Whitsun 2008

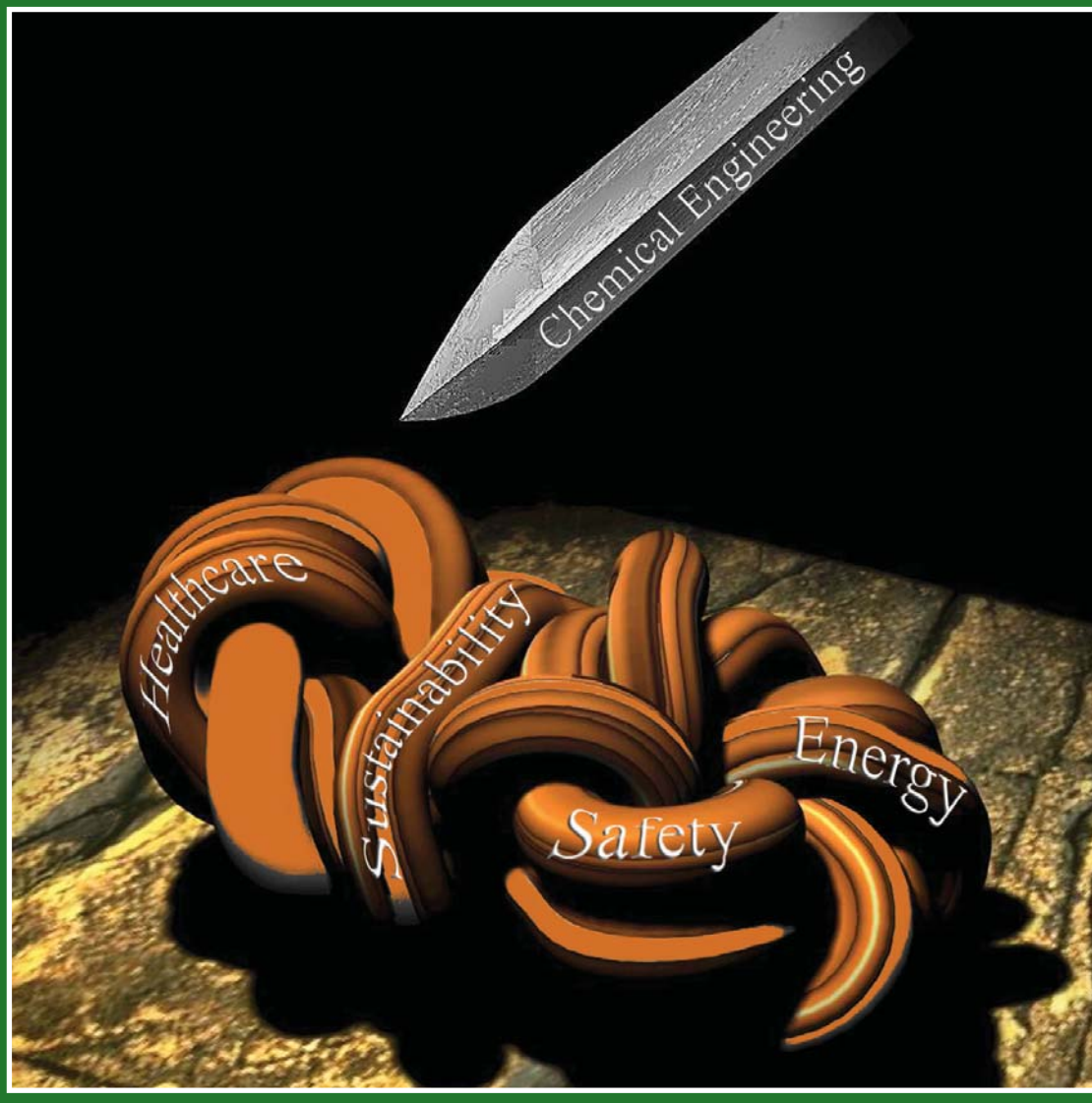
SCIENCE IN PARLIAMENT

Bioethics

New Diseases

Business Needs Scientists and Engineers

Science in the Regions



Chemical engineering tackles the 21st Century Gordian Knot

engineering TOMORROW

Meet some of the leading researchers of today and tomorrow at the Engineering and Physical Sciences Research Council reception, sponsored by Mr Phil Willis MP.

House of Commons Terrace Pavilion 7pm, 7th July 2008.

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SCIENCE IN PARLIAMENT

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

The Parliamentary and Scientific Committee

We are preparing for the Second Reading debate in the HoC of the Human Fertilisation and Embryology Bill. Unlike in the HoL, the Government has conceded free votes for Labour Members on issues of conscience, which are likely to be on admixed hybrid embryos, the need for a father and saviour siblings, as well as on any amendments to the Bill on abortion.

Chemistry & Industry (2008, 7 April, 5) reports that Pfizer, in its lawsuits with 3,000 individuals and organisations over its sale of COX-2 inhibitors, has failed to make the *Journal of the American Medical Association* and the *Archives of Internal Medicine* reveal the names of their peer reviewers. Had Pfizer been successful in this court battle there would have been serious consequences for the publishers of all learned journals.

The publication by Duckworth Overlook of Nigel Lawson's book, "An Appeal to Reason", a sceptical look at climate change, is timely in view of Parliamentary consideration of the Climate Change Bill.

Government has decided to launch a carbon capture and storage competition to clean up coal burning power plants with post-combustion technology. Would it not have been better to give pre-combustion carbon capture an equal chance of success to kick-start the hydrogen economy? The race is on, but Japan has the clear lead at this point in time.

Nature (2008, **452**, 674) has revealed that, of 1400 scientists surveyed in 60 countries, one in five had used methylphenidate (better known as Ritalin), modafinil, or beta-blockers to enhance their cognitive performance.

The controversial Galileo project finally got off the ground on 27 April with the launch of the second and final test satellite Giove-B, put into orbit by a Soyuz rocket in Kazakhstan. It carries the most accurate atomic clock in the world. This is Europe's equivalent to the US GPS system for navigation.

Dr Brian Iddon MP
Chairman, Editorial Board
Science in Parliament

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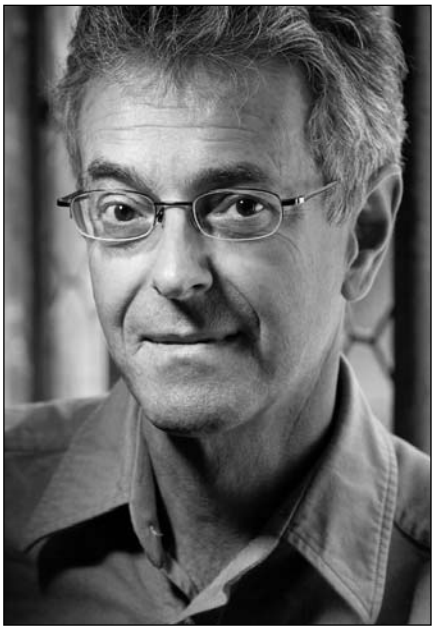
Front cover: The Gordian Knot - often used as a metaphor for an intractable problem solved by a bold stroke. (credit: Piotr Pieranski, Poznan University of Technology, Poland)

ISSN 0263-6271

Professor Lord Krebs Kt FRS



In recent years, much has been said and written about evidence-based policy, and the UK has exceedingly good structures and processes in place to ensure that ministers and officials have access to high quality advice on science, including the social sciences, that are so important in many policy areas.

This is not to say that there should be a simple linear flow from scientific advice to policy, since many other factors, including ethics, feasibility, acceptability, costs and benefits come into play as science is woven into the fabric of policy decisions.

But the scientific waters may themselves get muddied and this can cause extra difficulties for policy makers.

The media are far from blameless in this. Although the science correspondents of the serious newspapers and the BBC are excellent, science reporting may go awry when it gets into other hands. On March 28th, as I sat down to draft this piece, the Times carried a headline on page 15 that stated: *"Mother told me of child's autism after MMR jab, doctor claims"*. The cursory reader of this irresponsible piece of journalism could be forgiven for thinking that the issue of whether or not MMR causes autism, that has caused thousands of parents to put their children at unnecessary risk, is still live. In fact the article was about Andrew Wakefield's appearance in front of the General Medical Council charged with serious professional misconduct.

But what about when the scientists themselves disagree? Disagreement and challenge is central to the process of science. Nobel Prize-winning physicist Richard Feyman defined science as *"organised scepticism in the reliability of expert opinion"*. So it should not be surprising that there is a often a spectrum of opinion amongst scientific experts particularly where the state of scientific knowledge, unlike the textbook certainties of school science, is incomplete. When I was Chairman of the Food Standards Agency, policy decisions on many key issues, from BSE to acrylamide to Sudan 1, were based on assessment of incomplete evidence.

But when different groups of scientific experts look at the same evidence and come to different conclusions, extra confusion is added.

A recent example is the spat between the Royal Commission on Environmental Pollution and the Advisory Committee on Pesticides about the so-called 'bystander effect', the possibility that people living near fields during pesticide spraying suffer ill-heath as a result. The RCEP concluded that it is *"plausible that there could be a link between pesticide exposure and ill-health"* whilst the ACP concluded from the same evidence that *"pesticide toxicity is unlikely to contribute importantly to chronic fatigue syndrome or multiple chemical sensitivity"*. The evidence is not water tight, but surely the two groups would have done themselves a favour, in terms of the credibility of scientific advice for policy, by talking through their differing interpretations?

Another, more recent, example relates to badgers and bovine tuberculosis. My 1997 report concluded that whilst it was clear that badgers do transmit TB to cattle, it was not clear whether or not culling badgers would be an effective control strategy. In response, MAFF/Defra set up the large-scale randomised badger culling trials to investigate the efficacy of culling.

The results suggest that 'reactive culling' (removing badgers from an area in response to an outbreak of TB in cattle) might actually make things worse, perhaps because culling encourages new, diseased animals to immigrate. However, large-scale, proactive and persistent culling can reduce the incidence of TB in cattle by about 25%. Scale is important, because around the edges of the culling area the risk of TB increases, possibly because of the immigration effect. The minimum area for a net benefit is 250 to 300 km^2. Even then the disease would not be eliminated.

The Independent Scientific Group set up to oversee the culling trials concluded that large-scale culling should not be adopted, whilst a smaller group, with less expertise, meeting for a day under the chairmanship of the then Chief Scientific Adviser, concluded the opposite. Perhaps based on this, the Welsh Assembly Government has announced that it intends to go ahead with a cull in areas where TB is a particular problem (hotspots), although in England, Defra has not yet decided.

If scorched earth culling were adopted over all the hotspot areas in the South West and South Wales, an estimated 170,000 badgers would be killed, well over half the UK population. Even then, success is not guaranteed: in the Republic of Ireland, scorched earth culling did lead to an initial decrease in TB, but last year there is a reported 15% increase. Alternatives such as improved testing and incentives to keep badgers away from cattle would cost less and be at least as likely to work. However, if ministers are expected to implement evidence-based policies, the scientists must be expected to be clear and consistent in their advice.

OPINION

Rt Hon John Denham MP

Secretary of State for Innovation, Universities and Skills

The Prime Minister created the new Department for Innovation Universities and Skills on his first full day in office.

He recognised that, in a rapidly changing world, Britain can only succeed if we develop the skills of our people to the fullest extent; carry out world-class research and scholarship; and apply both knowledge and skills to create an innovative and competitive economy.

DIUS therefore brings together three strands of policy that will determine our future economic and social wellbeing – by creating the right conditions for prosperity, improved quality of life, and a country where no-one is left behind.

As the Secretary of State, Gordon Brown asked me to put science and research at the very centre of Government policy.

Of course, the longstanding excellence of our research base means that the UK has a strong story to tell. It is second only to the United States in terms of global influence. With just one per cent of the world's population, we undertake 4.5 per cent of the world's research, produce nine per cent of the world's scientific publications and claim 12% of world citations. More than that, our research base is a powerful engine for the UK economy: attracting inward investment, translating discoveries into profitable spin-outs and forging effective international links.

These achievements do not happen by chance. I pay tribute to the imagination and expertise of our scientists. Their breakthroughs benefit every one of us.

But our reputation for science is also driven by serious investment. By 2010/11 my department will be spending almost £4 billion a year on science. That's a 17 per cent increase in funding over three years, and double the amount spent in 1997.

Add to this the £2 billion we provide directly to English universities via HEFCE's quality-related funding stream, and total support will amount to almost £6 billion for research – more than at any time before.

In challenging economic circumstances, other countries have not been so generous. The USA has seen below-inflation increases for the fourth year running, with cuts to areas including particle physics and fusion. Settlements in Germany and Australia fall well behind the real-terms increases delivered in the UK.

Still, the UK's investment is fully justified. With people, money and knowledge ever more mobile in a global economy, and powerful nations re-emerging with great ambitions in research, we must maintain our competitive advantage. Furthermore, we face a set of major challenges. We need to secure sustainable energy sources, tackle the changes occurring to our environment and better understand the nature of the security threats facing our country.

When I set out the details of the science budget, I therefore announced details of four thematic programmes under the auspices of the research councils. Almost £1.3 billion from the science budget will fund work on energy, the environment, ageing and global security.

These programmes represent an unprecedented effort to make headway on these universal challenges and position the UK to capitalise on the opportunities presented by globalisation.

I am confident that the multi-disciplinary efforts of our scientists will yield new insights. But to maximise the impact of their research, it is essential that we improve public engagement with science, and increase the influence of scientific evidence on public policy.

It was 50 years ago that C P Snow gave his famous "Two Cultures" lecture, in which he complained that as "the great edifice of modern physics goes up, the majority of the cleverest people in the western world have about as much insight into it as their Neolithic ancestors would have had."

We have, of course, made progress since the Fifties. Yet the importance of scientific understanding has never been greater.

If policy makers do not have access to the latest scientific evidence and advice, we will not be able to make the best decisions about the challenges facing this country. If the public do not understand scientific methodology and cannot evaluate risk, they face being unable to make the best decisions for themselves and their families.

For these reasons, DIUS's forthcoming "Science and Society" strategy is vital. Our vision is that Britain should be "excited about science, value its importance to our economic and social well being, feel confident in its use and support a representative, well qualified workforce."

Similarly, it is impossible to think of a policy area, or a Government department where science does not make an important contribution. Our recent Science and Innovation White Paper sets out how we intend to bring the fruits of new and existing technologies to bear in both the private and public sectors.

I'm a great admirer of C P Snow, but his predictions for the future were sometimes wide of the mark. I would like to think that Britain can prove him wrong in the 21st century by harnessing the excellence of our science base and appreciating its contribution to our society.

100 days as the Government Chief Scientific Adviser

Professor John Beddington CMG FRS

Government Chief Scientific Adviser and Head of the Government Office for Science

I am now three months into my role as the Government Chief Scientific Adviser (GCSA), and am beginning to see the scale of the task ahead. This is an exciting and challenging time to be advising the Prime Minister and Cabinet – I doubt if the potential for science and engineering to contribute to good policy making and sound government has ever been greater.

Science and engineering will help us to address the main challenges we face as a nation, and as a planet – adapting to climate change, global security and international terrorism, rising populations and the consequent pressure on food, water and other natural resources and the impact of human and animal diseases.

These challenges are deeply interconnected. To tackle them will take important cross-department and multi-agency relationships. I see a vital part of my leadership role as working in partnership with others in Government and beyond – in the UK and overseas. Clearly I have the privilege to be working with many talented people. The challenge is to identify where there is a need for stronger leadership and co-ordination, so that we can bring the power of those combined talents to bear on the problems we are facing.

The Government Office for Science (GO-Science), which I lead, lies within the Department for Innovation, Universities and Skills (DIUS). This provides valuable opportunities for us to interact with the Science Minister, Ian Pearson and the Secretary of State, John Denham as well as the newly appointed Director General of Science and Research, Adrian Smith.

A crucial resource is the network of chief scientific advisers (CSAs) who operate within most Government Departments and I am now meeting with a "core issues" group of CSAs every three weeks. I am also arranging for regular meetings with the CSAs and the Chief Executives of Research Councils.

