

Engineering: turning ideas into reality

On 27th March the Committee published its Fourth Report of Session 2008-09, *Engineering: turning ideas into reality,* HC 50-I.

DEBATE

On 2nd April there was a debate in Westminster Hall on the Science and Technology Committee's Tenth Report of Session 2006-07, *Investigating the Oceans,* HC 470, and the Government's response published in the Innovation, Universities, Science and Skills Committee's Fourth Special Report of Session 2007-08, I*nvestigating the Oceans: Government Response to the Committee's Tenth Report of Session 2006-07,* HC 506.

GOVERNMENT RESPONSES

Pre-legislative Scrutiny of the Draft Apprenticeships Bill

On 19th February the Committee published its First Special Report of Session 2008-9, *Pre-legislative Scrutiny of the Draft Apprenticeships Bill: Government response to the Seventh Report from the Committee, Session 2007-08,* HC 262.

Re-skilling for recovery: After Leitch, implementing skills and training policies

On 24th March the Committee published its Second Special Report of Session 2008-09, Re-skilling for recovery: *After Leitch, implementing skills and training policies: Government response to the First Report from the Committee,* HC 365.

DIUS's Departmental Report 2008

On 31st March the Committee published its Third Special Report of Session 2008-09, *DIUS's Departmental Report 2008: Government Response to the Third Report from the Committee,* HC 383.

FURTHER INFORMATION

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

HOUSE OF COMMONS LIBRARY SCIENCE AND ENVIRONMENT SECTION

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

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

Fuel Poverty Bill

Research Paper 09/25

The Bill is a Private Member's Bill introduced by David Heath MP. The Bill would bring in three measures which aim to reduce fuel poverty: an energy efficiency programme to bring existing homes up to current energy efficiency levels; social tariffs to limit vulnerable households' exposure to high energy bills; and reinforcement of the legal duty on the Government to act to end fuel poverty.

Green Energy (Definition and Promotion) Bill

Research Paper 09/41

The Bill is a Private Member's Bill introduced by Peter Ainsworth MP. It defines the term 'green energy' and aims to promote its development, installation and usage.

The Bill aims 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.

HOUSE OF LORDS SCIENCE AND TECHNOLOGY SELECT COMMITTEE

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

PANDEMIC INFLUENZA

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

On 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, 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 further expert briefing at a seminar in February 2009 and held a further evidence session with Government officials on 17 March. The Committee is likely to publish a follow-up report before the long recess this year.

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) and Lord Patel remains as chairman.

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

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

The final evidence session, with Ministers, took place in late January 2009. The Committee is currently considering a draft report. The final report is expected to be published in June 2009.

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 will now be holding regular evidence sessions on Tuesday mornings,

while Parliament is sitting, until July, and will be meeting with a wide variety of witnesses from within the food industry, consumers groups and academia. It is expected that the Committee's report will be published in autumn 2009.

SYSTEMATICS AND TAXONOMY

During 2007-08 the Select Committee undertook a short inquiry into systematics and taxonomy. The inquiry was a follow-up investigation from the Committee's past inquiries into this subject (in 1991 and 2002) and looked at the UK's capability in this field, taxonomic data collection and management, and the skills base. The inquiry also looked at the application of taxonomic data, for example, in environmental change monitoring. The Committee took a range of evidence and published its report on 13 August 2008. The Government have responded to the Committee's recommendations and a debate in the Moses Room of the House of Lords took place on 25 March.

FURTHER INFORMATION

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

PARLIAMENTARY OFFICE OF SCIENCE AND TECHNOLOGY (POST)

RECENT POST PUBLICATIONS

eDemocracy

January 2009 *POSTnote 321*

The current proposal for an ePetitions system in the House of Commons is just one example of increasing interest in eDemocracy. Reasons include growing use of the internet, the popularity of web based applications such as social networking, and the trend towards digital convergence. This POSTnote looks at recent UK initiatives, and at challenges faced in their design and implementation. It examines debate over the purpose of eDemocracy and where its future lies.

Intelligent Transport Systems

January 2009 *POSTnote 322*

Information and communication technologies may be widely used on the roads in future in so-called 'Intelligent Transport Systems' (ITS). Systems that warn of upcoming hazards or intervene to avoid them could prevent accidents. ITS could also enable road charging and the better provision of information to drivers, which may help to reduce congestion. This POSTnote outlines current and future applications of ITS in road transport, as well as technical, behavioural and economic limitations to their deployment.

Lessons from History

January 2009 *POSTnote 323*

In the past decade the Government has repeatedly emphasised the importance of taking an 'evidence-based' approach to policy-making. In 2006 the House of Commons Science and Technology Committee welcomed the Government's progress in integrating scientific evidence into decision making. However, despite increasing use of evidence from the natural and social sciences, evidence from humanities disciplines such as history is not widely used. This POSTnote considers how history could help to inform decisions on key scientific and technological policy issues.

Marine Renewables

January 2009 *POSTnote 324*

Britain has an EU-mandated target to meet 15% of its energy requirements from renewable sources by 2020. The UK has the largest wave and tidal resources in Europe, so marine renewables are a candidate for contributing to this target. Around 15-20% of the UK's electricity could potentially be produced from marine renewable sources, but the technology is not mature. This POSTnote considers the technologies available and the environmental, economic and technological challenges involved in their deployment.

Wild Deer

February 2009 *POSTnote 325*

Wild deer populations are increasing in number and geographic range in the UK. Deer are a valuable natural resource if managed sustainably, but when occurring at excessive densities, they can have negative effects on biodiversity, the rural economy, human health and safety, and animal welfare. This POSTnote examines the current status of wild deer in the UK, their ecological, economic and social impacts and legislation on their management.

Food Hygiene Standards

February 2009 *POSTnote 326*

Food poisoning caused by microbes is a serious public health problem. Hygiene standards and procedures are laid down in food legislation to protect public health. However, improving food hygiene is not just a matter of implementing and enforcing regulations. This briefing describes recent developments in food regulation and examines options to improve food hygiene in businesses through monetary penalties, training and the use of local "Scores on the Doors" schemes.

Geo-engineering Research

March 2009 *POSTnote 327*

There is evidence that efforts to reduce emissions of greenhouse gases may be insufficient to avert unacceptable levels of climate change; global emission levels are currently higher than even the highest scenario produced by the Intergovernmental Panel on Climate Change (2001). Geo-engineering seeks to use global scale engineering to offset the effects of greenhouse gas emissions. This POSTnote summarises the arguments relating to research funding for geo-engineering.