I also believe it is vital that the CSAs co-ordinate their efforts and advice. Within the CSA group, I have begun to set up subgroups to focus on key problems across departments. We now have a Climate Change/Food Security subgroup, which should help harmonise scientific advice that can seem on the surface to conflict. I am thinking for instance of the recent issue of biofuels, where the environmental impacts (DEFRA) suggested different approaches from the renewable energy obligations (DfT). We are also looking at the possibility of similar cross-department co-ordination for Infectious Diseases and other areas.

Wider World

But the need for co-ordination goes beyond the networks within Government. Many of the problems we are facing over the next few decades – climate change, food security, energy and infectious diseases – are global in nature and will require global solutions.

On a government level, I was impressed by the willingness of China to collaborate on these issues when I met Minister Wu at the UK-China Joint Commission on Science and Technology in London on 16 April. One pleasing example is that our two countries are collaborating on a project to investigate the potential for near-zero emissions coal (NZEC) power plants and on vaccines for avian influenza. This is all the more important considering China's current extraordinary pace of economic growth and its impressive expansion in science and technology.

Such collaborations involve not just governmental agreements but the co-operation of scientists and engineers too. The UK's Medical Research Council has recently signed memorandums of understanding with the Chinese Academy of Sciences, the National Natural Science Foundation of China and the Chinese Academy of Medical Sciences – an excellent example of co-ordinated efforts in action. Further opportunities for us to promote such international co-operation should come when DIUS takes over leadership of the Science and Innovation Network, which comprises more than 100 science attachés based in UK embassies overseas.

Climate Change

Climate change is of paramount importance. We must radically curb global emissions and we must adapt to those changes that we cannot avert. Robust international agreements and policy frameworks will be critical. But a key priority is also to fully mobilise the practical skills of our engineers. We will need to bring engineers into Government in a much greater way than before.

The Energy Technologies Institute is a key organisation and I am delighted to have been invited to join its Board. Jointly funded by Government and the private sector, the Institute will

identify the most promising low carbon technologies from research and accelerate these towards market readiness.

I am also impressed by the Carbon Trust. With the Government-led goal of carbon reduction but with the freedom of an independent company, the Carbon Trust offers everything from support for research through to venture capital and advice to business.

At the strategic level, I have been delighted to contribute to the Energy Research Partnership. Initially established and partly driven by GO-Science, the Partnership brings together key individuals at senior levels from across the public sector, business and research, to focus on raising the scale, impact and coherence of the UK's low-carbon innovation investments and activities.

Together approaches such as these will lead us towards the energy savings we need in buildings, transport and infrastructure, while seeking alternative low-carbon energy sources.

Food security

Less widely acknowledged until recently, but potentially just as serious as climate change, is the related problem of food. The world's population is now increasing by 6 million individuals per month. Moreover the burgeoning economic growth in Asia (mainly China and India) is taking people out of poverty and giving them more purchasing power. As a result they are asking for the reasonable things that we all take for granted: meat and dairy foods, which take considerably more production power than simple grains. Thus demand for food is predicted to increase by a full 50 % in the next two decades, and the very proper goal of alleviating poverty is presenting us with a major issue of food production.

Until now, science and technology have ensured that agricultural production keeps pace with increased demand. But new factors have emerged to decrease the supply of food just when demand is rising ever farther.

One such is the rise of biofuels. In principle they can help to mitigate climate change. But in practice, using an agricultural product for energy means that it becomes more scarce, and the price of food sky rockets. The resulting shock to world agriculture is a stark reminder of how interrelated the problems of food, energy and climate change really are. However, biofuels have great potential for good and proper scientific analysis is essential to discriminate between the sustainable and unsustainable.

In addition there is the problem of water shortages. One factor in this is urbanisation and the growth of megacities. By 2030 60% of the world's population will be living in cities, and competing with farmers for water. Moreover, climate models suggest that water availability will begin to decrease in many parts of the world. Indeed this may already be happening – the high price of wheat today is in part due to recent extensive droughts in Australia.

Following a food prices summit on 22 April 2008 with leading experts, the Prime Minister pledged £30m to support the World Food Programme to address the problem in the short term. He has also recognised the need for longer term technological solutions, for example developing higher-yielding and more climate-resilient varieties of crop.

This is especially important as I do not believe that the extent of the recent price increases for food can be dismissed as a short term phenomenon. All of the factors I have described – climate change, population growth, water availability, growth in biofuels, the shift towards a meat-eating diet in developing countries – will bring more sustained upwards pressure on food security and prices. Somehow we will have to satisfy those demands while also addressing climate change. I am considering the possibility of starting a new Foresight project later this year to look at the future of food and farming systems in a global context.

The bottom line is that agriculture will need to deliver more food, and more crops for energy, on less land and using less water. The only way to do this will be to improve agricultural production using the best science and technology. We need a new green revolution.

Problems at Home

The problems I have been discussing also have a serious impact here in the UK. For instance, wheat is now three times the price it was three years ago, so naturally farmers are planting much more – with implications for biodiversity. GO-Science includes the Foresight and the Horizon Scanning teams and we are about to begin an extensive Foresight project on land use in the UK. Moreover, the inflationary effect of increased food prices clearly hits the poorer sections of our society as a higher proportion of income is spent on food, which provides an uneasy parallel with the developing world.

There are many other problems on the horizon which scientific knowledge will be vital to address. For instance, the Foot and Mouth outbreak in Surrey last year and the recent emergence of bluetongue both pose a stern reminder of the need for research into animal diseases. This is important for humans too. If H5N1 virus – avian flu – mutates to transmit itself readily between humans the consequences will be very serious. Pandemic Influenza occurred three times in the twentieth century and there is no reason to believe it will not recur in the 21st Century.

All of these problems are complex and all will need fully co-ordinated solutions. I am a firm believer in the power of integrated approaches. I started academic life as an economist and, before I became GCSA, my research involved applying both science and economics to the effective use of natural resources.

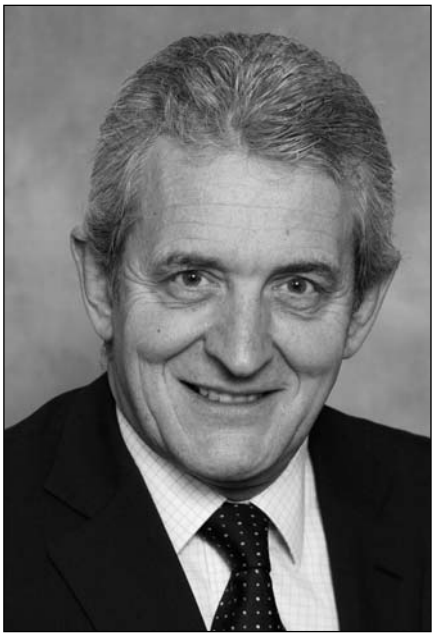
My new position puts me at the Head of the Science and Engineering Profession in Government. My task for the next five years is to lead those talented scientists and engineers whose expert guidance the Government urgently needs. I intend to provide them with an environment in which they will develop a spirit of camaraderie, networking, and interchange of ideas. The problems we face both in the UK and in the world at large are formidable. But I strongly believe that together, through the powerful collaboration that I envisage between science and engineering, business and government, we will find ways to solve them.

Science in the Home Office:

The Role of the Chief Scientific Advisor Fighting the Bad Guys

Professor Paul Wiles

Chief Scientific Advisor and Director, Research Development and Statistics, Home Office



To most people science in the Home Office probably relates to using DNA or finger prints in forensic science. Yet despite this, science is playing a broader role in the fight against crime, counter terrorism, developing identity management systems and managing migration.

Science in the Home Office is remarkably diverse and I suspect unique in government with an almost equal divide between physical, social and statistical sciences. The science we fund includes research to protect the public against explosives and chemical, biological, radiological or nuclear (CBRN) threats, technology to support the police and other agencies, including setting standards for protective body armour and less lethal weaponry and investigating new technologies to detect drugs, pioneering the use of biometrics to assure identity, understanding the extent of crime, the effectiveness of measures to reduce crime and the behaviour of those wishing to perpetrate crimes, understanding the drivers and impacts of migration and so on. We fund research both to help evidence-based policy decisions and to support the delivery of policies. For example, our scientists have been involved in designing the security arrangements at Heathrow's new Terminal 5, preparing the security arrangements for the 2012 Olympics in London and provide technological assistance to the police in sensitive, covert operations.

The Home Office also has two important functions regulating the use of science. We are responsible for implementing the Animals (Scientific) Procedures Act 1986, which regulates the use of animals in science, and we have recently appointed a Forensic Science Regulator, whose role is to ensure the scientific quality of forensic evidence in the Criminal Justice System.

With this wide remit it is impossible for me to be an expert in all science relevant to the Home Office or to be intimately involved in each research programme. My role is to be an advocate for the department's science both internally and externally, to be a 'critical friend' of the department's scientists through challenge and assuring quality and to provide a strategic direction to the department's science and ensure we are funding science in the right areas that meets both our immediate and longer-term requirements. Critical to my role is the support I receive from our expert scientific committees. The department has an overall Scientific Advisory Committee and specialist committees that provide advice on the misuse of drugs, the use of biometrics, CBRN research, statistics, economic advice on migration and animal scientific procedures. These committees provide the in-depth advice the department needs often on very challenging issues, and I am always indebted for the time and commitment that committee members give to the department.

I also have a wider role as Government Chief Social Scientist. This UK-wide function is both to champion good social science and its use in government and also to support and develop the government social science community and the quality of its work.

With science and innovation increasingly becoming important in all our lives, the challenges to ensure ministerial advice is based on the latest scientific evidence and that policies are implemented using the most appropriate up-to-date technologies are greater than ever before. This is particularly so in the Home Office, as whilst the majority of science is a force for good, there are those that use the latest technologies and information to subvert the course of justice and disrupt our way of life – therefore it is vital that we, through policies and law enforcement agencies, stay one step ahead.

To achieve this I consider there are three major challenges facing Home Office science, if not all government science, in the next few years: the challenge of integrating the scientific disciplines; the challenge of integrating across government departments; and the challenge of promoting the use of scientific evidence amongst parliamentarians.

The challenge of integrating scientific disciplines is one that has been brought to the fore in recent years, not least since the 2001 outbreak of foot and mouth disease. It was all too easy to see this as purely an animal disease problem, but in retrospect it is clear that it was a wider issue about managing the rural economy, encompassing a much wider range of expertise. Only by thinking more broadly, about whole 'systems', and

integrating the scientific disciplines around such issues will departments be able to provide comprehensive advice to ministers. Most government departments have now published Science and Innovation Strategies and at best these cut across the scientific disciplines to describe the evidence base for developing policies in the future. The Home Office will be preparing its second Science and Innovation Strategy later this year, and this is a theme I want to ensure is embedded in the department's strategy.

I also look forward to developing the integration of the scientific disciplines further through my role as Head of Government Social Research, working closely with the heads of other scientific disciplines and the cross-government Heads of Analysis Group.

However, cross-discipline working is not only challenging for government, but requires changes by scientists: the challenge of working in unfamiliar groupings, and the need to overcome the barriers of language and culture of the different scientific disciplines. Government alone cannot effect change in the wider scientific community and it is important that we work together with other science funders and learned societies. The Research Councils have set an example by establishing RCUK as a means of working more collaboratively.

In addition, most major issues facing the government in the near future will require a cross disciplinary response and I cannot think of a major issue that, at least scientifically, will not require a cross-government response. For example, climate change has long been seen as an environment issue, or at best an environment and development issue. However, climate change will have wide impacts, for example, is likely to have considerable implications for immigration and we are only just beginning to look at its implications for security and crime.

Cross-government working is where I have seen one of the largest improvements during my time in government. The community of departmental Chief Scientific Advisors has grown and strengthened over recent years and has become a positive forum to promote cross-government science. The Security and Counter Terrorism Science and Innovation Strategy is an example of a significant success in this area and is probably the only truly cross-government Science and Innovation Strategy. However, there are many other areas of science that could benefit from this approach. For example, the Home Office is working to develop a co-ordinated cross-government research programme on drug misuse. There needs to be a significant increase in such cross-government research programmes in the future.

Government scientists also need to go beyond co-ordinating within government. To achieve really effective solutions to today's big issues, government will have to work closely with the Research Councils and others to deliver the fundamental research upon which policy-related research can build, and more closely with industry to scale-up research and provide innovative solutions. The latter is particularly important to ensure that new technologies are successfully transferred into on-the-ground implementation and that innovation benefits the UK economy. This is why at the Home Office we work closely with industry suppliers to promote innovation in a wide range of technologies, be it scanners for use in airports, protective equipment for the police, detectors for explosives and so on. It is too early to say how successful the new Technology Strategy Board will be in assisting government in such innovation – but it is a step in the right direction and, I hope, will be influential in promoting exciting private sector innovation for use in the public sector.

The final challenge I see, and perhaps a perennial one in Whitehall, is to ensure that good quality science and evidence feeds consistently into policy development. As I have already mentioned the work of the Chief Scientific Advisors network has helped raise the profile of science. However, as the need to understand how science can improve policy making and delivery has increased, Whitehall has not been immune from the broader decline of scientific education. There are few policy makers who have a sound training in science. This leads to scientists within government having to promote their expertise more vociferously, and having to explain the results of research with more care, particularly when data are equivocal and can be easily misrepresented. The new programme of training in professional skills for government has to ensure that policy makers have a better grasp of using scientific evidence, are more numerate, and understand why innovation is essential for effective government and our global competitiveness and international standing. Not understanding how scientists can support ministers (particularly in the social and statistical sciences) is of real concern and can only be done if scientists, or those with a good understanding of science, are positioned at the highest level of decision making throughout government.

Taking a swab sample to test for possible explosive contamination

The challenges ahead are both difficult and exciting. The role for scientists in government can only increase, as technology and information plays an ever greater part in our lives. However, scientists in Whitehall, must continue to work together to resolve the issues of the day, and they must be prepared to work at senior levels, often outside their scientific-comfort zone, to ensure key decision makers are aware of how science can improve policy making.

Translation in practice

Sir Leszek Borysiewicz PhD FRCP FMedSci
Chief Executive, Medical Research Council

It is an exciting time for UK health research. Strong Government support, additional funding, and a clear strategy for investment – in equipment, in facilities and in people to carry it out – leave us with only one task: to deliver. I'd like to explain how the Medical Research Council, along with its partners in research, are responding to the challenge.

It's now a year and a half since Sir David Cooksey's report, 'A review of UK health research funding', focused the minds of public funders on accelerating the translation of fundamental research into benefits for the person, in health and disease. A generous settlement for the MRC's 'translational research' in the Comprehensive Spending Review (CSR) – an extra £132 million over the next three years – has demonstrated the Government's clear support. Working in collaboration with the National Institute for Health Research (NIHR), the body through which the Department of Health delivers its new R&D strategy, the MRC has published plans to deliver on this investment.

Working in partnership

In his review, Sir David identified the need for an overarching health research strategy to ensure UK health priorities are considered through all types of research. He also proposed measures to help health researchers develop and deliver better therapies for patients, building on the UK's outstanding record in basic health research.

He identified two gaps in translation – first, the translation of basic and clinical research into ideas and products and, second, the introduction of those ideas and products into clinical practice.

We now have a co-ordinated strategy aimed at filling these gaps, built around the advice, priorities and needs of the NIHR, the MRC and the NHS. The strategy encompasses translational, public health, e-health records and methodology research and human capital.

Plan to deliver

The MRC's plans will build on translational activities and schemes that already exist, such as our substantial funding for clinical and pre-clinical research on healthcare innovations, support for MRC and NIHR clinical trials, other initiatives and programmes, work within the MRC's own units, institutes and centres, and research funded through UK universities. Our plans include a continued investment in fundamental basic and clinical research which underpins our translational agenda and has been shown time and time again to be the engine room of healthcare innovation. Figures on the UK research base in 2007 show that the UK comes second after the US in the number and share of the world's scientific citations.

A major focus of the MRC's strategic funding will be in 'experimental medicine' – targeted programmes that support early-stage clinical discovery work. Funding for this will double by year three of the CSR period. Our overall approach is to make sure that we have an integrated way of supporting research, developing the infrastructure and ensuring that we have the highly trained people able to deliver this agenda.

Enabling and supporting new treatments

The MRC leads in implementing a strategy for the discovery and exploratory development of fundamental research towards patient benefit. The aims of this strategy include:

- accelerated development of novel therapeutics, devices and diagnostics;
- faster identification of pathways of disease leading to the identification of targets for therapeutic intervention;
- increased skills base to deliver high quality research for greater health and economic benefits; and
- increased partnership by the industry sector in UK biomedical research.

To deliver this plan there will be dedicated funding streams, specific targeted initiatives, support for key facilities, co-ordination of existing infrastructure and capacity development.

The MRC already supports a substantial amount of fundamental, hypothesis-led basic and clinical research through its research funding boards. We are augmenting these proven funding mechanisms with a new funding stream, specifically aimed at accelerating the process of research and development of promising discoveries, through support of milestone-driven, goal-oriented research.

To support and underpin experimental medicine research, the MRC has

launched a series of strategic initiatives, targeted at specific points in the process. These initiatives are in biomarkers (surrogate indicators of a biologic state or process), human and animal disease models, and disease-based sample collections. They will be achieved through the support of relevant investigator-initiated research proposals, as well as specific calls for proposals in defined areas with earmarked funding. There are further initiatives in drug safety science.

There are opportunities for partnership funding for certain initiatives, from charities and industry, as well as from the Technology Strategy Board (TSB) – the executive non-departmental public body which promotes innovation in the UK.

There is already significant support by the MRC and NIHR for infrastructure that underpins translational research, but levels of support will be reviewed. We want to identify and fill potential gaps in UK research facilities.

Big ideas

The MRC's translational plans and activities are wide-ranging. We have been nurturing our relationship with industry and running 'showcase' events, which bring together academics and industry representatives to share ideas and develop future collaborations. We have funding schemes to encourage joint grant applications. Other ways of working with industry are being explored with industry stakeholders, the TSB and other research councils.

Increasing the UK's capabilities in translational research will require increased numbers of scientists trained in relevant areas of science. The MRC will enhance training and career opportunities in translational areas, such as clinical research training, pharmacology, toxicology, informatics, methodology, and biostatistics, together with industrial collaborative studentships.

The MRC is leading in methods research and the development of new and improved systems and theories for health research. We aim to develop a high-quality national platform in methodology research and establish the UK as a world leader in innovation in this area.

NIHR will lead on evaluative research and clinical trials, and will increase the amount of high-quality research in the UK. Through the NIHR, the MRC will provide funding for trials that assess potential new treatments and their underlying mechanisms of action, and continue to support trials in global health.

On the world stage

Translating research is high on the international agenda. By building partnerships with our European and international counterparts, the MRC ensures that we share and develop best practice, have the chance to learn through others' experiences and influence policy-making across borders.

I represent the UK research councils on the steering committee of the European Heads of Research Councils. This forum provides the opportunity to discuss key issues relating to the effectiveness of European translation research, such as intellectual property rights and sharing of knowledge between researchers, and allows us to co-ordinate our approaches to translation.

Translational research has recently been raised in the biomedical field in a high-profile White Paper published by the European Medical Research Council, to which the MRC contributed. The paper sets out the present status and future strategy for medical research in Europe.

Stem cell research and the MRC

Stem cell research has the potential to result in life-saving treatments and is an important part of the MRC's portfolio and translational strategy – we continue to support research on both adult and embryonic stem cells. We are reviewing our stem cell and regenerative medicine research strategy with an aim to develop joint strategies with the TSB and NIHR for academic and industry co-operation. There has already been a joint call with the TSB in regenerative medicine.

The MRC will lead the stem cell area and will also continue to strongly support basic stem cell research through response mode funding. The Delivery Plan sets a goal of increasing spend on stem cell research by at least a third.

The new approach will be managed through a new expert committee with its own budget. It will be responsible for reviewing and funding all stem cell research applications received with a translational basis. There will be a new stem cell 'portal' to receive all applications, and to enhance partnership with other funders.

The UK is a leader in stem cell research and regulation and, here, research can flourish with public support in a tightly-regulated environment. The MRC supports the scientific aspects of the Human Fertilisation and Embryology Bill, currently going through Parliament, which is an update of the 1990 law. It will allow new scientific procedures, under strict regulation, that can potentially help understand and cure debilitating diseases such as Parkinson's and Alzheimer's. Polls suggest that around 70 per cent of people support the use of embryos in research to find cures for disease, but we need to continue to discuss this rigorously.

Benefits to society

The new measures for health research funding in the UK, and the emphasis on translation, will bring discoveries in science closer and faster to the clinic and to society in general. It will enable new therapies to be identified as early as possible, and improve prevention, diagnostic and public health strategies in the most efficient way, boosting productivity and the economy. There is always the need for a vibrant and well-resourced basic science base, which the MRC will continue to support. These leading discoveries and the benefits that ensue will enable the MRC and its partners to play a prominent role in the worldwide effort of accelerating the process of turning science into outcomes, resulting in better and longer lives for us all.

A Human Bioethics Commission

The Baroness Warnock

Among the highly controversial issues arising from the revision of the Human Fertilisation and Embryology Act (1990), there was one amendment that looked fairly harmless. This was an amendment introduced by Lord Brennan, and strongly supported by Baroness Williams of Crosby and Lord Alton, among others. It required that a National Human Bioethics Commission be set up, a small body of not more than eight members, established by statute, and reporting to Parliament from time to time. I argue that such a body is unnecessary, and would be both expensive and possibly damaging in its effects.

We already have the HFEA, whose remit is to issue (or refuse) licences both for research and clinical practice in the field of embryology, whose decisions are based on moral considerations. However it could be plausibly argued that the functions of this Authority are too narrow, confined as they are to individual requests for licences, and that they should not stray into the more general territory of bioethics.

More important, there already exists the Nuffield Council for Bioethics. This is a much respected body, whose task is to identify and examine ethical questions that arise from new research and technology, and to anticipate public concerns. It consists of lay people as well as scientists, and it consults widely. It has published very useful and balanced reports, its work would be duplicated by a new Commission.

However, those who are in favour of establishing a Commission suggest that the Nuffield Council, being funded by the Nuffield Foundation and the Wellcome Trust, is necessarily biased towards science. They advocate the new body in the belief that religion and a morality derived from religion would be better represented on it.

It is not clear how widely drawn the definition of Human Bioethics would be, if the Commission were set up; but in the context of the new Embryology Bill, the central issue is the moral status to be accorded to the human embryo. It is on this question that the gap between scientific thought and that of the Roman Catholic Church is apparently unbridgeable. Since 1869, Roman Catholics have held that the human soul enters the body at the moment of the fusion of egg and sperm, the 'moment of conception'. Lord Alton, in a speech at the report stage of the Embryology Bill (House of Lords Hansard January 15th 2008 col 1222) using a common and somewhat misleading short-hand, asserted his 'passionate belief' that 'life begins at conception', and that embryos should not be unnecessarily destroyed after this moment. From day one a human embryo is potentially a human person, and it lies with God alone to take away its unique form of life. And of course it is outrageous, on this view, to create an admixed embryo, by placing the nucleus of a human cell which contains its DNA in the outer capsule of the egg of a rabbit or a cow; for such an embryo would not possess the dignity possessed by an embryo who had received its soul after conception. Other animals are not thus ensouled. This is the difference between human dignity and whatever respect we may show to animals.

If a National Human Bioethics Commission were set up, and if it consisted of just eight people, these people would presumably be regarded as moral experts. The difficulty would be that unless the eight were all of the same opinion regarding the status of the human embryo, they could not well publish any unanimous reports. For the sad fact is that there is no such thing as a moral expert. Mercifully, we do not live in a theocracy, within which there are indeed experts (though even they sometimes disagree in their interpretations of the law). We are a democracy, and though we may listen to one another, and even envy those who believe passionately that they know for certain what is right, in matters of legislation it is Parliament and not any moral experts who must make the decisions. This they must do trying their best to consider what is for the common good, including the good that will come from new therapies issuing from research. I fear that a National Commission of the kind envisaged might take our eyes off the central fact: no commissioners, however hard they thought about the questions would have the authority to dictate the answers to Parliament. All the things that the commissioners had debated would have to be debated afresh in both Chambers. The authority of the law derives from its having been so debated and voted on in Parliament. For a Commission, even a statutory Commission, to take that authority to itself would be wrong.

Why the United Kingdom needs a National Bioethics Commission

Professor Lord Alton of Liverpool

The Chief Medical Officer, Sir Liam Donaldson, has remarked that "We have had, generally, in this country a deficit of medical ethics". The truth of that comment has been borne out in the debates on the Human Fertilisation and Embryology (HFE) Bill.

Along with colleagues from all parts of the House of Lords, notably Lord Brennan and Baroness Williams of Crosby, I moved amendments to the Bill to redress this "gap" and to provide for a free-standing National Bioethics Commission to provide a balanced and credible permanent forum capable of adequately informing debate.

This is not to take the place of Parliamentary Select Committees but it would be a way of redressing a debate too frequently dominated by vested interests or by small elites who for two decades have enjoyed free rein in shaping the bioethics agenda. Too frequently they have become narrowly ideological in trying to justify their earlier decisions and in dismissing alternative, more ethical, approaches. The net effect has been to undermine public confidence in science.

Our proposal is that a National Bioethics Commission would be given statutory foundation. It would have a diverse membership on terms laid down in statute, would be supported by public money, and would be separate and independent from particular government departments and agencies, having no regulatory, administrative or quasi-legislative functions. Its purpose would be to enhance the democratic process by providing the material to support better informed public debate. Decisions subsequently take on contentious matters in the life sciences would be supported by an informed public view and could be taken in a more democratic and inclusive fashion than they are at present.

The idea of a United Kingdom National Bioethics Commission has been proposed in the past. Dr Brian Iddon MP rightly reminded me of recommendation 85 of the 2005 Science and Technology Committee Report, to "recommend the formation of a single commission to develop policy issues relating to the assisted reproduction, embryo research and human genetics".

Beyond Parliament distinguished commentators and spiritual leaders, such as the Archbishop of Westminster and the Chief Rabbi, Dr Sir Jonathan Sacks, have supported this proposal.

Professor Roger Brownsword of King's College said in his evidence to the HFE Joint Scrutiny Committee that he thought the UK was less utilitarian than it had been and that changes need to be made to the current regulatory regime to reflect "a political culture which is more committed to the human rights agenda". Professor Sir Ian Kennedy, Chairman of the Healthcare Commission, remarked that he had concerns about the Human Fertilisation and Embryology Authority's (HFEA) dual role in inspection and "thinking about really deep issues of bioethics".

It is impossible for the HFEA to reconcile these conflicting roles: the watchdog and the burglar being too closely identified with one another.

Our recent debates have underlined the fast-moving and complex nature of the daunting issues that face us: everything from whether it is right to add to the 2.2 million human embryos destroyed or experimented upon since 1990; the absence of a single cure anywhere in the world using embryonic stem cells; the contrasting exciting advances (80 cures and 350 clinical trials), in the use of ethically acceptable adults cells; and whether it is right to create animal-human hybrid embryos or to use a dead person's tissue to create a human embryo.

In response to the growing number of these challenging questions we need a greater urgency and definition. In part this is a matter of prudence, effectiveness and efficiency, but there is also an important and ineliminable ethical aspect. Ethics comprise the identification of values and principles, but also surely the determination of their appropriate application. That is no easy matter, particularly given the diversity of moral, social and religious perspectives that characterise contemporary society. At the same time, however, there is widespread agreement on the importance of ethics. Among those who reflect on such matters, there is general agreement

about the centrality of such values as welfare, autonomy and respect, and growing recognition that they cannot be reduced to a single value but must be maintained in some kind of balance.

International experience is also relevant. Governments or Ministers have established national bioethics committees in Austria, Belgium, Denmark, France, Germany, Italy, the Netherlands, Portugal, Sweden, Switzerland and in other countries. It is the worst kind of national chauvinism to dismiss overseas best practice as inferior and irrelevant to the British model.

Their constitutions, remits, operation and achievements can teach us a great deal. The Danish and German models are widely admired, but several others also have good features.

The Commission would have the authority and standing of an independent statutory body. Its membership should encompass relevant professional expertise, patients and other user-group interests, as well as major religious and ethical groupings. Membership would reflect the diversity of positions held within society and appointment procedures must be public and transparent. Although independent, such a committee would be responsible to Parliament through a Minister to whom it should deliver an annual report, including recommendations for policy, and additional reports could be commissioned when required. Its remit would be the entire range of bioethical issues, including, but not confined to, those concerning reproduction.

Some have argued for a new in-house Westminster committee.

Parliament is perfectly free, at any time, to establish such a body and it might well enhance the work of the existing Select Committees. These two ideas are not mutually exclusive; indeed, they could complement one another very well. Establishing a Parliamentary Committee is not a legislative issue; a National Bioethics Commission is. This is an ideal moment to implement the 2005 recommendation of the Science and Technology Committee and to use the Human Fertilisation and Embryology Bill to put a Commission onto a statutory basis. If we fail to do this, we will have missed a great opportunity.

Professor Lord Alton of Liverpool is an Independent Crossbench Peer.

Better Innovation – Better Business UK Innovation in Central Europe

Alison Winzenried-Pring

Regional Manager, Europe Central, FCO Science & Innovation Network

Twelve key players from the UK innovation scene participated in a UK innovation mission to Central Europe in March 2008. Led by Nick Stuart from the Science & Technology Unit of UK Trade and Investment (UKTI) and Sheena Newell of AEA Energy & Environment, the UK delegation comprised representatives of UK research, finance, industry and the Knowledge Transfer Networks.

The four-day innovation roadshow programme was arranged by the British Embassy Science and Innovation Network (SIN) and UKTI teams in Prague and Warsaw. It included UK Innovation Partnership Conferences in both locations, plus meetings with key innovation contacts and site visits. The total audience figure ran to over 150, comprising innovation specialists, government officials, innovative businesses, university and innovation park representatives.

The roadshow's coherent proposition in UK innovation was based on UKTI's UK Innovation Map*. Better innovation means better business: by introducing the British innovation environment and UK expertise to the Czech Republic and Poland, the roadshow aimed to strengthen UK co-operation with these two countries in the innovation sector, thus facilitating wealth creation collaborations between Czech and Polish partners and key players in the UK.

Central Europe was identified as a region which would benefit from the Innovation Map's clear presentation of

*https://www.uktradeinvest.gov.uk/ukti/fileDownload/UKTIInnovationReport.pdf?cid=415913

the UK's complex innovation landscape because the UK has a particular interest in ensuring that innovation professionals in rapidly developing EU Member States work closely with UK industry and academia. With UKTI and SIN officers co-located in Prague and Warsaw, and SIN's focus on regional working within Europe, the geographical focus was clear.

Both Poland and the Czech Republic benefit from large chunks of EU Structural and Cohesion Funds (SCF). This financial provision offers them the opportunity to use this funding to help develop their science infrastructure and put sustainable policies in place to foster innovation.

Poland's Innovative Economy programme (OPIE) is worth €9.7bn over the period 2007-2013, including €8.3bn EU funding (12.3% of total Polish SCF for the same period). The programme comprises a range of sub-programmes designed to improve Polish economic development by fostering an innovation culture and improving R&D infrastructure. The €190m Wroclaw Research Centre (due to be operational by 2013) is one example of how Poland is using its SCF funding.

A range of reforms is under way to improve the Polish science landscape. The National R&D Centre (NCBR), set up in 2007, is the leading Government funding agency for applied research. R&D funding is becoming much more focused on key strategic programmes and projects, with excellence seen as a major criterion for funding.

Similar developments are seen in the Czech Republic where the government is looking to give its economy more of a focus on high added value business and increase its R&D spending. It is using €7.3bn of its structural funds primarily to improve science (R&D), competitiveness, and research infrastructure using three specialised operational programmes (Business and Innovation, Education for Competitiveness, and Science & Research for Innovation).