Delaying Gratification

March 2009 *POSTnote 328*

Evidence shows that people may be biased towards seeking short-term rewards at the expense of greater long-term benefits. Several factors influence how inclined people are likely to be towards the present. Understanding these could inform policies that encourage individuals to make important life choices that affect their own long-term interests. This note reviews evidence on the influence of time in decision-making, and looks at the implications for policy domains such as pensions, health and consumer affairs.

CURRENT WORK

Biological Sciences – Assisted Reproduction, Single Embryo Transfer, Animal Cruelty and Interpersonal Violence, Internet Pharmacy and Counterfeit Medicines, Personalised Medicines, New Addiction Treatments, Diet and Cancer, Nutritional Standards in Schools, Deception Detection Technologies and Regenerative Medicine.

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

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

Science Policy – Futures and Foresight, The Dual-Use Dilemma and Discounting Procedures

CONFERENCES AND SEMINARS

Renewable Energy in a Changing Climate

On 12th January 2009 POST held a seminar in conjunction with the Parliamentary Renewable and Sustainable Energy Group (PRASEG) to discuss the findings of POSTnote 315 of October 2008. This explored the potential effects of climate change on the generation of renewable energy; from wind, wave and tidal power and also other renewable sources such as biomass and solar. This was considered alongside the potential changes in energy demand, which may be influenced as the climate changes in the coming decades.

Wild Deer in the UK: Impacts of Rising Deer Populations

On 26th February 2009 POST co-operated with the British Ecological Society to explore findings from POST's February 2009 briefing note on Wild Deer (POSTnote 325). Wild deer are a valuable natural resource in the UK and a popular component of UK biodiversity. However, their populations have increased notably in recent decades. The seminar explored the UK's approach to deer management.

Innovation & Delivery of Energy Technologies in Pursuit of Low Carbon Targets

On 25th March 2009 POST, in conjunction with the Westminster Energy Forum, organised a major conference in the Attlee Suite on some of the factors affecting clean energy technology deployment in the near future.

WORK FOR SELECT COMMITTEES

Commons Committees

Business and Enterprise Committee: Dr Martin Griffiths gave technical advice on drinks delivery technologies for its inquiry into *Pub Companies* and assisted with a briefing on the Government report on *Digital Britain.*

Welsh Affairs Committee: Dr Martin Griffiths assisted with an oral briefing on communications technologies for its inquiry into *Digital Inclusion.*

International Development Committee: Dr Chandrika Nath produced a written briefing on Kenyan and Tanzanian agricultural exports; Dr Jonathan Wentworth a written briefing on reducing emissions from deforestation and degradation (REDD) and Dr Michael O'Brien a written briefing on power generation in the developing world, all for the committee's inquiry into *Sustainable Development in a Changing Climate.*

Transport Committee: Dr Katy Milne, POST fellow, produced a written briefing on international aspects of noise and airspace management for the committee's inquiry into *The Use of Airspace.*

British-American Parliamentary Group

Dr Michael O'Brien produced a briefing on regional greenhouse gas reduction initiatives in the US, with a focus on Oregon and Washington states, for a mission by the Group to the Pacific North-West of the USA.

STAFF, FELLOWS AND INTERNS AT POST

Commonwealth Professional Fellow

A significant development during the period was POST receiving its first fellow under this scheme, run by the Commonwealth Scholarships & Fellowships Plan. Mr Richard Mubiru, senior researcher at the Ugandan Parliament, joined POST for three months in January 2009, mainly to work in connection with POST's Africa Programme (see below). Richard also spent time with the House of Commons Library, the Commons Overseas Office and the Royal Society.

POST is applying for two such fellowships for 2010.

POST Research Council and other doctoral fellows, and interns:

Select committee placement

Ellen Colebrook, John Innes Centre and University of East Anglia, Biotechnology and Biological Sciences Research Council Fellowship – has been placed with the Commons Innovation, Universities, Science and Skills Select Committee, providing assistance to the committee in various ways.

Conventional fellows and interns

Jerome Boyd-Kirkup, Cambridge University, Medical Research Council Fellowship

Thomas Douglas, Oxford University, Wellcome Trust Fellowship

Abbi Hobbs, York University, Economic and Social Research Council Fellowship

Sarah Murty, National Oceanographic Centre, Southampton, Natural Environment Research Council Fellowship

Katy Milne, Imperial College London, Engineering and Physical Sciences Research Council Fellowship

Naima Narband, University College London, Royal Society of Chemistry Fellowship

Chris Jones, Rothamsted Research, Biotechnology and Biological Sciences Research Council Fellowship

In February POST welcomed its annual short term postgraduate interns from the Tokyo Institute of Technology: Toshihiro Mukai, Shoko Watanabe, and Fang Yu. They participated in POST events and provided short term research assistance.

INTERNATIONAL ACTIVITIES

POST African Parliaments Programme

In the latest developments in this three-year programme, POST is collaborating with the International Network for the Availability of Scientific Publications (INASP) whereby INASP staff member Dr Kirsty Newman has become Programme Officer for the project. She is spending 50% of her time working on POST's programme in Uganda and 50% taking forward similar capacity-building activities in other developing country Parliaments, with funds from INASP.

POST is working with Ugandan National Academy of Sciences (UNAS) to carry out a 'baseline study' of how effectively S&T is handled in the Ugandan Parliament. A final report will be published in summer 2009.

In further collaboration with UNAS, POST is sponsoring a 'programme co-ordinator' in Uganda to take responsibility for driving its programme forward and looking into in-country options for its continuation. This new staff member will start work in May 2009