A new Technology Research Council will provide grant funding for applied research, for which university-business collaboration – including part funding from business – will be required. New legislation is in the pipeline designed to encourage applied research and innovation to allow universities to commercialise successful results of its research, patent, sell licences and start spin-off companies.

This focus on revamping the Polish and Czech R&D landscapes offer a range of potential business opportunities for UK organisations in collaboration with local partners. The UK has much to offer by way of best practice, indeed Professor Rudolf Hanka of the University of Cambridge has recently become one of the innovation advisers to the Czech Prime Minister.

In terms of achievements, all of the UK missioners have leads likely to result in collaborations, possibly contracts. The Polish and Czech audiences, already interested in the UK's approach, went away with a much better understanding and, importantly, a desire to pursue links with the UK. There was so much interest in the Knowledge Transfer Networks and the Knowledge Transfer Partnerships that equivalent structures may well emerge in both countries.

By working together, UKTI and FCO SIN have delivered a strong set of events promoting UK innovation, and delivering on joint objectives in a way that neither could have achieved separately. The expertise of the SIN officers in Prague and Warsaw and access to their local networks were essential to a successful outcome.

The opportunities revealed by the innovation roadshow have created demand for follow-up activity in the UK later this year. And the SIN teams in Prague and Warsaw are working on plans to raise awareness of the opportunities which structural funds could offer UK businesses in partnership with local organisations in the Czech Republic and in Poland.

UK INNOVATION MAP

The UK builds on a history of innovation to deliver new products and services. With an extensive network of organisations focused on innovation, the UK is a global innovation hub that creates wealth for the UK and its international partners.

The Innovation Map, recently produced by UK Trade & Investment, identifies for the first time the 12 key groups into which all UK innovation organisations fall. UKTI's Science & Technology team works in collaboration with those 12 key groups, helping to raise the profile of UK Research & Development.

The Innovation Map can be downloaded from https://www.uktradeinvest.gov.uk/ukti/fileDownload/UKTIInnovationReport.pdf?cid=415913

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Facing up to the Grand Challenges

Andy Furlong
Institution of Chemical Engineers

Every parliamentary constituency in Britain faces its own unique challenges. And yet the big tests facing society are shared across the nation, and indeed throughout the world. Secure and nutritious food supplies; access to clean water; affordable healthcare; public safety and mitigating the impact of climate change – these challenges affect us all and global solutions are called for if we are to sustain a viable planet with more equitable distribution of wealth and resources.

These issues are often termed 'grand challenges'. They are global in both scale and scope, daunting in nature and for many people, policymakers included, sit in the 'horribly difficult' pile earmarked for tackling by someone else. Seemingly as intractable as the legendary Gordian Knot, it's entirely understandable that people frequently choose to focus on secondary challenges that are closer to home. However, the world is changing at a frightening pace. Millions of people still lack solutions to these grand challenges and those who do – or at least did – are facing real difficulties, perhaps for the first time in their lives, with rising food prices, fuel costs and the visible impact of climate change beginning to take effect.

Opportunity or threat?

Grand challenges pose both opportunities and threats to policy makers. Opportunities, societal and economic, for those with the solutions; threats for those who fail to address the challenges and curb public unease. But who are the problem solvers – who will provide the secure food supplies, the clean water, improved healthcare and cleaner energy? Shared challenges dictate shared solutions and engineers will play a pivotal role.

Last year, the Institution of Chemical Engineers (IChemE) published a *Roadmap for 21st Century Chemical Engineering* [1]. The report which featured in the pages of this journal twelve months ago [2] outlined the chemical engineering approach towards tackling six major challenges facing humanity and contained a series of short, medium and long-term action plans that the Institution and its 27,000 international membership should progress in pursuit of a sustainable future. On launching the Roadmap, IChemE Vice President, Ian Shott, described the contribution chemical engineers could make: "Chemical Engineering is playing an increasing role in meeting society's needs, from energy generation to food production, water supply to waste management and from consumer goods to healthcare products."

Already there are many examples of chemical engineering expertise being used to tackle pressing international issues. Chemical engineers at BASF have designed a more environmentally friendly process for the manufacture of nylon. The new technique reduces emissions of harmful oxides of nitrogen by simplifying the production of an intermediate chemical, cyclododecanone, thereby cutting the number of process steps from four to two. Further afield, New Zealander, Howard Bradbury, has developed a novel drying technique to remove potentially fatal levels of cyanide from cassava flour, a staple food in the diet of many poorer communities. Quite literally, an example of how chemical engineers can save lives. Both of these projects were recognised at the Institution's Annual Innovation and Excellence Awards in London last autumn.

A profession in demand

Unsurprisingly chemical engineers are in demand, at home and abroad. It's a career path that's proving increasingly appealing to students in the UK too. Last year, UK universities saw a record number of students opting to study chemical engineering, with an all-time high figure of 1455 undergraduate students starting first degree courses. Since 2001, applications to study chemical engineering in the UK have grown by more than 70% and admissions have risen by 55% as a result.

The Head of Chemical Engineering at Glasgow's Strathclyde University, Dr Carl Schaschke said: "The upturn in interest in chemical engineering nationally is a reflection of the changing role and unique skills of the chemical engineer. Now, more than at any time in the past, chemical engineers can be found central to meeting the societal needs of energy provision, health care and tackling head-on crucial environmental issues that affect everyone."

Securing a healthy pipeline of high-quality chemical engineers is good news for industry and society. It's good news for graduates too. New figures reveal that 2007 graduate starting salaries averaged £26,000 and packages exceeding £30,000 were not unusual.

Image problem

Despite this, chemical engineering – and engineering as a whole – still

needs to work on its image. A recent Engineering and Technology Board study[3] looking at public perceptions of engineering and engineers revealed that awareness and understanding of engineers and engineering tended to be narrowly defined and primarily related to construction and manual professions. The quantitative survey findings showed that the word 'engineer' most commonly triggered images of construction and mechanics – associating engineers primarily with building and fixing things than rather than design, innovation and creativity.

In 2007, to coincide with the 50th Anniversary of its Royal Charter, IChemE asked Ipsos MORI to research public perceptions of chemical engineering. The survey, which assessed the views of 2000 people, provided a sobering view of public attitudes and understanding of our profession. Over a third of people surveyed had no idea what 'chemical engineering' meant. A further quarter admitted to only a vague idea.

ABC1s claimed a better understanding of chemical engineering with just over half of the respondents in this category agreeing with the proposition that chemical engineers were important to the UK economy. This trend was reinforced amongst older respondents and those educated to degree level.

55% of those surveyed believed that chemical engineers 'use advanced technology', whilst 38% agreed that chemical engineering 'improves the quality of the products we buy'. Amongst other findings, 29% believed that chemical engineering was 'increasing in importance' and 31% thought that chemical engineering 'offered a career with good prospects'. Conversely, two out of three people disagreed with these propositions. This presents quite a headache for a profession that is working hard to improve its reputation and secure public confidence through engagement and influence programmes particularly with young people via its well regarded whynotchemeng careers campaign.

The benefits of innovation

And yet there are many examples of chemical engineers here in the UK who are making real progress on the grand challenges described at the beginning of this article. Arnold Black, a chemical engineering graduate of Leeds University, manages a team of twenty (many of them chemical engineers) in his role as Network Director at the Resource Efficiency Knowledge Transfer Network. His team provides services to industry and academe, promoting innovation and commercial environmental solutions in the field of resource efficiency.

Black's broad remit covers everything from resource-efficient manufacturing in food processing and consumer goods manufacture through to recovery of materials from waste streams such as electronic scrap and construction material. This can include technologies such as bio-technologies for alternative fuels and electrochemical water clean-up.

In Cambridge, chemical engineers working for Stem Cell Sciences UK, are pioneering bio-manufacturing processes for the automated production and manipulation of stem cells. Stem cells are a potential source of research, screening of new drugs and cell therapy but the challenge is generating enough high-quality stem cells to allow sufficient research.

And in Cardiff, chemical engineers have designed an innovative way of producing catalysts, using acetates and carbon dioxide rather than nitrates to significantly reduce their environmental harm, eliminating energy-intensive precipitation, solvent and waste.

Skill shortages loom

Such innovation will benefit both the environment and the UK economy but it's only possible with a secure pipeline of chemical engineers. However, alongside the looming problems of climate change there is another issue that requires urgent attention – a shortage of scientists and engineers to maintain and build on existing work as older professionals retire.

The UK process sector is now paying the price for the dramatic downturn in the number of students studying chemical engineering in the mid-1990s. Engineering recruitment agencies are already searching as far afield as Brazil and Nigeria to fill vacancies. And in the future, as the demand for skilled chemical engineers grows internationally, this could become a major problem presenting both government and business with severe difficulties for example, in the battle to cut carbon emissions through the deployment of clean coal technology, carbon capture, nuclear power generation and renewables.

Facing up to the grand challenges

There has probably never been a better time to be a chemical engineering student. Employers continually lament a tight recruitment market, the sit vac pages of process sector publications are expanding and graduate salaries are on the up. The grand challenges, it would seem, are fuelling the demand for chemical engineers?

Nonetheless, we must not rest on our laurels. In 2007 many UK chemical engineering degree courses are either at, or are fast approaching, capacity. Whilst this is having a beneficial effect on the quality of the undergraduate intake, a shortage of places does not bode well for a future in which the grand challenges will become even more exacting. Government, industry and professional bodies, including IChemE, must work together to meet the demand for extra places.

In the years ahead, governments in all nations will be under pressure to demonstrate that they are facing up to the grand challenges with policies and strategies that will secure a sustainable society.

Delivering those policies and strategies will require skilled scientists and technologists to make things happen. Here in the UK policy makers can safeguard the future by securing a healthy supply of chemical and process engineers – 21st Century problem solvers capable of solving knotty problems with bold strokes.

1 http://www.icheme.org/roadmap2007.pdf

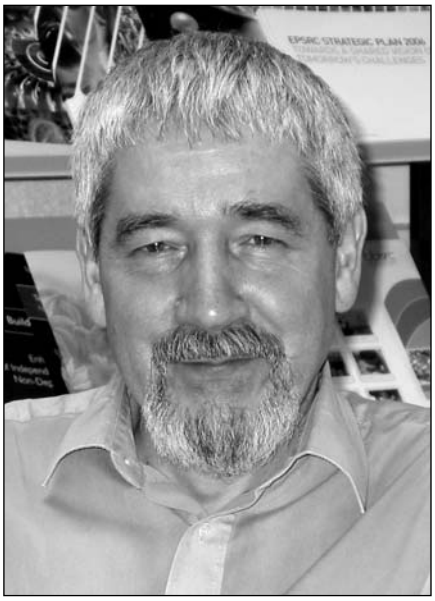
2 Shared Challenges, Shared Solutions, Dr. Ramesh Mashelkar, Science in Parliament , Summer 2007 pp12-13

3 Public Attitudes to and Perceptions of Engineering and Engineers 2007, Engineering and Technology Board

Tackling the major challenges facing society

Professor Dave Delpy

Chief Executive, Engineering and Physical Sciences Research Council



Addressing the 'big questions' has always been fundamental to science and engineering and now, more than ever, we need to find the answers. Securing sustainable energy supplies and halting the effects of climate change are global necessities. Harnessing the potential of new technologies, to develop innovative medical treatments or to enhance global security, will improve millions of lives across the world. As a society, and as a scientific community, we need to strive harder than ever before to develop and shape solutions – and that ambition underpins the Engineering and Physical Sciences Research Council's long term vision.

Scientific research has the potential to tackle the issues affecting all aspects of our lives – issues that are changing the climate of our planet and affecting the way in which our rubbish is collected, changing how we book our summer holiday and the security needed for a safe journey. With this potential comes responsibility, and our responsibility as a research council is to ensure the UK's scientists and engineers can tackle the challenges we face head on.

Aligning priorities

The Government's long term public policy challenges include the pressure on natural resources, demographic change and an ageing population, acceleration of innovation and technology requirements, and global uncertainty and the threat of terrorism.

To address these, working in collaboration with the academic community and the other Research Councils, we have developed four

EPSRC Priority Research Themes:

Energy - The mission of this on-going programme is to help the UK to meet its energy and environmental targets by supporting world class research to develop and exploit low carbon technologies and reduce energy use.

The programme encompasses power generation and supply, demand reduction, alternative energy vectors, transport and security of supply.

Digital Economy - a rapid response to developments in Information and Communication Technology (ICT) is vital to the future economic and social prosperity of the UK. The Digital Economy theme will link world-class ICT researchers with those in other scientific disciplines, business and other users to create a multidisciplinary, user-focused research base capable of responding to new opportunities.

The programme builds on a solid foundation: five previously funded IT-centric interdisciplinary research centres have already built a strong research base engaging social scientists, clinicians, psychologists, biologists, designers, artists and film makers.

Nanoscience, Through Engineering to Application - Nanoscience is a rapidly maturing field with the potential to revolutionise society. Harnessing the possibilities it creates could lead to environmental, healthcare and energy benefits, and major advances in materials, optics, and computing.

The theme will build on significant research and investment to create a coherent, directed programme taking basic research through to application.

An important element will be a public engagement programme to debate concerns, explore the ethical and social implications and clarify the benefits of nanotechnology.

Towards Next Generation Healthcare - This programme aims to improve the health of UK citizens at all stages of their lives and responds to the challenges and opportunities created by an ageing population. The programme will foster cross-discipline partnerships and industrial relationships including collaborations with major healthcare companies, the NHS, medical charities and the Medical Research Council.

This collaborative approach will not only enable world class research, but also accelerate the transition from basic research to clinical products, practices and patient benefits.

priority research themes; 'Energy', 'Digital Economy', 'Towards Next Generation Healthcare' and 'Nanoscience, Through Engineering to Application'. These priorities form a central strand of our Delivery Plan – a three-year framework that sets out our high level objectives and how we will achieve them. Each priority theme has a wide ranging remit and will require contributions from all scientific and engineering disciplines.

But identifying the issues will not, in isolation, lead to solutions. Our Delivery Plan also outlines our continued commitment to investing in talented people, maintaining and developing the UK's skills base and creating an environment and culture that fuels creativity, innovation and ambition.

Scientific ambition

Tackling major global issues requires a culture of ambition on the same scale. In fostering this, we will be encouraging the research community to develop proposals that will challenge current understanding and unlock doors to new scientific fields.

We will look to support longer, larger research programmes to give researchers the time, resources and facilities they need.

The issues facing society do not respect the boundaries of established scientific fields, geographical or political borders. More ambitious research is likely to include multidisciplinary teams working as part of multilateral international partnerships and a major component of the international policy of the Research Councils is, wherever possible, to break down barriers to such collaborations.

Accelerating benefit

Too much is made of a perceived conflict between fundamental and applied research – supporting high quality research and ensuring better impact from it are mutually compatible objectives. Fundamental breakthroughs, across the entire spectrum of scientific disciplines, fuel the innovative solutions and applications of tomorrow. Challenging established ideas remains at the heart of discovery and new thinking is essential to sustaining progress.

In generating world class research aligned to major societal and global issues, we must also ensure the potential of that research is realised. Working with the Technology Strategy Board, the Energy Technologies Institute and industrial and charitable partners, we will strive to accelerate the exploitation of research for both social and economic benefit.

We know the 'big questions' facing us will evolve and, as existing problems are solved, new ones will be posed. The key to continued success lies in maintaining a vibrant, creative and formidable UK research capability.

Our ten-year vision is for the UK to be as equally renowned for knowledge transfer and innovation as it is for research discovery. Meeting the commitments we have made in our three-year Delivery Plan will ensure we are on track to realise that vision.

For more information visit www.epsrc.ac.uk, or contact Jenny Whitehouse, Parliamentary Relations Manager: jenny.whitehouse@epsrc.ac.uk, 01793 442892.

Strategic partnerships

Building strategic partnerships with a range of organisations including industrial companies, charities and other research organisations will create increased funding opportunities and accelerate the exploitation of world-class research.

In the latest partnership, EPSRC and The Wellcome Trust have launched a joint £45m initiative to boost innovation in medical engineering.

Major advances in healthcare and life sciences research are frequently underpinned by the development of new technology, such as magnetic resonance imaging (MRI), reconstructive surgery and non-invasive diagnostic tests.

The initiative will provide funding for several multidisciplinary centres of excellence within the UK, bringing together experts in physical and engineering sciences with those in the clinical and life sciences.

This joint initiative will not only enable the development of new medical technologies, but also improve the integration of expertise in the public and private sectors so that innovations are harnessed effectively by the healthcare industry and aided through the process of regulation, commercialisation and distribution for patient benefit.

Investment in People

As part of its continued commitment to investing in skills and training, the Engineering and Physical Sciences Research Council has announced a £250m investment in new centres for doctoral training.

EPSRC is looking to establish at least 40 new centres to train the next generation of highly skilled and talented researchers capable of addressing the challenges of the 21st century.

The centres will support training across EPSRC's entire remit, including its priority research areas, and the investment will also provide a number of Industrial Doctorate Centres – with a greater focus on future careers in industry. The successful bids in this initiative are set to be announced in December 2008.

POWER ATTRACTS – AND REQUIRES – ADVICE

Science, Parliament and Government

There has never been a time when science has been more central to the concerns of Government and Parliament.

Or a time when scientific advice has been more necessary.

Or its influence more crucial.

Over the course of history Governments have been advised and influenced by philosophers, lawyers, diplomats, academics, journalists and economists – and more recently by single issue pressure groups, by environmental and non-government organisations and by others.

All these still have a role to play.

But the issues that face Governments and Legislators around the world now involve science, engineering and technology to a more pervasive extent than ever before.

Science is now a top priority. Here in the UK the fundamental issues that face Government and Parliament, and the decisions on what to do about them, still remain essentially political decisions. But scientific advice is both needed and required.

Operating under its Royal Charter "to serve the public interest" the Royal Society of Chemistry (RSC) undertakes a wide range of activities designed to offer assistance to MPs and Peers given that so many of the issues they face have a scientific aspect.

Parliamentary Briefings

The RSC provides direct assistance to MPs including briefings for Ministerial Statements or general debates on scientific issues, for use at Committee or Report Stage, PQs and Adjournment Debates.

"I want to pay a compliment to the Royal Society of Chemistry, which has probably inundated hon. Members with information about the research that it is doing… through its skilled membership."
[Dr Ian Gibson MP]

Parliamentary Links Day

The RSC has for decades run the pioneering (and since imitated) *Parliamentary Link Scheme* – which brings together members of the Society with the MPs in whose constituencies they live – and this scheme remains at the heart of the Society's strategic efforts to build bridges between the scientific community and Parliament.

Parliamentary Links Day remains the largest scientific event held annually in the Houses of Parliament and involves the active participation of sister organisations such as the Institute of Physics, the Institute of Biology, the Royal Society, the Royal Academy of Engineering, the Campaign for Science and Engineering, the Geological Society and many others.

Science is multi-disciplinary, the solutions to many problems are multi-disciplinary, and over the years *Parliamentary Links Day* has evolved accordingly.

In recent years major themes – such as *Science and the G8 Summit* and *Science and Globalisation* – have been explored by key figures including the Prime Minister, Foreign Secretary, senior Cabinet and Shadow Cabinet Ministers, the Government's Chief Scientific Adviser, the Chairs of major Select Committees and world renowned scientists and engineers.

RSC Westminster Fellowship

The Society runs a three month funded placement for young scientists working in the Parliamentary Office of Science and Technology. This 'injects some chemistry directly into the bloodstream of Parliament.'

Devolution

The RSC continues to pioneer scientific links with devolved bodies, and has already developed new Link Schemes between the scientific community and Members both of the Scottish Parliament and the Welsh Assembly.

In Scotland the Society and the Royal Society of Edinburgh work jointly to make available to MSPs the wide-ranging knowledge and expertise that both organisations offer. The annual *Science and the Parliament* event (now in its 8th year) attracts over 300 delegates and 30 exhibitors and provides an ideal opportunity for networking between the political and scientific communities.

In Wales relationships have been enhanced by the establishment of the annual *Science and the Assembly* event which now provides a welcome opportunity to debate key science issues and to meet scientists and engineers.

"My Hon. Friend will know that I was at the recent Bill Bryson awards launch from the Royal Society of Chemistry, a terrific programme encouraging young people to take an interest in science. We want more people to be excited about science."
[Ian Pearson MP]

The Role of Scientific Advice

Scientific advice and how it is organised always matters. There are limits to the advice that the Government can obtain solely from its own resources and it needs to tap the wealth of expertise that lies within the scientific community.

Governments have to make decisions and the scientific community has to understand the pressures and constraints that it faces.

The scientific community now has a greater opportunity – and responsibility – than ever before to ensure that it provides the best possible scientific advice in the most timely and understandable way.

Some of the world's most important challenges – including global climate change, and how to ensure plentiful supplies of energy, food and clean water – are the very ones where the scientific community has the most to offer. Science is part of the solution.

And the Royal Society of Chemistry is here to help.

VOICE OF THE FUTURE

Young Scientists Make Their Voice Heard

It was standing room only on 11th March for the biggest science event held in the House during this year's National Science and Engineering Week.

Entitled ***Voice of the Future*** it was organised once again by the Royal Society of Chemistry (RSC) on behalf of the whole science and engineering community with the aim of strengthening links between scientists, Parliament and Government.

It brought together over 150 younger scientists and engineers in the early stages of their career, typically aged from their early twenties to mid-thirties, from all the UK's major science disciplines. The audience also comprised 6th Form science students from four secondary schools within London who are contemplating careers in science.

These scientists came from the RSC, the Royal Academy of Engineering, the Royal Society, the Institute of Physics, the Institute of Biology, the Campaign for Science and Engineering, the Biosciences Federation, the Geological Society and many more. Encouragingly, the majority were female.

The centrepiece was the *Science Question Time*, similar to the BBC TV Question Time, which was chaired by Phil Willis MP. The subjects raised included standards of education, gender inequalities in science, research funding and how to tackle pseudo-science. The young scientists had the opportunity to put their probing questions to the panel of MPs – from the Commons Select Committee on Innovation, Universities and Skills – which included Dr Ian Gibson MP, Dr Evan Harris MP, Tim Boswell MP, Dr Brian Iddon MP, and Dr Des Turner MP. The ensuing exchanges opened up a dialogue between the next generation of talented scientists and Members of the Select Committee.

Voice of the Future also included a chance for the young scientists to hear from, and question, Ian Pearson MP, Minister for Science and Innovation. Mr Pearson's address highlighted the importance of science and engineering to the challenges faced globally, such as climate change and food security. He also discussed the important role science plays in Britain for maintaining competitiveness in the global economy, and the need for dialogue between scientists and the public.

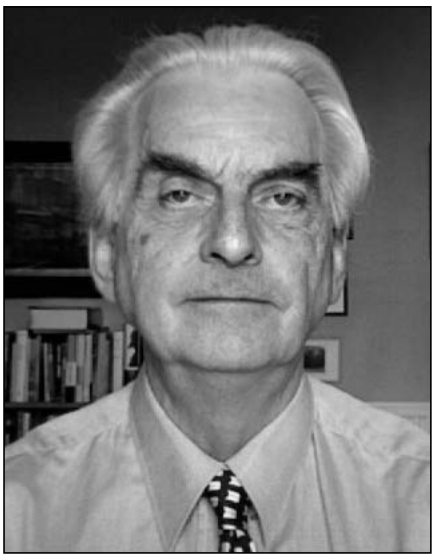
Jennifer Clark, a Health, Safety and Environment specialist at Eastman Chemical Company, was delighted by the chance to attend as one of the young delegates: "The Voice of the Future is a fantastic experience providing the unique opportunity to speak to MPs, learn what they are doing to support chemistry and science in the UK, and ask provocative questions."

The RSC Chief Executive Dr Richard Pike, commenting on this year's event, said, "We are very pleased to be able to provide these scientists with such a great opportunity to question MPs and Ministers on how scientific issues are dealt with, and also hear from them what their vision is for the future. This event allows younger members of the community to ask unrestricted questions, and on subjects most relevant to the future of the scientific community, such as education, skills and the infrastructure for research and funding."

RSC | Advancing the Chemical Sciences

MRSA, New, Yet Old

Professor Hugh Pennington FRSE
President, MRSA Action UK



When asked to become President of MRSA Action UK I accepted without hesitation. The decision had nothing to do with my own status as an MSSA carrier (I have been one since my medical student days) but was due to the privilege of becoming formally associated with an organisation typical of the best British special interest groups – ones which exert beneficial effects on policy far outweighing their sparse resources – and because of its aim, which is to prevent the preventable.

It is hard to think of a better example of Hegel's principle – "what experience and history teach is this – that people and governments never have learned anything from history, or acted on principles deduced from it" – than MRSA. Its history also exemplifies another principle – that the relationship between science, practice, and policy is hardly ever simple or straightforward. Perhaps most disappointing of all is that, although the story of MRSA science has been one dominated by British discoveries, we currently languish at the bottom of the international league of success in controlling it in our hospitals.

MRSA stands for methicillin resistant *Staphylococcus aureus*. Medical bacteriology became a science in the late nineteenth century. It was dominated by Germans. They discovered most of the important organisms. The big exception was *S. aureus*, which was first identified and named in 1880 by Alexander Ogston, a surgeon at Aberdeen Royal Infirmary. Ogston was an enthusiastic proponent of the antiseptic methods developed by Joseph Lister in Glasgow in the late 1860s and early 1870s. My estimate is that of all the preventive measures introduced against the staphylococcus, its impact has never since been matched. Before its introduction the *mortality* rate of 'cold' – non-traumatic – orthopaedic operations done by the most experienced surgeons was about 9%. Wound *infection* was virtually universal. In 1884 William Macewen reported his series of 804 antiseptic limb-bone operations at Glasgow Royal Infirmary. Only 8 became infected, and only 3 died, one of pneumonia, one of tuberculosis, and one of diphtheria.

Lister's carbolic worked against the staphylococcus. But it was toxic. Not only did it wreck the hands, it was absorbed through the skin and damaged the kidneys. When a surgeon started to pass black urine it was time for him to take a holiday. Alternative antiseptics came in. Research done in the 1890s showed that hand hygiene with alcohol worked well against *S. aureus*. Its therapeutic index – comparison of its staphylococcal killing power against its ability to cause dermatitis – was good. It was widely adopted. But rubber gloves were introduced and its use fell away.

In the 1930s the standard multi-volume British bacteriology textbook was the Medical Research Council's *System of Bacteriology*. Alexander Fleming wrote the chapter on *Staphylococcus*. Its preparation required him to do some research. It led to the discovery of penicillin in 1928. And the first patient to be treated in its first clinical trial by Howard Florey and his team at Oxford had a staphylococcal infection. Albert Alexander was a policeman. An infection of his face from a rose thorn scratch had spread to his lungs and shoulder. He first received penicillin on 12 February 1941, and improved dramatically. But even with the recycling of penicillin from his urine, the supply ran out, and he relapsed, dying of staphylococcal septicaemia on 15 March.

Fleming discovered the first naturally-occurring penicillin-resistant staphylococci in 1942. Then they were uncommon. However, important research by the bacteriologist Mary Barber at the Hammersmith Hospital in London showed that not only did they increase proportionately soon after the introduction of penicillin

(from 12.5% in April-November 1946 to 38% by February-June 1947) but that the rise was not caused by the organisms becoming resistant while patients were being treated. It was due to the spread of a resistant strain in the hospital. Such strains made penicillinase, a penicillin-destroying enzyme. In response a penicillin derivative resistant to the enzyme, methicillin, was developed by the Beecham Research Laboratories in Surrey. It was thought that penicillinase production was the only way for a staphylococcus to become resistant to penicillin, so resistance to methicillin would not develop. But within a year such strains appeared, at Guildford. The first MRSA outbreak occurred two years later, in 1963, at Queen Mary's Hospital for Children at Carshalton. Eight wards were affected; thirty-seven patients were infected and one died. Gordon Stewart was its bacteriologist at the time. He closed his account of the outbreak with prescient words: "Lastly, and most important, patients harbouring these rare strains must be isolated, vigorously treated, and preferably should be sent out of hospital as soon as possible." The organism continued to cause problems, however, and bacteriologists to warn.

A 1985 account of a two-year outbreak at the Royal Free Hospital concluded "Several authors have reported failure to contain MRSA infection without an isolation unit; hospitals without such facilities or, as at this hospital, unable to finance the staffing of a unit, may find that this epidemic MRSA will pose a considerable threat to their clinical practice."

MRSA are antibiotic resistant because they have acquired a gene, *mec* A, that allows them to build cell walls (a process blocked by penicillin antibiotics) in the presence of methicillin. At least eleven different MRSA have evolved independently in different parts of the world. A turning point for the UK was the appearance of two epidemic strains, EMRSA 15 and 16. EMRSA 16 was first seen in Kettering in 1992.It spread quickly. In 1994 it was causing problems in 21 London hospitals. By 2000 it was common throughout Britain, and was spreading internationally. The voluntary reports to the Health Protection Agency (and its predecessor, the Public Health Laboratory Service) of staphylococcal bloodstream infections in England, Wales and Northern Ireland are informative. In 1992 116 isolates were resistant and 4462 sensitive. In 2003, 6085 were resistant and 8560 sensitive. A simple way of monitoring the scale of the problem is to measure the ratio of the two. It is reasonably accurate because it automatically takes account of changes in hospital practice that affect staphylococcal infections as a whole. Resistant strains became commoner. By 1999 they accounted for 40% of *S.aureus* isolates. It is still the same today. But in the Netherlands it is about 1%. Why is this?

The Dutch and Scandinavian success in controlling MRSA has been due to their policy of "search and destroy". Key elements are the treatment of MRSA carriers in single rooms with barrier precautions, the screening and precautionary isolation of high-risk patients (eg those from endemic places like the UK) until negative test results come, the vigorous investigation of all patients and healthcare workers in a ward if any patient becomes a carrier, and the closure of a ward to new patients if there is evidence of the transmission of infection. Hand disinfection is not mentioned in Dutch guidelines because it is already being done assiduously. Using mathematical modelling the Dutch have concluded that their success has been due to their combined approach – no single measure will work on its own – and that if applied to the UK it would bring our MRSA levels to theirs within 6 to 12 years.

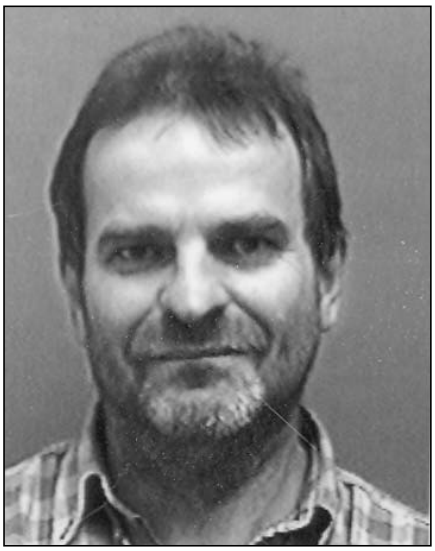
During the first three decades of their evolution UK MRSA caused local outbreaks. A degree of complacency developed; "search and destroy" was deemed to be too expensive. When EMRSA 15 and 16 appeared they were not taken seriously enough. Old habits die hard; policy makers have only just begun to give isolation the attention it needs.

Staphylococci grow well on agar plates. But saying that exhausts virtually all that is straightforward about them. All attempts to develop vaccines have failed. We do not know why some people carry *S.aureus* for life and others not, neither do we understand why EMRSA are such successful nosocomial pathogens. For the overwhelming majority of patients infected in hospital, the precise route of transmission is never established. Is aerial transmission important? We do not know. Will the new community MRSA strains establish themselves in hospitals? We can only guess.

Some complain that MRSA have become political. Their analysis is right, but their judgment wrong. All infections have a political dimension. Consider foot and mouth disease. Even before it ceased to be endemic in Britain, in 1889, the Government had a vigorous stamping out policy – search and destroy. It has spent billions. If only we had had the same for MRSA!