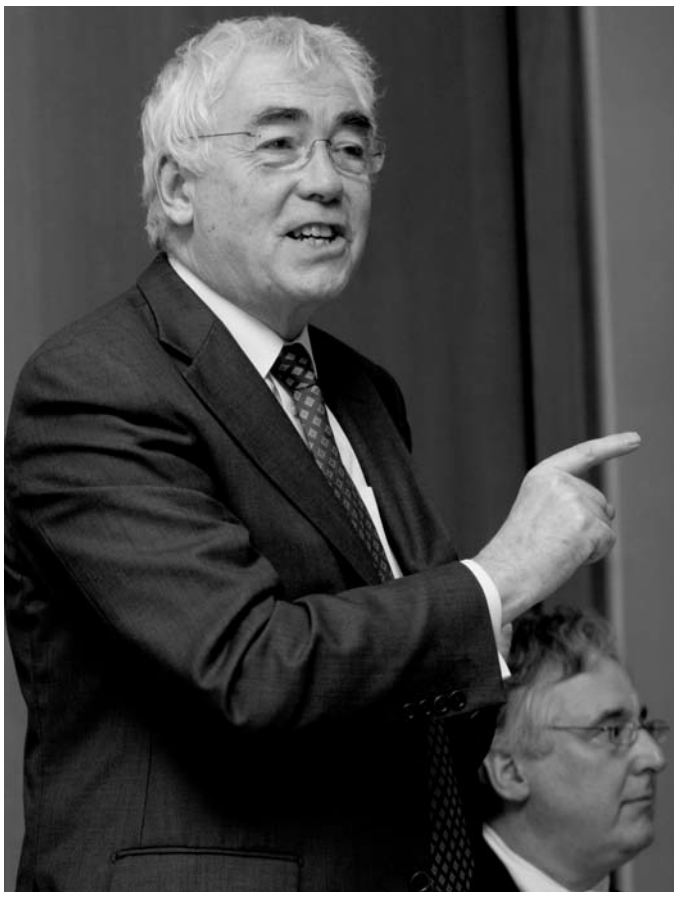
POST has also assisted UNAS in a successful bid for funding from the Wellcome Trust to support an MP-scientist pairing activity at the Ugandan Parliament for a further three years.

Co-operation with the European Parliament

In March the Director was invited by the European Parliament to chair the final session of a workshop organised at its Brussels headquarters on the Role of Science and Technology Co-operation between the EU and Developing Countries. This was attended by more than 150 delegates and the chairing involved seeking their agreement on a final workshop resolution.

VOICE OF THE FUTURE

The Attlee Suite was once again packed for this year's *Voice of the Future* event held on 10 March during National Science & Engineering Week. It was again organised by the Royal Society of Chemistry on behalf of the whole science and engineering community. Over 200 young scientists and engineering students, including 80 A Level students contemplating a career in science, had the chance to hear first hand from – and *question* – both the Minister of Science **Lord Drayson** and the Shadow Minister for



Innovation and Universities **Adam Afriyie MP.** There was also a *Science Question Time* with MPs from the Innovation, Universities, Science and Skills Select Committee led by its **Chair Phil Willis MP.**

Lord Drayson said that, despite the economic recession, the Government remains committed to maintaining investment in the UK's science base. He also said that there has never been a better time to be a scientist or engineer and that 2.7 million new jobs were likely to be created in the UK between now and 2017. More immediately, he told the early-career researchers that the Government is looking again at the issue of short-term contracts for PostDocs.

In the *Science Question Time* to the IUSS Select Committee someone from the University of Sheffield asked the MPs whether they thought the recent trend for financial professionals to retrain as teachers was an appropriate long-term solution to the current teacher shortages in areas like chemistry and physics. **Phil Willis MP,** as Chair of the Select Committee, said he welcomed fast-track teacher training initiatives such as the Teachfirst programme. **Dr Brian Iddon MP** argued that there needed to be more support to recruit enthusiastic teachers. **Dr Evan Harris MP** agreed about the importance of enthusiasm and bankers with a science degree would be preferable to non-specialists teaching science. However, he believed a better approach was to recruit more young teachers, improve teachers' pay and reduce the debt burden by scrapping tuition fees.

In his address **Adam Afriyie MP** was asked whether there would be any significant changes to science policy in the event of a Conservative Government. He commented that both parties shared similar views on science and its role at the heart of policy-making – but he did express concern that a focus on funding applied research with obvious economic potential would come at the cost of support for fundamental research.

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 12th January to 2nd April 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

ENERGY

Energy: Nuclear fusion

Debate in House of Lords Grand Committee on Thursday 5 February

Lord Taverne: If we achieve nuclear fusion, it will be the best solution to the problem of the world's future energy supply. I am not an expert and the science involved is way beyond me. A recent visit was made to Culham and a recent meeting in the Commons was attended by a very high-powered group from Culham which I am ashamed to say was attended by only three peers and two MPs. Culham is the site of JET, the Joint European Torus. In 1991, JET achieved controlled deuterium-tritium fusion reactions for the first time on earth. In 1997, JET produced fusion power in the megawatt range for some seconds, with a maximum of 16 megawatts. Construction has now started on the much larger tokomak, ITER, in the south of France and this will take the operating time to one and a half hours, 10 times a day. Will ITER receive sufficient financial backing? Cost estimates have already increased sharply. Our own national budget for fusion is many times smaller than that of Germany, France or Italy. Should we not give it higher priority?

The Minister of State, Department for Innovation, Universities and Skills (Lord Drayson): Our UK support for fusion research increased from approximately £19 million in

2003-04 to a projected total of £34 million in this financial year. Over the four-year period 2006-07 to 2009-10, the Engineering and Physical Sciences Research Council's support for fusion will be over £100 million. The JET operating costs are £60 million of which the United Kingdom provides one-eighth, and the ITER EU/EURATOM budget over the next five years is €1.9 billion. The scientific community has judged that nuclear fusion has a good chance of success notwithstanding the long timescale and huge investment that will be required to realise it.

Peak Oil

Debate in the House of Commons on Friday 27 February

Barry Gardiner (Brent North): First, we have either just arrived at, or have just passed peak oil – the point on the Hubbard curve at which the maximum rate of global production has been reached. Secondly, and directly related to that, is the challenge of climate change and the need to stabilise average global temperatures to no more than a 2° rise. Although the report produced by the Intergovernmental Panel on Climate Change in 2007 equated that with a concentration of 450 parts per million of CO_2 equivalent in the atmosphere, more recent research from our own Hadley centre and NASA's Goddard institute suggests that that might be over-optimistic. That has led the European Commission, in its January communiqué on a post-2012 framework for the spring Environment Ministers Council, to suggest that a 350 ppm CO_2 equivalent stabilisation target might be better.

The third factor is political risk. This is what some people call security of supply, but it is effectively the political risk to which Governments are so acutely sensitive, owing to the fact that they are unable to control a resource that is essential to their economy functioning well. Energy is the lifeblood of the economic body, and the moment it stops flowing is the point at which the economic body begins to die. Perhaps the most striking example of the effect of the convergence of those three factors came earlier this week, when Stephen Tindale, a former head of Greenpeace, announced his conversion to the need for a new generation of nuclear energy plants in the UK.

I should make it clear that I am not in any way suggesting that the world is about to run out of oil. The International Atomic Energy Agency would suggest that there are enough proven and probable reserves of conventional oil left to supply the world with oil for a further 40 years at current levels of consumption. That is about 2.4 trillion barrels over and above the 1.1 trillion barrels that the world has produced so far. Beyond that, it makes sense to account for new discoveries of fields as yet unknown and for oil sands and oil shales, along with coal to liquids and gas to liquids, which, combined with extra-heavy oil, could account for a further 9 trillion barrels, although at significantly increased production costs, ranging from $50 to $115 a barrel.