"difficile" by name, "difficile" by nature

Professor Nigel Minton
University of Nottingham



The bacterial genus *Clostridium* is an ancient grouping, which evolved on this planet long before there was an atmosphere. To them oxygen in the air we breathe is a poison. They are 'anaerobes', and thrive in oxygen-free environments such as our digestive tracts. Partly as a means to survive exposure to the air, they produce a specialised structure called an endospore. Compared to normal bacterial cells, spores are extremely resistant to all manner of chemical and physical agents, surviving exposure to heat, drying, certain disinfectants and low energy radiation.

The antics of a few give this large genus a bad name, just 12 species cause over 90% of clinical disease. The vast majority are entirely benign. Indeed, many species are of great value to mankind. *Clostridium acetobutylicum*, the forerunner of the modern biotechnology industry, is able to ferment renewable carbon neutral biomass into butanol – a biofuel superior to ethanol as a petrol substitute. The neurotoxin of *Clostridium botulinum*, more popularly associated with BoTox and cosmetics, has tremendous therapeutic uses (eg the treatment of squints), while the spores of harmless clostridial species have great potential as tumour delivery systems for treating cancer.

C. difficile is a black sheep of the family. The organism is part of the 'normal' gut flora in 3% of healthy adults, although this percentage increases with age. Problems occur when the good bacteria in the gut are disrupted, most usually through their obliteration by prescription of antibiotics. Under these conditions, *C. difficile* proliferates to cause *Clostridium difficile*-associated disease (CDAD). Clinical severity ranges from a self-limiting diarrhoea, through acute and severe diarrhoea to the potentially fatal pseudomembranous colitis. The bacterial factors responsible for disease, so-called virulence factors, are two large toxins (Toxin A and B). Spores are pivotal in disease transmission, but while other factors must play a role, their identity currently remains little more than conjecture.

Since the turn of the new millennium there has been a dramatic rise in the incidence of *C. difficile*. Cases of CDAD in England and Wales have increased year on year from 19,600 cases in 2000 to 55,620 in 2006, a 184% increase. As a result, 2005 saw 3807 death certificates on which *C. difficile* was either directly or indirectly attributed as the cause of death; more than twice that of MRSA. A number of reasons have been suggested for this increase, ranging from improvements in reporting procedures, the increasing age of the population and therefore the number at risk, increased antibiotic resistance, lower standards of hygiene and overcrowding in hospitals. A further significant factor has been the emergence of so-called 'hypervirulent' strains.

Reports on the emergence of more virulent strains in Canada first began to appear in the scientific literature in 2003. These documented an increase in incidence (5-fold the historical average); more severe disease (complications rising from 7.1% to 18.2%); higher relapse rates (increased from 20.8% to 47.2%); increased mortality (from 4.7% to 13.8%) and great antibiotic resistance (most notably to fluoroquinolone antibiotics). Characterisation of the strains involved indicated that they were all of one particular type (type 027 of the 150-plus recognised ribotypes), that they all produced a relatively rare toxin (CDT) in addition to toxins A and B and carried a mutation in a gene *(tcdC)* that leads to the production of increased levels of toxins. By June 2006, type 027 strains had been reported in 7 Canadian provinces, and by October 2007 had been isolated in 37 US states. The scientific community at large and the public alike became generally aware of similar problems in the UK in June 2005 with The Independent front page headline 'New Superbug threatening Britain's hospitals'. It referred to two outbreaks at Stoke Mandeville hospital between October 2003 and June 2004, and again between October 2004 and June 2005. Over this period some 334 patients were affected with 38 mortalities. Since this date numerous

UK hospitals have been affected, and 027 strains have now been isolated from 16 European states and Switzerland.

Between 1990 and 2003, laboratory reports from England and Wales collected at the Anaerobe Reference centre by Jon Brazier demonstrated that the most common UK 'epidemic' strains belonged to ribotype 001 (55%). The second most common strain was type 106 (10%). By 2005, when a random survey was undertaken over a 1 week period, 001 had declined to just over 25%, type 106 had risen to nearly 26%, and 027 had burst on to the scene representing almost 25% of all isolates. A similar survey is currently ongoing, and while the results are not finalised, 001 seems to have fallen away further, while 106 and 027 remain neck and neck (Jon Brazier, personal communication). These newly common strains are more resistant to antibiotics than other strains so that the once dominant strain of the 1990s, type 001, is being replaced by "fitter" strains that have advantages in adapting to and overcoming the changing selective pressures of our healthcare environment.

Currently many UK hospitals and elderly nursing homes have high levels of contamination with *C. difficile* spores, with increasing numbers of susceptible, antibiotic-treated patients propagating the organism. If infection rates are to be controlled, a number of measures need to be followed. These include: regular surveillance; isolation or barrier nursing; maintenance of high standards of personal hygiene, and; intensive cleaning of affected wards to remove the bacterial spores. These measures need to be mindful of the fact that spores of *C. difficile* are resistant to alcohol-based antiseptics (alcohol hand-washing gels are ineffective), and chlorine-based disinfectants can be only partially effective. To minimise outbreaks and spread of the organism, adherence to strict antibiotic policies is required. The use of oral cephalosporins and clindamycin, which are known to precipitate the disease, needs to be restricted. Additionally fluoroquinolones, not previously associated with the disease, now seem to be selecting for hypervirulent strains such as type 027 strains and need careful use. Future research must concentrate on: developing improved diagnostic methods; increasing our knowledge of the mechanisms by which the host becomes resistant/susceptible to infection; developing new therapies; improving knowledge of transmission mechanisms; developing disinfecting/cleaning methods that remove the spores from the patient environment, and; increasing our understanding of what makes a strain virulent.

The Clostridial Research Group, within Nottingham's Centre for Healthcare Associated Infections (CHAI), is focused on a number of issues. We are particularly interested in determining how the organism causes disease and why certain strains have become hypervirulent. If we are to make progress, we need to identify the *C. difficile* determinants that are required for infection and disease progression. Insight into possible mechanisms has arisen following the determination of the genome sequence of a representative strain. However, such a genetic blueprint tells us there are 4,000 or so individual genes, but it doesn't tell us what they do. In biology, you never really know what a gene does until it isn't there. Thus, to prove that any gene product contributes to disease we need to inactivate the gene and compare the virulence of the mutant generated to the non-mutated organism. Until recently this was not possible in *C. difficile*, as the methods available for making mutants were ineffective. A technological breakthrough at Nottingham has removed this bottleneck with the development of the ClosTron gene targeting system. It enables the rapid and reproducible creation of mutants, and has led to a 5 year MRC project (initiated October 2007) in collaboration with UCL (Peter Mullany) which seeks to inactivate all those genes previously hypothesised as being involved in virulence and assessing the effect on the capacity of the strain to cause disease. If we understand how the bug causes disease, we can develop rational countermeasures.

Equally important is the need to be able to rapidly diagnose CDAD. Symptoms alone are not enough to diagnose the condition. Toxin assays can reveal the presence of *C. difficile* in the patient's faecal sample, but can result in false negatives if concentrations are too low. Culturing the organism is more sensitive if methods are carried out correctly, but can give false positives, as some people are asymptomatic carriers. New, more rapid methods are required, particularly to identify the new hypervirulent strains. Towards this target, Nottingham is part of a European consortium, lead by Dr Ed Kuijper (Leiden University Medical Centre, NL), which seeks to develop appropriate diagnostic tests. Their development will enable clinicians and infection control teams to mount more immediate and effective countermeasures.

At Nottingham we have initiated programmes of work which should eventually lead to more effective means of controlling CDAD. In the mean time, the UK has one of the worse, if not the worst, rates of *C. difficile* infection in the developed world. We can clearly do better, and there is a collective responsibility from all those concerned (politicians, funding agencies, healthcare professionals, research scientists) to deliver a safer environment to the UK public.

HIV Vaccines

Professor Andrew McMichael FRS

Director, Weatherall Institute of Molecular Medicine, John Radcliffe Hospital, Oxford

More than 20 new virus infection threats have emerged in the last 30 years. Of these, Human Immunodeficiency Virus (HIV) has dominated, although avian influenza has the potential to be even more catastrophic. HIV emerged in central sub-Saharan Africa by transfer from Chimpanzees to humans. Chimpanzees are widely infected with a very similar virus, the closest to HIV is found in animals in south eastern Cameroon. The transfer most likely occurred by biting or contact with Chimpanzee blood. Such transfers could well have occurred sporadically for centuries but the virus infection that 'took off' in humans probably happened between 1930 and 1950. Since then, HIV has spread and radiated around the world; it now infects more than 25 million people. The mortality rate is close to 100% without treatment.

The pharmaceutical industry, building on basic research in academic laboratories, has been highly successful in discovering more than 20 anti-HIV drugs. When used in combinations of three or more, they can very successfully suppress the virus. The modern drugs have fewer side effects and are relatively easy to take. They can control the virus indefinitely and have reduced mortality from AIDS substantially in developed countries, a major success story for late 20th century medicine. However, the drugs do not eliminate the virus and have to be taken for life. They are expensive and their correct and safe use needs substantial medical infrastructure. Although there are ambitious roll-out programmes for HIV drug treatment in Africa, fewer than a quarter of those who need therapy are receiving it.

The alternative to complex and expensive life-long treatment programmes should be a vaccine. However, HIV vaccine development has been extraordinarily difficult. Soon after discovery of the virus in 1983, it was thought that it would be straightforward to generate virus envelope protein by genetic engineering techniques (it was) and to make a vaccine. After several years one such vaccine progressed to advanced clinical trials to test its ability to prevent infection and it completely failed. The reasons for this are now becoming clearer, thanks to detailed high quality research on the structure of the virus envelope protein which has led to an understanding of how the virus can take advantage of mutations to evade immune responses. The virus envelope protein mediates attachment to the two protein receptors on the surface of human T lymphocytes (called CD4 and CCR5) and then causes fusion of the virus and cell membranes enabling the virus to invade the cell. This process involves complex changes in the shape of the envelope protein, first as a consequence of binding to CD4 to expose the site on the envelope that binds to CCR5 and then major shape change in the stalk of the molecule to cause membrane fusion. This flexibility in shape makes it very hard for antibodies to bind sufficiently well to stop the process. Furthermore, the envelope protein is coated in sugar which protects it from antibody attack. A very extensive search for parts of the envelope that can bind protective antibodies has revealed just four 'Achilles heels', but infected humans and vaccinated humans only very rarely make antibodies to these sites and even then the antibodies are made in quantities too low to be protective. So the trick is going to be to find synthetic molecules that strongly stimulate these antibodies when put into vaccines, much easier said than done and not yet achieved after years of effort.

These difficulties led to another approach, using a vaccine to stimulate killer T cells. Killer T lymphocytes are not infectable by HIV, because they lack CD4 on their surface, and their natural role is to clear up virus infections by killing virus infected cells in the interval between virus entry and production of virus progeny – a time window of around 24 hours. Normally this is a very effective way of controlling a virus infection and there is very good scientific evidence that these T lymphocytes control the chronic phase of HIV infection, helping the patient to delay progression to AIDS, often for more than 10 years in the absence of treatment. Extensive studies in monkeys showed that vaccines that stimulate killer T lymphocytes could influence the course of infections with simian immunodeficiency virus (SIV), a very close relative of HIV. Vaccinated animals did become infected – the killer T cells can only act after cells have become infected – but they controlled the virus better and survived longer. Given these results,

there was considerable optimism that this approach might be useful in humans. Although HIV can escape from killer T cells by mutating the parts of the virus seen by the T cells, these are in relatively invariable proteins of the virus, so it was expected that the T cell stimulating vaccines would be able to cope with much of the virus variability.

The vaccine that looked the most promising, because it had stimulated the strongest killer T cell responses in HIV-uninfected people in early clinical trials, was the Merck vaccine. This was based on a common cold virus, adenovirus-5, into which was inserted three HIV genes. Although many people had some pre-existing immunity to adenovirus, it was shown that this did not reduce the immune response to the HIV genes. Therefore a large trial to test the efficacy of the vaccine was set up in volunteers who had a relatively high risk of HIV infection. After two years, in September 2007, the trial was terminated because an interim data analysis showed that the vaccine had no protective effect. Worse, there was a trend towards more infections in people who had pre-existing immunity to the adenovirus in people who received the vaccine, compared to those who had a placebo vaccine (saline). This has caused much alarm and despondency. Merck has pulled out of HIV vaccine research and other major pharmaceutical companies have followed suit.

A debate is ongoing as to what went wrong in the Merck trial. It is quite possible that none of the safety questions raised would hold up in a longer term study with more people tested, but reasonably no-one wants to take any risk of causing harm. It does look as if the vaccine failed to reduce the virus level in those infected, the primary goal, but it could be that the type of T cells stimulated were not strong enough and that there were not enough of them. It is also possible that the vaccine and the infecting virus differed too much for the T cells to be effective. It is also possible that the newly infecting HIV causes so much immunosuppression that it overwhelms even a vaccine prepared immune responses. All these ideas are being examined at the moment.

So where do we go from here? There is still an urgent global need for an HIV vaccine. This is less pressing in the developed world because drug treatment can do so much, though without a vaccine the number of people infected will steadily increase. The burden for further HIV vaccine development is now wholly on the non-commercial funding agencies and the academic world. Both major approaches have now hit brick walls, but for the antibody field this led to a boost in top quality science aimed at really understanding the problem in depth, which could in the future lead to real discoveries in vaccine design. The T cell field needs the same kind of reassessment and redirection. The National Institutes of Health (NIH) in the USA, with remarkable foresight and well before the result of the Merck vaccine trial was known, set up a $350m international consortium, that includes UK laboratories in Oxford and London, to examine more closely how very early HIV infection is controlled and to what extent genetic and pre-exposure natural immunity influences the outcome. The aim is to better understand why some people respond to HIV infection better than others, a very few completely controlling the virus without any drug treatment. A full understanding of the 'correlates of protection' has a good chance of helping the better design of vaccines.

In conclusion, this is a difficult time for HIV vaccine development. We are all looking for new leads after recent disappointments. What is constant is the need for the vaccine and it remains a high priority to attract the best young scientists into the field with the chance to be truly innovative in contributing to the effort.

In discussion the following points were made:

Alcohol is a marvellous cleaning agent and was widely used until the recent introduction of rubber gloves. Money was not available in South Africa from the Government but came from international sources. Disagreement was expressed on the efficacy of gels on C.diff. The evidence base is unreliable however, and obtaining scientific and clinical proof of efficacy is very difficult, especially in South Africa where no work was undertaken on the problem and evidence is lacking. In response to the charge that hospitals have retreated with respect to challenges to hygiene it was pointed out that there were no hip replacements in hospitals 50 years ago, and there were no strains of bacteria resistant to penicillin then, hence the risk from either of these did not exist. The negative impact of the RAE has resulted in less expenditure in this area and the number of medical scientists funded is very small resulting in no doctors going into microbiology. In contrast, Alexander Fleming put all his personal income arising from research on penicillin back into the subject.

Surveillance was raised as an issue. Are we up to scratch with surveillance with Blue Tongue, Avian Flu and SARS hovering on the horizon? In the US, the CDC and in the UK, the WHO do pick things up. Academics could also do more to make it their business too, especially concerning Avian Flu, where links need to be established between surveillance and diagnostic tools, but it all comes down to money. National surveillance undertaken in real time differs in the private sector which does not report, and the NHS which does, but is very important in picking up issues such as the Cadbury chocolate contamination incident for example. Comparison was made between the highly regulated conditions of abattoir slaughtermen on the one hand and an unregulated hospital culture where nurses pay for their own uniforms to be laundered at home. A change in human attitudes and behaviour is necessary but it is not clear how we should do it. Perhaps variable resistance of people to HIV could form the basis for natural selection in the future?

Science and the Regions

Dr Ed Metcalfe

Chief Scientific Advisor,
South East England Development Agency, SEEDA.

Introduction and Background

The RDA role in supporting science and innovation came to general notice through the House of Lords Inquiry "SETting the regional agenda" in 2003. This report highlighted the RDA role in funding science and innovation, at £240m pa, and stimulated closer engagement with government departments and the research councils. The 2004 Spending Review, following the 10-year investment framework for science and innovation, recognised the importance of increasing knowledge transfer and set RDAs a mandatory target to increase university-business collaboration. We exceeded this target, creating more than 7,000 new collaborations a year, and have increased our investment in science and innovation by 50%. To increase high level advisory capacity from business leaders, vice-chancellors and research councils, we developed Science and Industry Councils in every region.

The regions work with government departments through a lead role system: we share the lead role with DIUS, with the North West Development Agency who lead on skills. As the strategic and operational lead for innovation science and technology, SEEDA co-chairs the **Regional Innovation, Science and Technology (RIST)** Group with DIUS, to become an established mechanism for sharing best practice between innovation groups across the RDAs and devolved administrations, and facilitate engagement with government.

The RDAs are uniquely placed to provide a focus for SME involvement and investment, and, based on an understanding of the strengths of regional businesses and the knowledge base, we can catalyse and co-ordinate partnership working and collaboration. The main challenge for the UK to be globally competitive is to increase the pace of innovation. The Chinese proverb *"A peasant must stand a long time on a hillside with his mouth open before a roast duck flies in"* reminds us that to make things happen we need to encourage a chain of innovative developments. The public sector has a role in creating the conditions in which innovation can flourish. In our input to the 2007 Comprehensive Spending Review, we developed the evidence base on regional innovation support, and realised that although we might be using different descriptions, the RDAs were doing very much the same things to promote innovation – commercialisation, networks, knowledge transfer, innovation guidance, and skills – and we are beginning to understand the most effective levers and mechanisms for creating wealth from our investment into the excellent UK knowledge base (Figure 1).

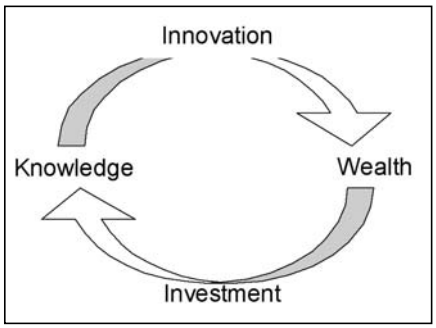


Figure 1

We are using this understanding to address the cluttered and confusing landscape through business support simplification, to develop a few products recognisable by businesses across the UK but delivered according to regional needs and priorities. One of the most important innovation products is "Innovation collaborations" (Figure 2):

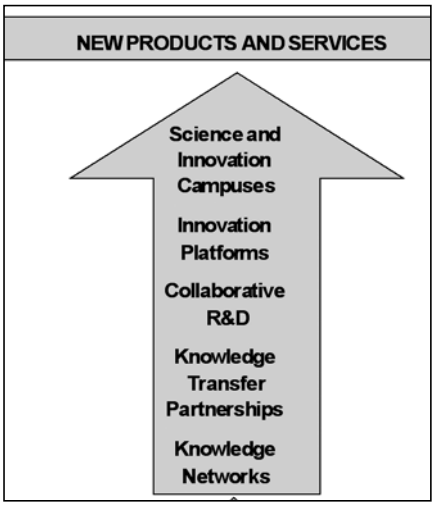


Figure 2 Innovation Collaborations

This product provides help for companies to work together with the science and research base. Innovation rarely happens through a single individual, it requires people with complementary skills and knowledge, and developing a single product may involve many businesses. The rate-limiting factor in the rate of innovation is often the growth of trust between partners, including businesses and universities or other knowledge base

institutions. We can accelerate this growth of trust through firstly engineering serendipity – increasing the frequency of productive contacts through **knowledge networks**, such as the London Technology Network which trains university business fellows to act as a conduit for increased business responsiveness, and facilitates collaborative projects of some £15m pa with businesses through highly structured networking events.

The relationships can be encouraged and deepened through **knowledge transfer partnerships**, in which an academic, research student and business work together. RDAs support the national KTP scheme, and several run shorter "mini-KTPs" up to a year for small businesses. We will integrate these into a flexible KTP product to address the needs of a wide range of businesses.

RDAs support deeper multi-partner **collaborative R&D programmes**, including substantial pan-regional programmes. The ASTRAEA programme funded by £11.2m from 5 regions, £5m from government, and £16.2m from businesses can create a UK lead in the potential $10bn market for unmanned airborne vehicles.

RDAs have shown strong interest in the creation of challenge-led Innovation Platforms which can lead to substantial global business opportunities across the supply chain. Working together across government, the research councils and the RDAs, we can focus on substantial investment programmes to create early market leads. SEEDA as a partner in the Intelligent Transport Systems and Services platform managed the very first Innovation Platform call – funded projects include a wireless services demonstrator in Reading.

We also need places where collaboration can take place with academics and business researchers working together on a common problem as well as providing shared facilities to help businesses develop and grow. Science and Innovation campuses in the support product "**Shared Business Support Environments**" are being developed by regions to address this need, building on experience such as Yorkshire Forward's Centres of Industrial Collaboration. The strategy has succeeded beyond expectation. In three years 12 CIC centres collaborated on 1700 projects with business, creating or safeguarding 1300 jobs and generating £40m of income in the region and business success stories across all industry sectors. In addition to supporting the Harwell Science and Innovation campus (alongside NWDA support for Daresbury) SEEDA will support the development of at least two new campuses, advised by our science and industry council in line with regional priorities, including the Kent Thameside Institute for Sustainability in the Thames Gateway as part of an international network, including the LDA and EEDA, giving access to world class knowledge in sustainability. This centre of excellence will enable collaborative working and research to develop, test and demonstrate solutions for **Integrated Resource Management for Communities and Districts**, and will provide a test bed for integrating current best practice technologies into large and complex systems.

"**Access to business expertise**" has three strands to help business product, process and service innovation. The *Manufacturing Advisory Service* (MAS) addresses the needs of UK manufacturers, particularly SMEs, by providing practical hands-on assistance from experts to enable them to adapt continuously to new methods and technologies. The *Innovation Advisory Service* (IAS) helps businesses kick-start the innovation process. The key components are low bureaucracy and a team of highly competent advisors who have worked at director level in the private sector and have specific technology experience. The advice focuses on customer needs, based on a wider understanding of innovation than R&D. *Designing Demand* supports roll out of the Design Council programmes since businesses using design perform better – in one survey 75% of businesses reporting growth said design contributed to their sales growth, while most companies that hadn't grown could not see a role for design.

Looking ahead, the RDAs have already taken on board most of the Sainsbury report recommendations, and will respond positively to the DIUS science and innovation strategy. We have learnt from our experience with the micro/nanotechnologies and national composites networks that knowledge exchange transcends regional and national boundaries and regions need to **collaborate to compete** globally. Pan-RDA collaboration focusing on regional priorities will achieve an effective **partnership between the regions and the Technology Strategy Board** (TSB). Over three years, the RDAs have committed to align at least £180m funding with £720m TSB funding and £120m from the Research Councils. With business match funding this will create a £2bn programme to create a step change in support for innovation. The regional partnership with the TSB will be overseen through a Strategic Advisory Group, by the chairs from the regional Science and Industry Councils and their devolved administration equivalents. Supported by an Operational Advisory Group, regional Prospectuses will be used to align regional and national Technology Strategy priorities, with significant investment on a small number of **Innovation Platforms** which show excellent potential for bringing together the power of the public sector across government departments, research councils and RDAs to address major societal challenges and create early stage global business leads.

At the same time we will increase the **clarity and coherence** of innovation support regionally and locally, through the Science Cities being developed in six regions, and through sub-regions with a critical mass of creative and connected people (eg South Hampshire). An integrated approach will provide the business support needed, whether for skills, globalisation, enterprise, procurement, sustainability or innovation. And we will continue to explore how best we can support businesses, from open innovation pilots to develop an intellectual property market, to innovation vouchers for small businesses to use with universities.`

The Northwest Regional Development Agency

Dr George Baxter

Director of Science and Innovation, Northwest Regional Development Agency

The Northwest Regional Development Agency (NWDA) leads the economic development nd regeneration of England's Northwest. As a business-led organisation, the NWDA provides a crucial link between the needs of business and Government policies. As such, a major responsibility for the Agency is to help create an environment in which businesses in the region can flourish through offering business support, encouraging new start-ups, matching skills provision to employer needs and bringing business investment into the region.

England's Northwest is a fast growing, vibrant region, combining a dynamic business base, cosmopolitan urban centres, breathtaking landscapes and an internationally recognised creative and cultural scene.

It boasts Manchester, the largest media hub outside of London; Liverpool, one of the world's most famous waterfronts; Cheshire, home to AstraZeneca's largest global Research & Development premises; Lancashire, a world class centre of excellence in advanced manufacturing and engineering; and one of Europe's leading national parks, the Lake District.

With almost seven million inhabitants and 230,000 companies, the Northwest is a thriving economy. It is worth a remarkable £106 billion – a tenth of the overall UK GDP. It is the UK's largest regional economy, larger than several European countries, including Denmark and Finland, and it is one of only three regions to contribute positively to the UK's balance of trade.

And it's not just excellent for business. A huge 29% of the region is designated as National Park or area of outstanding beauty. The Northwest boasts the largest lakes and mountains in England, not to mention the longest stretch of undeveloped coastline.

These rich natural assets are part of the reason why England's Northwest has been voted the top location for quality of life in the Reward Group's cost of living survey for two years on the run, while a poll by Ipsos MORI in 2006 rated the region highly on areas of outstanding beauty, culture and nightlife.

Our vision for the Northwest is a dynamic, sustainable, international economy which competes on the basis of knowledge, advanced technology and an excellent quality of life for all.

Projects and schemes supported and funded by the NWDA are largely delivered by public and private sector partners, at a sub-regional and local level. Once a project has been developed and has secured Agency investment, a team of specialists will work closely with partners to deliver the scheme.

The Agency works with a wide range of local and regional delivery partners, including local authorities, community and voluntary groups and the private sector. However, perhaps the most significant partners are Urban Regeneration Companies (URCs).

The Agency has been instrumental in establishing URCs in key towns and cities across the Northwest:

- New East Manchester
- West Lakes Renaissance (Furness and Cumbria)
- ReBlackpool
- Central Salford
- Liverpool Vision (the first URC in the UK)

Acting as champions for their local areas, URCs aim to co-ordinate focused plans for the regeneration and future development of their towns and cities, and to stimulate new investment.

To ensure local solutions to local problems, the Agency has formed five Sub-Regional Partnerships, which bring together business, the public sector and voluntary and community groups. They are responsible for leading economic development within their sub-regions and identifying economic priorities which will deliver the Regional Economic Strategy (RES).

The five Sub-Regional Partnerships are:

- Cheshire and Warrington Economic Alliance
- Cumbria Vision
- Greater Manchester Forum
- Lancashire Economic Partnership
- The Mersey Partnership

In 2006, the Agency was one of the first regional development agencies (RDAs) to be assessed by the National Audit Office (NAO). In the NAO's Independent Performance Assessment, or IPA, the Agency was awarded a "Performing Strongly" rating, the highest ranking available.

RDAs have a very high profile role in economic regeneration but we are very interested in Science and Innovation as

drivers of productivity and hence GVA growth, which is the key economic target for RDAs. There is no need to repeat arguments here about our inability to compete as a low cost economy – these are well understood by all partners in the UK. What is critical on a Regional level to achieve this is a thorough understanding of what the real strengths and opportunities of the Region are. Similar Regional strategy documents worldwide often contain the same, similar sector objectives – nanotechnology, biotechnology, IT etc with no real understanding of the core abilities in these areas which lie in the Region. So, we ask ourselves – would an independent observer recognise the Northwest from a description contained in our strategy documents? We hope so, and it is probably more important to note what is not included in those documents as well as what is included.

In the North West, as well as major strengths, we have specific issues to face in our economy – a lower number of businesses than the UK average, lower start-up rates, concentration of innovation in a few large science-based companies, and the "export" of some of our best people to other Regions, especially to London and the South-East. Hence, our interventions as an RDA are targeted towards these issues, within the guidance of the Government's Business Simplification Support Project. These interventions arise out of a policy framework, led by NWDA, but developed in partnership with public and private partners. In particular, the North West Science Council (NWSC) acts to provide advice and guidance on science policy and interventions to the RDA Board. The NWSC was the first Science Council to be formed in the UK (in 2001) and has published 2 Regional Science Strategies since then. It is a partnership of private sector (eg AstraZeneca, Rolls-Royce, Unilever, BAES, CBI) and public sector and Universities, at senior level. As well as developing Regional Science Strategy, it proofs major science-related projects in the Region and also Regional cluster organisation strategies.

It is possibly easier to illustrate the typical role of NWDA in Science by reference to some specific points.

National Biomanufacturing Centre (NBC)

The North West is a vibrant centre for the pharma/biotech industry – more than 200 companies employ over 20,000 staff and NW Universities produce over 25,000 life-science graduates every year. With the growth in the numbers of new start-up companies, the ability to develop and manufacture a wide variety of novel biopharmaceutical medicines for early phase clinical trials is crucial. However, investment by any one small company in such a facility (costing tens of millions of pounds) is prohibitive. The NBC funded by NWDA, ERDF and DTI provides this service on a commercial basis to enable these companies to more rapidly commercialise their products. The aim is that the Centre will become self-sustaining after a few years.

Knowledge to Innovation (K2I)

Research on the reasons why SMEs fail to innovate shows that one of the main reasons is a lack of knowledge of key managerial staff in how to innovate ie the process of ideas generation through to implementation. K2I will work with more than 400 SMEs to provide practical advice and guidance on this process, using real examples, leaving more than 1,000 senior staff with an enhanced ability to innovate and operates across all sectors of industry from financial services through to Advanced Materials.

These are only two examples of the type of work which NWDA is driving to improve our Innovation capacity. They illustrate two of the key principles of intervention by the public sector in this field – the ability to tackle market failure by aggregating SME demand in sectors of strong growth and the ability to reach large numbers of companies in a concerted fashion. The Regions and RDAs are crucial to this, in our ability to work in areas large enough to have critical mass in a world-scale, but small enough to comfortably reach the key decision makers.

SCIENCE IN THE REGIONS

A Key Regional Partner Perspective

Professor Colin Whitehouse FREng

Deputy Chief Executive & Director of Campus Strategy, Science and Technology Facilities Council

The last several years have seen very significant improvements in the UK's regional economies, driven hard and very productively by the English RDAs and the devolved administrations. However, on occasion, these developments have led to inter-regional competition, several claims of duplicated world-class capabilities and hence sub-critical mass activities when compared with that of the UK's leading international knowledge economy competitors. The present article therefore builds on the author's very considerable experience of science and technology working in and with several of the UK's regions, to seek to convince the reader that really key opportunities now exist for these different regions to be even more focused and realistic regarding their

respective genuine present or future world-class capabilities and "unique selling points", and then use these analyses to identify key value-adding collaborative opportunities with other regions. That mechanism can then be used to develop much-strengthened added-value critical mass activities at the UK-level which can then become genuinely competitive with even the strongest knowledge-based economies elsewhere. It is the author's view that this realisation has already started to gather significant speed in the UK but more can be done and progress can undoubtedly accelerate.

This article is written against a background of the author's many years of experience working in semiconductor and nanoscience/ nanotechnology-related research and senior management in UK industry, Universities and Government Laboratories, and career-long efforts always seeking to optimise UK added-value inter-working between these different sectors. The experience has included close working with many RDAs, devolved administrations and other key regional organisations, along with several years of experience gained in seeking to generate genuine international-class critical mass multi-partner interactions, particularly during the years when the author sponsored major collaborative research programmes via RSRE (now Qinetiq) Malvern and also later when he chaired the White Rose Research Group which brought together the research of the Universities of Leeds, Sheffield and York, a new UK collaborative model which continues to go from strength to strength even to this day.

During the earlier years of these interactions with the RDAs, it became rapidly clear to the author that many of the RDAs and devolved administrations had identified claimed regional "clusters" of specialisms and expertise, which were often numerous but, even more importantly, duplicated the claimed specialist "clusters" of several/most of the other UK regions. This lack of more detailed and critical self-analysis then inevitably generated inter-regional competition, much of which was sub-critical mass in a really genuine international knowledge economy context.