None the less, the IAEA outlook predicts annual production decline from now on, at a rate of 6.7 per cent. It is important to realise that there are significant limiting factors apart from price. We do not seem to be discovering significant new fields quickly enough. Data on existing reserves are suspect, particularly in the middle east, and depletion rates may be more rapid than some Governments are prepared to admit. Unconventional resources such as ocean floor or Arctic oil shales are proving technically more difficult as well as more expensive to develop.

The oil-producing countries are less willing to export as they increase their own domestic consumption. I think it was King Abdullah of Saudi Arabia who said in 2006 of some newly discovered field: "Leave it in the ground, Inshallah our children will need it".

Parliamentary Under-Secretary, Department for Energy and Climate Change (Joan Ruddock): The objective of our Government energy policy is to deliver affordable, secure and clean energy to UK businesses and consumers. In order to ensure security of supply now and into the future, the Department of Energy and Climate Change monitors potential risks to supply. Clearly, one potential threat to UK energy security is that the global supply of oil is not sufficient to meet future demand. There is a wide range of views as to why oil supplies may become insufficient, including geological constraints, insufficient investment, political instability and resource nationalism.

However, assessing peak oil is extremely complicated due to limited data and the importance of assumptions made about future developments in the energy sector. Consequently, risk assessments vary widely by source. We look at the different sources, but we do not estimate the timing of peak oil production ourselves. We realise that a number of factors influence the balance of supply and demand of crude oil, and that these are not limited to the amount of available recoverable conventional oil resources. They also include the global demand for oil in the future, access to and investment in the development of existing resources, and technological progress that may allow us to extract more oil from current sources.

The International Energy Agency estimates that only about a third of all ultimately recoverable conventional and economically recoverable oil has actually been produced to date. The report also states that "there are reserves to meet demand at least through to 2030 if the investment is there".

The Prime Minister has asked Malcolm Wicks to review international energy security, and he may wish to include within his review consideration of supply and demand in the oil markets. Secondly, we are already putting in place policies that will reduce the energy intensity of the UK economy and help to increase its resilience to shocks in energy supplies. It is a fact that the UK is one of the least energy intensive countries in the G7.

Let me turn for a moment to transport, which is the biggest consumer of oil in the UK economy, accounting for about 70 per cent of total oil consumption. The Government are therefore working towards improving efficiency in the transport sector and within the 2020 EU package to achieve a target of 10 per cent renewable transport fuels by 2020. The Government are also keen to promote the uptake of new technologies when they arrive and, as part of the recent announcements on transport strategy, we made a commitment of £250 million to deliver consumer incentives to promote electric vehicles.

Nuclear Engineering: Higher Education

Question and Written Answer on Thursday 2 April

Greg Clark (Tunbridge Wells): To ask the Secretary of State for Innovation, Universities and Skills pursuant to the Answer of 10 February 2009, Official Report, column 1902W, on engineering: higher education, how many (a) masters level students and (b) doctoral students received funding for nuclear engineering courses in each of the last five years.

Mr Lammy: Data at the level of detail requested by this question is not collected centrally. The following table sets out the overall numbers of chemical, process and energy engineering students at English higher education institutions over the last five years which would include nuclear engineering students.

Academic year	Masters	Doctorates
2003/04	935	605
2004/05	865	645
2005/06	870	630
2006/07	920	665
2007/08	725	865

Notes:

1. Figures are based on a HESA standard registration population and have been rounded to the nearest five.
2. Covers enrolments of all domiciles to both full-time and part-time courses.
3. Excludes the Open University due to inconsistencies in their coding of subject over the time series.

Source: Higher Education Statistics Agency (HESA)

Nuclear Power: Research

Question and Written Answer on Thursday 2 April

Greg Clark (Tunbridge Wells): To ask the Secretary of State for Energy and Climate Change how much the Government spent on nuclear fusion research (a) in the UK and (b) internationally in each of the last five years.

Mr Lammy: I have been asked to reply.

The Government provide support for nuclear fusion research in the UK through the Engineering and Physical Sciences Research Council (EPSRC).

UK funding, including the Nuclear Contract of Association, is as follows:

	£ million
2003-04	19.2
2004-05	22.7
2005-06	20.7
2006-07	26.0
2007-08	26.1

CLIMATE CHANGE

Climate Change: Arctic

Question and Written Answer on Monday 23 February

Gregory Barker (Bexhill and Battle): To ask the Secretary of State for Energy and Climate Change what research his Department has conducted into the scale of polar icepack melting in the Northwest Passage.

Joan Ruddock: My Department funds the Met Office Hadley Centre (MOHC), through its Integrated Climate Programme with joint funding from the MOD and DEFRA, to monitor, understand and predict climate change; this research includes incorporating sea ice into global climate models to ensure best possible predictions on melting of Arctic sea ice. We also liaise with other research groups in the UK and internationally on this topic.

The Northwest Passage temporarily became fully open and navigable in summer 2007, for first time in recorded history, due to the record low extent (September average area: 4.28 million sq km) of Arctic sea ice melt. The same situation occurred in summer 2008, when the sea ice area (4.67 million sq km) was at its second lowest on record. Satellite monitoring data since 1979, available from the US National Snow and Ice Data Centre (NSIDC) shows there has been a long-term decline in the extent of summer Arctic sea ice and that this decline has accelerated over the last decade; the long-term downward trend of around 10 per cent per decade can be linked to human emissions of greenhouse gases and aerosols. It is not yet clear if the much larger summer ice melt in the last two years is an acceleration of this long-term trend or a short-term variation around it. Recent analysis by the MOHC suggests that changes as large as the observed record low in 2007 can indeed result from natural year-to-year variability around the longer term downward trend; this provides confidence in the ability of the MOHC's climate model to simulate changes in the area of Arctic sea ice and its continuing decline. However, it is evident that climate models show a wide range of future predicted rates of sea ice decline. Whilst the IPCC's Fourth Assessment Report suggested the Arctic would be largely free of summer ice by 2100, many more recent models predict this will happen much sooner – by the middle of this century or even earlier; several experts suggest there may possibly be no summer sea ice by the mid 2010s.

Satellite and other records also show a long-term decline in the average thickness and age of Arctic sea ice over recent decades. For example, scientists from University College London recently reported that the thickness of the ice was significantly lower (by an average of 10 per cent) during the winter of 2007-08 than during the previous five winters, indicating that the total volume of sea ice has decreased significantly. Though based only on satellite data (which are not ideal for measuring sea ice thickness), this result confirms previous evidence of decreasing sea ice thickness over the past three decades from US and UK submarine sonar measurements.

The retreat of Arctic sea ice has geo-political implications, with the Northwest Passage becoming increasingly ice free and fully open to shipping. There are other important implications; by reducing the reflectivity (albedo) of the Earth's surface, it increases the amount of solar radiation that the surface absorbs, thereby

accelerating warming. Temperatures have already risen almost twice as quickly in the Arctic as in the rest of the world over the past 100 years. Sea ice retreat also has significant impacts on Arctic ecosystems, as many organisms (including certain species of fish) depend on its presence for survival. DECC is continuing to seek updated assessments of Arctic sea ice conditions and impacts from UK and international experts.

Investigating the Oceans

Debate in Westminster Hall on Tuesday 2 April

Mr Phil Willis (Harrogate and Knaresborough) When the former Science and Technology Committee announced its *Investigating the Oceans* inquiry in November 2006 we did not envisage that so little progress would be made on such an incredibly important area of science and Government policy. I am therefore delighted that today, some 18 months after the publication of the recommendations, we can seek a progress report from the minister. Although the Government have a greater interest in what is happening in our coastal waters, the oceans are globally important as they are critical to the ability of humans to live on earth in mitigation of climate change and a potential future source of power. The inquiry was undertaken due to a perceived lack of interest and policy by Government and the need for a greater understanding of marine science. The research was undertaken as a direct result of the prodding and enthusiasm of Dr Iddon, Member for Bolton, South-East.

Dr Iddon (Bolton, South-East) In 1986 the House of Lords report flagged up the lack of co-ordination in marine science and the shortage of money for research. This policy area is extremely complex and is not working as effectively as it should. There is a plethora of organisations involved and they are in silos and do not interact as well as they should.

The Parliamentary Under-Secretary of State for Environment, Food and Rural Affairs (Huw Irranca-Davies): I come here today as marine champion. I am chair of the ministerial marine science group, which oversees the new Marine Science Co-ordination Committee. A prime example of the importance of science to policy is underpinning initiatives that will be taken forward through the Marine and Coastal Access Bill. The Marine Management Organisation, which will be located in Tyneside, is a strategic, planning, multifaceted organisation involving enforcement, implementation of the Marine and Coastal Access Bill, as well as marine science, including access to Brussels, Strasbourg and the rest of the UK including Scotland.

SCIENCE POLICY, RESEARCH AND HISTORY

Charles Darwin

Debate in the House of Lords on Thursday 19 March

Baroness Hooper: This debate calls attention to the celebrations of the bicentenary of Charles Darwin who asked questions and found many of the answers. He has been called one of the most influential Britons of all time and the most important natural historian ever. It is a compelling fact that 150 years after the publication of the Origin of the Species modern genetics has proved that all life is related. Direct descendants of the Darwin family are present and some of the descendants of friends and colleagues of Darwin will speak in this debate. I agree with the view that faith and science are not fundamentally opposed to one another. Yet we are told that Darwin died an agnostic. He remained as courteous and respectful to those who retained religious beliefs as he was to fellow agnostics.

Lord Jenkin of Roding: Darwin was persuaded to turn his attention to geological time and helped others such as Lord Kelvin to establish that the universe was much older than had been believed at the time, so answering the arguments that it could not have happened. It was left to Mendel to discover the basic laws of inheritance and to subsequent generations of scientists to discover how they worked.

The Earl of Selborne: Although Darwin wrote more books on plants than on anything else, he did not in fact consider himself a botanist. He felt comfortable in zoology and, of course, geology, but he did not have an equivalent training in botany. In his will he left money to Kew to compile an index to the names and authorities of all known flowering plants and their countries. This project will be coming to fruition in 2010 under the Convention on Biological Diversity in which Kew will play a leading role and it looks realistic to say that Darwin's checklist, which he wanted for scientific purposes, will be critical for practical conservation purposes, and appear next year.

Lord Lyell: I wish to draw attention to the tremendous working relationship established between my ancestor, my great-great-great-uncle Charles Lyell, and Darwin. I declare my interest as the great-great-great-nephew of Sir Charles who went on to become the first professor of Geology at King's College, London – not without some opposition from the ecclesiastical establishment.

Baroness Sharp of Guildford: In the year of Darwin's bicentenary it is worth emphasising one of the central tenets of scientific research and method. By definition research is about experimentation. If we undertake experiments, almost by definition we do not know what the outcome will be. Increasingly the Government are putting pressure on scientists to identify when putting forward project proposals what the economic impact will be with the danger that only low-risk projects that are well tried and tested will be taken up.

Systematics and Taxonomy (S&TC Reports)

Debate in House of Lords Grand Committee on Wednesday 25 March

Lord Sutherland of Houndwood: In introducing this debate I pay tribute to those who prepared and published two previous reports on relevant and related matters: the late Lord Dainton, whose report was published in 1992, and Lady Walmsley whose report was published in 2002. Taxonomy is the scientific discipline of describing, delimiting and naming organisms, both living and fossil, and systematics is the process of organising taxonomic information about organisms into a logical classification that provides the framework for all comparative studies that are the foundation of our understanding of biodiversity in the natural world.

Changes in biodiversity can be either consequences or harbingers of climate change. Our ability to measure changes in biodiversity requires the skills of taxonomy and systematics. The implications of these measurements for food supply and safety are central to our capacity as a race and as a society to prepare for that change. If changes in biodiversity have such potential gravity, the importance of the study of taxonomy and systematics is beyond question. These disciplines are essential for our survival as a human race.

In this country we have three of the most important collections in the world, the Royal Botanic Gardens at Kew, the Natural History Museum and the Royal Botanic Garden in Edinburgh. NERC will commission a study about the number of scientists in this area in the future. NERC together with the Natural History Museum will study the national priorities that should be formulated in this area, and NERC and BBSRC will provide funds for the development of a road map for delivery of internet-based taxonomy. The rejection of our recommendation that there should be a lead department in this area is disappointing as it is at the core of our recommendations for several reasons including, for example, the failure on the part of the Government response to consult the regime in Scotland where one of the three great national collections is located in Edinburgh.

Lord Haskel: I am an unashamed supporter of this Government, however during our debate with the Government there has been an exchange of views about the management and culture of science within the Government. Lord Sutherland explained the importance of understanding environmental sustainability. This is why taxonomy and systematics should be firmly in a powerful lead government department, such as DIUS – a department strong enough to halt its decline. At present the responsibility for systematics and taxonomy is spread over many departments.

The Earl of Selborne: One current problem concerns descriptive taxonomy where there has to be some determination of priorities. We can probably list all the plants and vertebrates. In 2010 we are due to do what Darwin asked for – that is to produce the definitive list of plants in the world. However, no one is going to attempt to do that for invertebrates or nematodes and many other such species. The other problem, which is always being addressed by the taxonomic community, is that taxonomy in universities has melted away, or at least there is very little left. Our three reports seem to suggest that the United Kingdom is particularly bad in this respect, but it is also true of Europe and other countries. Therefore the obligation to do training and research in taxonomy falls more and more on the national centres of excellence: the Natural History Museum, Kew, Edinburgh and regional universities, although the application of modern techniques that rely on DNA sequencing clearly does happen in universities and is a growth area.

Lord May of Oxford: The first of two hobbyhorses I wish to ride pertains to the Department for International Development. Our committee recommended in its report digitisation projects on the biodiversity conservation and sustainability needs of developing countries, which is a paraphrase of DfID's stated priorities; that is the sustainability needs of developing countries. DfID's response was to reject that recommendation on the ground that it did not match its priorities. There are two more serious themes, namely the lack of a lead department to co-ordinate addressing issues which involve various combinations of at least six government departments: DIUS, DfID, Defra, DCMS, FCO, and Research Councils UK. The second of my concerns is the seeming lack of awareness of the nature of the subject of taxonomy and systematics, within Research Councils UK more generally. Particular emphasis was laid on the Natural Environment Research Council, whose approach was, we found, 'confused', but there is a more general failure of co-ordination in Research Councils UK.

Lord Soulsby of Swaffham Prior: When exotic disease strikes this country, as it has with bluetongue, there is a scramble for experts who can identify the transmitting insects – the Culicoides, or midges, as they are often called – to assess the vector potential of the various strains of the midge. Although we do a reasonable job, we have to rely somewhat on people on the continent of Europe to help us out. The number of species in the phylum Arthropodium is massive. Many of them are still unknown and likely to remain so until we have many more people looking at them in detail. The dearth of entomologists and the lack of entomological training are an important issue. That should be compared with the vertebrate situation where, with few exceptions, the fauna is well known, well studied and well written up.

Lord Krebs: I re-read my contribution to the 1992 Dainton report just before the debate and the questions that we are raising now have a depressing ring of familiarity about them. It is almost as though there has been a dialogue of the deaf between the Select Committee and the taxonomy community on the one hand, and the Government on the other. I hope that the Government's ears are open and listening today.

Baroness Walmsley: One of the Committee's most serious complaints was about the lack of awareness at Research Council level of the problems of taxonomy. We welcome the forthcoming NERC study but it is vital that it makes an effort to not only count taxonomists but to understand how they work. Quoting directly from Dr Henry Disney, University of Cambridge, she said, "NERC still fails to understand the way a leading specialist in alpha taxonomy works. This remains a major reason for the current decline in fundamental alpha taxonomy. As a recognised leading specialist on a large family of flies … I am representative of those who are unable to procure funding from NERC because of their inappropriate criteria."

Lord De Mauley: I noticed no reference to Europe in the Government's response. What effort, if any, are they making to co-ordinate work on taxonomy and systematics with our fellow members of the EU? It would be interesting to know what co-operation was going on across the Atlantic.

The Minister of State, Department for Innovation, Universities and Skills (Lord Drayson): It is the Government's aim to ensure that this country maintains its position as a leading science nation. Systematics and taxonomy are important to the research base, and we are committed to protecting and strengthening them. They are essential underpinnings to work on biodiversity, understanding ecosystem services and climate change and also stimulate sheer intellectual curiosity. Economic aspects are exemplified by UK taxonomists, who identified the mealy bug attacking cassava in Africa and its natural enemy in South America.

Their discovery led to savings of up to $20 billion. The Government accepted 20 of the 25 recommendations produced by the committee. However, other concerns expressed in the debate will be taken back to the department and looked into further. The forthcoming review by NERC will be led by an expert committee that will examine NERC's four-year strategy and determine which aspects will require new taxonomic knowledge and skills, and make recommendations on how these skills will be met. This will be followed by a further assessment of the need for a lead department in this discipline. In my role as Science Minister with a seat in Cabinet I presently have an opportunity for discussion of cross-departmental issues and decision taking. I am presently unsure whether locating responsibility in a single department such as DIUS would be an appropriate solution. However, I am prepared to look at the matter again, based on data which comes out of the NERC review.

Lord Sutherland thanked all the contributors with a reference to Butch and Sundance, bank robbers fleeing the forces of law and order over desert and mountain, when one turns to the other and says "Who are these guys?". The answer in this case will clearly be Selborne, Walmsley, Soulsby, Krebs and May, who have already been at it for 17 years and will, I hope, be ably supported by those of us who are rather newer to the game.

Clinical Trials: EU Law

Question and Written Answer on Tuesday 31 March

Mr Todd (South Derbyshire): To ask the Secretary of State for Health whether he has made an assessment of the impact of the EU Clinical Trials Directive on medical research activity in England; and if he will make a statement.

Dawn Primarolo: The Medicines for Human Use (Clinical Trials) Regulations 2004 transpose the provisions of the EU Clinical Trials Directive into United Kingdom law. UK stakeholders were widely consulted before implementation and continue to provide feedback.

The pharmaceutical industry has consistently confirmed that it is content with the broad thrust of the Directive, and that it reinforces systems and practices to which it already conforms. In collaboration with partners in the UK Clinical Research Collaboration, including research charities, the Medical Research Council and universities, the Government is in dialogue with the research community about further opportunities to reduce the burden of regulation, taking account of risk. Departmental officials have arranged a workshop on dismantling barriers to clinical research for 30 April 2009.

The challenges to medical research arise only in part from the implementation of the Directive. In 2006, the Government published a comprehensive health research strategy Best Research for Best Health setting out a range of measures to transform the health research environment. These measures have begun to take effect. A copy of the strategy has already been placed in the Library.

A UK-wide regulatory and governance advice service now gives researchers free access to expert advice regulation. Research ethics committees are now organised in a national research ethics service which facilitates and promotes ethical research by maintaining a consistent UK-wide system of ethical review. An integrated research application system now offers a single point from which to apply for permissions and approvals for health and care research in the UK, enabling researchers to enter the information about their project once instead of duplicating information in separate application forms. The National Institute for Health Research co-ordinated system for gaining National Health Service permission will standardise and streamline the process for gaining NHS permission in England. These measures are reducing approval times and bureaucracy.

The Medicines and Healthcare products Regulatory Agency publishes information monthly and in its annual report on the number of applications for clinical trials of medicines in the UK. The data show that the total numbers of clinical trials in the UK have remained stable since the implementation of the Directive. There are 3,000 trials currently active in the UK of which some 25 per cent are from non-commercial sponsors, the highest figure in the European Union.

Representatives of many UK stakeholders contributed to a European Commission conference in October 2007 on the operation of the clinical trials directive and perspectives for the future. The conference identified the perceived benefits and difficulties and made a number of recommendations for change. The Commission has since announced it will make an assessment of the application of the Directive with a view to making legislative proposals by 2010.

Science: Research

Question and Written Answer on Thursday 2 April

Dr Kumar (Middlesbrough South and East Cleveland): To ask the Secretary of State for Innovation, Universities and Skills what assessment he has made of the adequacy of levels of research funding for science subjects in (a) Russell Group universities and (b) other universities in 2009-10; and if he will make a statement.

Mr Lammy: Government funding for research in science and other subjects is now at record levels, with DIUS funding set to reach almost £6 billion by 2010/11. Research funding for universities is allocated on the basis of excellence – through the RAE in the case of the HEFCE Quality Related (QR) block grant, and through peer review of projects in the case of Research Councils. In relation to the recent HEFCE block grant allocation, HEFCE have safeguarded the proportion of funding going to Science Technology Engineering and Maths (STEM) subjects.

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

GLOBAL FOOD SECURITY: MORE EUROPEAN INITIATIVES NEEDED SAY MEPS

The European Parliament calls for "immediate and continuous action" to ensure global food security. It believes the aid of €1 billion that the EU has decided to give to developing countries should be accompanied by fresh investment in agriculture and it calls for mechanisms to be set up to ensure that sufficient global food stocks are available. In the space of two years world food prices have increased by over 80% on average while cereal stocks have fallen in 2008 to a worrying historic low of 40 days' supply. According to the World Bank, over 860 million people in the world are facing chronic famine and this figure could rise by 100 million as a result of the current crisis. Commodity prices have fallen back to near-2006 levels but the Food and Agricultural Organisation (FAO) and Organisation for Economic Co-operation and Development (OECD) fear they may fluctuate more, and global food demand is expected to double by 2050.

ENSURING ADEQUATE GLOBAL STOCKS

Among the many measures proposed in the report, the European Parliament calls for the introduction of instruments to avert dramatic and damaging price fluctuations. It argues that the EU should take the initiative by proposing a global food inventory regime, the creation of a worldwide stockholding obligation programme to ensure the availability of food and a better basic storage system for key production inputs (protein, fertilisers, seeds, pesticides) in developing countries, preferably based on private-sector players including farmers' co-operatives. MEPs also call for a global assessment of the impact of the increase in biofuel production on commodity prices. They stress the need for international and regional agreements to ensure that energy crops do not jeopardise food security and they urge a firm commitment from the EU to give priority to second-generation biofuels which do not compete with food production.

REDIRECTING EU DEVELOPMENT TOWARDS AGRICULTURE

The House regrets the reduction in the amount of development aid being devoted to agriculture, which was 17% in 1980 and only 3% in 2006, and urges the Commission to direct EU financial aid – including the European Development Fund (EDF) – towards agricultural-led growth and to do all in its power to induce Governments of beneficiary countries to stick to their promise to devote 10% of national budgets to this sector. They also want new micro-credit facilities to be set up for small farmers, stressing the role such farmers can play in increasing production and in local food security. To complement the other development measures funded by the EU, MEPs call for a permanent food-security fund to be created in support of the world's poorest people, under Heading 4 of the EU general budget.

CAP, CLIMATE CHANGE, FINANCIAL CRISIS AND EUROPEAN RESEARCH

The European Parliament believes the common agricultural policy (CAP) must remain the cornerstone of EU food security policy now and beyond 2013 and that it should be adapted to go further than the measures contained in the Health Check. It also calls for EU agriculture spending to be kept at a stable and constant level to guarantee a fair income for farmers and for effective insurance policies to be made available to protect producers against massive price fluctuations. MEPs urge the Commission to look at the impact of climate change mitigation initiatives in the agriculture sector and to provide resources for this sector so that such initiatives do not depress EU farm output. They also call for a detailed assessment of the impact on food security of proposed EU legislation on plant protection products and an analysis of the effects of the global financial crisis on the agricultural sector. Lastly, the House calls for a programme of research and development on sustainable agriculture.

EU REACHES AGREEMENT ON 2009 FISH QUOTAS

EU Fisheries ministers reached agreement on 2009 fish quotas, with a big increase in permitted catches of cod in the North Sea but cuts elsewhere. They also agreed to tackle the problem of fish that are thrown back and left to die because they are too small, the wrong species or because fishermen do not have a quota to bring them back to market. Under the agreement, North Sea cod quotas will be raised by 30 per cent from 2008 levels, the first big increase in a long time.

While quotas will be lifted, fishermen will have to use nets and gear that allow more targeted catches so that they can avoid wasteful discarding. Non-governmental organisations argue the quotas set each year by ministers are deceptive because they only reflect the fish brought to shore and not those thrown away beforehand. "We are witnessing a scandalous wasting of millions of tonnes of fish each year in the North Sea. That must end," said WWF Germany campaigner Karoline Schacht. She said in the case of cod that "for each fish caught another is thrown away." In other Atlantic fishing zones, cod quotas will be cut on average by the 25 per cent recommended by the European Commission with the exception of the Celtic Sea south of Ireland.

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Biotechnology and Biological Sciences Research Council (BBSRC)

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Economic and Social Research Council

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Natural Environment Research Council

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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

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

Association of the British Pharmaceutical Industry

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

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

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

Association of Marine Scientific Industries

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

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

The Academy of Medical Sciences

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The 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.

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E-mail: rdyer.bsf@physoc.org
Website: www.bsf.ac.uk

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

British Science Association

Contact: Sir Roland Jackson Bt,
Chief Executive
British Science Association,
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London SW7 5HD.
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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 0740 Fax : 020 8871 9779
Website: www.BritishEcologicalSociety.org
Ecology into Policy Blog
http://ecologyandpolicy.blogspot.com/

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

British Nutrition Foundation

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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
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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

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

British Society for Antimicrobial Chemotherapy

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Executive Director
British Society for Antimicrobial Chemotherapy
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W: www.bsac.org.uk

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

CABI

www.cabi.org

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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

UNIVERSITY OF CAMBRIDGE

The Administrative Secretary, The Cavendish Laboratory,
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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

Founded 1882 Royal Charter 1891

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

Clifton Scientific Trust

CLIFTON SCIENTIFIC Trust

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

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

- for young people of all ages and abilities
- experiencing science as a creative, questioning, human activity
- bringing school science added meaning and 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

C-Tech Innovation ...advantage through technology

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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

etb

Contact: Clare Cox
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Fax: 020 3206 0401
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The Engineering and Technology Board (ETB) is an independent organisation that promotes the vital role of engineers, engineering and technology in our society. The ETB partners business and industry, Government and the wider science and technology community: producing evidence on the state of engineering; sharing knowledge within engineering, and inspiring young people to choose a career in engineering, matching employers' demand for skills.

The Food and Environment Research Agency

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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

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

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

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

Human Fertilisation and Embryology Authority

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

Institute of Biology

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

IOP Institute of Physics

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

Institute of Physics and Engineering in Medicine

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

IChemE

Institution of Chemical Engineers

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

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Institution of Civil Engineers

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

Institution of Engineering and Technology

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

KEW GARDENS

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

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

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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 India.

Lilly and Company Limited

Answers That Matter.

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

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

London Metropolitan Polymer Centre

Sir John Cass Department of Art, Media & Design

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

Marks & Spencer Plc

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

We have over 620 UK stores, employing over 75,000 people - 278 stores internationally in 39 countries.

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

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

The National Endowment for Science, Technology and the Arts

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

National Physical Laboratory

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

Natural England

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

Natural History Museum

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

Newcastle University

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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

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

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

Principal activities include:

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

PHARMAQ

PHARMAQ Ltd

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Website: www.pharmaq.no
http://www.pharmaq.co.uk/shop

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

Plymouth Marine Sciences Partnership

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

Prospect

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

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

The Royal Academy of Engineering

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

The Royal Institution

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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

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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

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Parliamentary Affairs
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Website: http://www.rsc.org
http://www.chemsoc.org

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

The Royal Statistical Society

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

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Semta - working with employers to improve performance through skills

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

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

Society for General Microbiology

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

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

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

Society of Cosmetic Scientists

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

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

Universities Federation for Animal Welfare

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Registered in England Charity No: 207996

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

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

SCIENCE DIARY

THE PARLIAMENTARY AND SCIENTIFIC COMMITTEE

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www.scienceinparliament.org.uk

Tuesday 16 June 17.30
Medical Testing – Do we want more or less of it?
Professor Michael Baum, Professor Emeritus of Surgery and Visiting Professor of Medical Humanities, University College London

Professor Karol Sikora, Professor of Cancer Medicine and Hon Consultant Oncologist, Imperial College School of Medicine and Scientific Director, Medical Solutions PLC

Tuesday 7 July 08.30
Breakfast Briefing
Nanotechnology – should we be worried?
Dr Alec Reader, Director Nanoktn
Dr Stephanie Lacour, Nanoscience Centre, University of Cambridge

Tuesday 14 July 17.30
Carbon Capture and Storage – Will It Work?
Charles Hendry MP, Shadow Minister for Energy
Dr Andy Read, Clean Coal Development Manager, Project Manager, CCS Project Kingsnorth Power Station, E.ON UK

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.

Tuesday 26 May 19.00
Quiz night

Thursday 28 May 19.00
Physics of the impossible
Dr Michio Kaku

Monday 1 June 19.00
The fiction lab

Thursday 4 June 19.00
An evening with Martin Rees
Martin Rees

Saturday 6 June, drop in between 11.00 & 16.00
June Family fun day

Tuesday 9 June 19.00
Whatever is the matter?
Tom Wyntie

Monday 15 June 19.00
June café scientifique

Wednesday 24 June 19.30
Eureka! How do you make a great inventor?
Phil Willis MP
Baroness Greenfield

Thursday 25 June 19.00
The evolution of animal and human cultures
Prof Andrew Whiten

Monday 29 June 19.00
Science around the world

Saturday 4 July, drop in between 11.00 & 16.00
July Family fun day

Monday 6 July 19.00
Fiction lab

Wednesday 8 July 19.00
Building bridges between genes, brains and language
Dr Simon Fisher

Wednesday 15 July 19.00
The science of scent: Capturing new smells
Will Andrews

Monday 20 July 19.00
July café scientifique

Monday 27 July 19.00
Quiz night

THE ROYAL SOCIETY

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

Highlights in the next few months include:

Monday 1 & Tuesday 2 June (all day)
New frontiers in science diplomacy

Tuesday 30 June – Saturday 4 July
Summer Science Exhibition 2009

With 20 fascinating, diverse and interactive exhibits ranging from how fluorescent fish could provide better understanding of human diseases, to a chewing robot that can help us develop dental technology, to how new space missions could help to unlock the history of the universe, the Summer Science Exhibition is a brilliant chance to meet and talk to the scientists behind the research.

Opening times:
Tuesday 30 June: 10.00 - 21.00

Wednesday 1 – Saturday 4 July: 10.00 - 17.00

The exhibition is FREE to attend and open to all.

All Royal Society lectures are available from the Royal Society website. The collection includes over 200 lectures with speakers including David Attenborough, Eleanor Maguire 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

Wednesday 24 June 10.30

Parliamentary Links Day 2009
Science and Global Security
Free admission by invitation.

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 15 June 18.00

Ripples from the Dark Side of the Universe – the Search for Gravitational Waves
Gunning Victoria Jubilee Prize Lecture
Professor J Hough FRS FRSE

Wednesday 17 June 18.00

Malaria, Mosquitoes and Models
Professor Charles Godfray FRS
Public Lecture

BRITISH SCIENCE ASSOCIATION

Monday 22 & Tuesday 23 June

Science Communication Conference
At Kings Place, London

Organised by the British Science Association in partnership with the Wellcome Trust, this year's conference addresses behaviour and choice – exploring the role that science communicators should or could play as influencers of behavioural change. The keynote speaker, Jonathon Porritt, will talk about influencing choice with regard to environmental issues. Policy makers, funders, science educators and more will be there to discuss a range of issues affecting the field of science communication.

Full programme:
http://www.britishscienceassociation.org/ScienceCommunicationConference

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ROYAL PHARMACEUTICAL SOCIETY OF GREAT BRITAIN

Contact: events@rpsgb.org

www.rpsgb.org/events

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Wednesday 10 – Thursday 11 June

IMFAIR 09
Coating and Surface Technology for the Aerospace industry
Conference and Exhibition
Royal Air Force Museum Cosford, Shropshire

SCIENCE IN PARLIAMENT sip

3 Birdcage Walk, London SW1H 9JJ
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