Despite significant improvements and ever-developing realism over the subsequent years, the author still believes that yet more progress can be made in this area and that even more detailed self-analysis can take place within the regions. Thus the RDAs and devolved administrations can show yet more real **leadership** in identifying genuine potential world-class competitive activities (however small in number), then provide major **influence** by focusing regional effort much more significantly in those areas, and then, very importantly, encourage and **catalyse** new internationally-competitive inter-regional critical mass via **collaboration**. These should be the major value-add regional activities and much more economic benefits and international competitiveness should then be attainable via the generation of a yet further tier of added-value via yet more effective inter-regional strategic interactions and critical mass collaboration.

Against that background and long-held philosophy, the author has trialled various added-value critical mass inter-working mechanisms during his career, often involving very effective and highly interactive virtual networking between the University, Government and industrial sectors. That experience has shown that given shared visions and key leadership personalities, such virtual networks can make very important progress and impact. However, they can often be somewhat fragile as changes in those leadership personalities and approaches inevitably occur over time.

Since mid-2004, the author has therefore been working closely with Government and specific RDAs (predominantly with NWDA and SEEDA to date, but also involving related discussions with SWRDA, Yorkshire Forward and the Scottish Executive) to develop and trial a totally new UK approach which operates on the basis of critical-mass generation via mixed-economy (Universities, Government Laboratories, Industry) co-location and new "open innovation"[(1)] approaches. This new approach led directly to the March 2006 Treasury-led Budget announcement of the formation of two new National Science and Innovation Campuses in England at Daresbury (DSIC) and Harwell (HSIC), based on the long-term campus sustainability then provided by the "embedded science" capabilities at the two major STFC laboratory sites.

At Daresbury very close, regular and productive STFC (previously CCLRC) high-level **strategic** interactions with the NWDA have led to extremely positive co-working and have allowed key components of the new campus vision to already be tested and proved to be successful. **Catalytic** funding from the NWDA has already assisted in the UK's first example of significant co-location of leading academics, PDRAs and PhD students from several different leading research-led Universities (Manchester, Liverpool and Lancaster) on the "neutral" Daresbury campus, physically co-located alongside STFC's significant team of its own scientists to form a new Cockcroft Institute National Accelerator Science Centre. Already this "critical mass" approach has

(1) "Open Business Models : How to Thrive in the New Innovation Landscape", Henry Chesbrough, Harvard Business School Press (2006).

generated well in excess of £20m of funding over the past two years, has achieved an exceptionally high success rate with peer-reviewed blue-chip grant applications and has also yet further strengthened critical mass by successfully attracting leading international scientists. The critical mass model is no longer just UK-based therefore but, very importantly, is also now working at the highest international level. Hence this new University co-location model is attracting ever-increasing attention and much consideration is now being given to actively rolling out a number of other similar critical mass "Technology Gateway Centres", as described in the recent STFC Delivery Plan.

Another very important component of the new campus model which has already been very successfully proven at Daresbury, again with much NWDA strategic involvement, has been the very effective use of this newly-generated STFC/multi-University knowledge base critical mass to then attract ultra-high technology companies seeking to use open innovation processes to gain much further two-way value from co-location. The new Daresbury Innovation Centre has already attracted 63 such ultra-high technology companies and the very real benefits of catalysing "open innovation" interaction mechanisms has meant that not only are the very high majority of these existing companies in significant growth (the average growth is currently 30% per annum) and expansion, but also very exciting new companies have already been generated as a direct result of "open innovation" interactions between the campus partners. As a result of all of this success, the Minister for Science and Innovation, Ian Pearson MP, announced a very important £25m next phase of private sector investment in major new innovation buildings at Daresbury very recently. Hence the initial **catalytic** support of NWDA has now fully proven the private sector viability of the campus model, and further major announcements regarding ongoing significant private sector investment at Daresbury are now expected. With this success, the Campus Board and NWDA are now making very firm plans for the site to be home to 10,000 staff in ten years.

Another really exciting developmental aspect at Daresbury has been the catalysation and testing of the very important new "open innovation" processes which have been facilitated by mixed-economy co-location. Indeed the author has never previously experienced the rate at which new innovation and company progress can occur other than in this co-location model. Indeed, such are the marked differences in innovation mechanisms and progress that several key leading University Business Schools are now seeking to perform major research programmes to study and monitor these very productive and stimulating new working processes at the Campus.

Since January 2006 therefore, this now-proven campus model is also being progressively introduced at Harwell in Oxfordshire, this time in very close collaboration with SEEDA and UKAEA, but again building on STFC's large-scale science facilities and major research activities at the Rutherford Appleton Laboratory. As at Daresbury, very considerable progress has also been made now at Harwell, and the coming weeks and months will see major announcements regarding the formation of a new public-private sector joint venture company to provide major further campus investment there also.

As effort has therefore been focused on the development of these two new national campuses, other English and UK regions have shown a very close interest (and, very interestingly, sometimes a very real competitive concern) regarding these campus developments. However, it is the author's view that these now significantly proven co-location critical mass open-innovation approaches at the two national campuses, can also be introduced very effectively at the regional level (alongside highly effective virtual networks if regionally appropriate), but only if each region identifies and uses co-location to build on their **genuine** international-class regional strengths. In that way, and instead of diluting regional investments by spreading support across numerous, sub-critical and often non-collaborating activities, the critical mass model can act as the catalyst for yet further major regional economic advances and also as a major magnet for serious inward-investing R&D activities..

One final comment. Now as a member of staff at one of the UK's Research Councils, it is the author's continuing

The New Daresbury Innovation Centre, already home to 63 ultra-high technology companies

strong and now yet further strengthened personal belief that the RDAs and devolved agencies should definitely not seek to be additional Research Councils, but instead should concentrate on working with key regional partners to continue to drive forward the very important skills agenda which is vital to sustain the UK's future knowledge economy. Another vitally important component of their ongoing activities is their continuing catalytic support and funding in the gap which still exists in the UK between the point at which extremely high quality potentially commercialisable research has been performed and the point at which significant venture capital support can then be attracted. It is the author's view that pure research should only be supported by the regions if there is a very clear and robust exploitation plan, which, for whatever reason, cannot be triggered by initial conventional Research Council support.

All in all therefore, truly excellent progress has been made in the UK regions, but yet more really important added-value strategic regional inter-working critical mass opportunities now exist. These opportunities should be pursued with vigour.

In discussion the following points were made:

Each RDA is phenomenally different from that of other Regions and sub-Regions also. There is an awesome resource in SEEDA, for example, when compared with the North West which is quite sparse by comparison. R&D is usually developed locally in relation to the available skills base. Where this is lacking there is a danger that multinational companies will depart.

The most important route for communication is the business link and cluster for small to medium sized companies. Large companies can and do go anywhere they wish to locate and the availability of the local skills base is the key factor in retaining their presence locally. There is no easy solution to the provision of S&T training as 25% of secondary schools have no physics teacher. There is therefore an essential need to share any existing inspirational teaching between schools to enable children to have access to this vital component in their S&T education. The establishment of specialist science schools creates new problems for students in view of the practical problems related to access and proximity of such schools to those wishing to attend them as they may have too far to travel on a daily basis. The system works well in the West Midlands and also in the North East, however. where chemical engineering flourishes and there is a Science Innovation Campus with 1600 technically qualified people on hand. In the South East there is no current need for the RDA to catalyse innovation and skills.

WHAT DOES BRITISH INDUSTRY WANT FROM OUR SCIENTISTS AND ENGINEERS?

NATIONAL SCIENCE AND ENGINEERING WEEK SEMINAR ON THURSDAY 13TH MARCH

During National Science and Engineering Week the Parliamentary and Scientific Committee joined with the Department for Innovation, Universities and Skills to host a Seminar in Parliament on British Industry's requirements from Scientists and Engineers. The Seminar, entitled What Does British Industry Want from our Scientists and Engineers?, was jointly chaired by Mr Ian Pearson MP, Minister of State for Science and Innovation, and Dr Douglas Naysmith MP, Chairman of the Parliamentary and Scientific, and was held in the Attlee Suite in Portcullis House on Thursday, 13th March.

Report by Robert Freer

Introductory Remarks

Ian Pearson MP

Minister of State for Science and Innovation

In opening the meeting Mr Ian Pearson MP, Minister of State for Science and Innovation, said he was very pleased to be attending this event as part of Science and Engineering week. He expected the total attendance this year at all events during the week would exceed that of last year when nearly 800,000 people took part in 3,000 events across the country.

He said the Government's commitment to promoting British science has steadily improved the supply of Scientists, Technicians, Engineers and Mathematicians (STEM) over a

number of years. Attainments at GCSE, A-Level, first degree and postgraduate results are all on an upward curve. But despite this encouraging progress challenges remain to ensure supply fully matches demand.

In schools we now have more science graduates teaching science than at any time in the past and we have 18,000 volunteer science and engineering ambassadors going into schools. These ambassadors come from a variety of different backgrounds, many are undergraduates, and can show school children not only what a subject is but what it is used for.

We need all the positive PR we can get for engineering; three quarters of young people don't know what engineers do. The Government has plans to improve the profile of engineering including the Technology and Engineering in Schools Strategy (TESS) and the National Engineering Programme (NEP), both of which are being delivered through the Royal Academy of Engineering. And the new Engineering Diploma will be available from September 2008 to help pupils with the skills to enable them to go into engineering degrees or into employment.

Mr Pearson said he wanted to see an improvement in the number of those studying science and engineering at all levels and to break down the stereotypes that surround some science subjects. For example, in subjects allied to medicine there are five times more women than men and in the biological sciences there are over 40% more women than men. Meanwhile, there are about 11,000 more men than women studying the physical sciences, and with the NVQ in construction there are over 50 times more awards going to men than to women.

NVQs are part of the programme of the Further Education and Skills sector designed to enable our workforce to adapt to the needs of the increasingly technology driven 21st century workplace. We are on course to meet our commitment to have 12 National Skills Academies by the end of the year which takes us closer to our goal of making skills more relevant to particular sectors.

Success with Government initiatives such as Train to Gain, Apprenticeships and the Skills Pledge depend on close partnership between business and providers. The focus on apprenticeships has been particularly successful and completions have risen from 40,000 in 2001/02 to over 100,000 now. In addition, the Qualifications and Curriculum Authority (QCA) is working with some 75 employers to explore ways of crediting their own industrial training programmes.

Our skills programme is overseen by the various Sector Skills Councils (SSC). SEMTA is the SSC for Science, Engineering and Manufacturing Technologies sector and is one of the largest SSCs covering 100,000 companies employing 2.5 million people, which provides up to 10% of our GDP – £74 billion every year – and contributes 33% of total UK exports. SEMTA is taking forward several key Government initiatives. They have published the Sector Skills agreement for the Automotive, Aerospace, Electronics, Marine and Bioscience sectors. SEMTA is also working with other SSCs to develop the 14-19 Diploma in Engineering and the Diploma in Manufacturing which will be available in 2009.

In Higher Education the outlook is promising, the long-standing decline in the numbers of university entrants in almost all the sciences has been reversed. The Government and the professional associations are working hard on this agenda, for example the 300 bursaries for physics undergraduates that the Institute of Physics offers have had a real impact.

Employers complain that we need more home-grown graduates in science and engineering but the problem is complex because up to three-quarters of the science graduates we do produce end up working outside science. This implies specialist skills are going to waste so we need to do more to promote careers in science and engineering and to ensure that science graduates have the skills they need to work in the scientific industries.

In my view there needs to be much closer collaboration between those who teach skills and those who turn them into products and profits. From school to post-doctoral level we are seeing the beneficial results for the UK science base that flows from dialogue and joint working between education and training providers, employers and professional associations. The Government will continue to promote more and better links of this kind.

Finally, the science challenge isn't just about training scientists, there is a job to be done with the general public. Public dialogue on science issues is crucial when it impacts so heavily on our lives. The recent survey of Public Attitudes to Science found that people are becoming more interested in science. Four-fifths of those surveyed said they were amazed by advances in science and technology. DIUS will shortly be setting out its plans for a new strategy on the role of science in society.

Business engagement with university scientists and engineers

Dr Alison Hodge MBE
QinetiQ University Partnerships Director

Dr Hodge said QinetiQ is a creative business which seeks to generate greater value from technology throughout the world through technology solutions, services, products, consulting and patents and licensing. New technologies offer both enabling opportunities and threats.

QinetiQ has a strategic interest in establishing links with scientists, technologists, engineers and mathematicians (STEM) in universities as part of the business supply chain and to improve its positioning with stakeholders and the wider public. Working with universities allows access to scientific techniques and facilities so that we can spot and access both existing and new developments worldwide. These contacts not only demonstrate the benefits gained from the significant national investment in universities but also encourage recruitment and recognition. Apprentices, graduates and PhDs are strongly motivated, willing and able to learn and have the opportunity to become world leaders in their subjects.

The universities gain considerable benefit from working with business. For the research staff business raises relevant challenges and provides valuable market knowledge. Students gain not only the opportunity to work on real projects but also an insight to teamwork and are introduced to wider employment opportunities. The market pull encourages universities to innovate and apply new scientific and technological discoveries. Universities also benefit from the publication of their work which helps improve their visibility with funders and the public. But there are special problems when working with universities. The role of universities is to use existing knowledge and where necessary to pursue new frontiers. Their product is not usually delivered in a package which can be immediately applied in business. Transferring the knowledge relies on human interaction and we need to ensure the right people are available.

There are a number of significant differences between the culture of a university and the issues which affect business decisions. A business has a corporate strategy developed by management to meet customer needs and financial targets, whereas university researchers enjoy academic freedom in pursuit of new ideas but rely on funding organisations.

Businesses respond to commercial sensitivities and usually require rapid action to produce a product or service of sufficient quality for its purpose at a cost determined by the market. On the other hand, universities usually work with a more protracted time scale with a different attitude to costs, and quality is judged by peer review in open publication in the technical literature.

For a business, necessity is the mother of invention and can lead to innovation by the universities to tackle a specific challenging problem rather than a generic challenging problem. Another practical difference is that in universities the student and staff turnover is higher than in business which has more managed staff profiles and successions.

To produce a mature product or service from an idea the completed project requires people with the relevant experience, sufficient time and financial investment and an integration of a number of separate systems. Technical considerations are just part of the solution; full performance includes training, data records, analysis, and maintainability among other criteria. As an example of technology transformation a laboratory experiment at Southampton University was developed by QinetiQ into a swimmer detection system.

EPSRC and QinetiQ together have jointly sponsored a new Professorial Chair of Technology Transfer in the Physical Sciences. This appointment is based at Imperial College and the first occupant of this chair is Prof Erkko Autio in the Tanaka Business School. The purpose of this appointment is to promote wealth creation in the physical sciences and engineering through an academically rigorous understanding of the needs of industry and the capacity of the universities.

In summary, business needs the science and engineering skills developed in universities to ensure that both existing knowledge is re-used and that new knowledge is created and applied. We need to promote the understanding by industry, by the public and by those advising the young that science and engineering are recognised as exciting and creative disciplines. To support this linkage we need more people with sound training and with practical skills who are willing to learn and gain experience and apply the knowledge gained. There are cultural gaps which exist and we need both business and the universities to understand, recognise and exploit these gaps.

What does British Industry want from our Scientists & Engineers? – ARM as an illustrative example

Sir Robin Saxby FREng
Past President, Institution of Engineering and Technology
Past Chairman and co-founder of ARM Holdings plc.
With the assistance of *Prof Ian Phillips Principal Staff Engineer at ARM Ltd*

Sir Robin Saxby said ARM is a listed public company registered and based in Cambridge but operates globally with almost all its revenue coming from outside the UK. It is a good example of an industry working with scientists and engineers. More than half its shareholders are based overseas and each site throughout the world is a centre of excellence, often developed out of a university connection.

ARM's engineers and scientists are global leaders in what they do. They are customer-driven and sensitive to the need to deliver on time to specification at the highest quality. To do this they need to be not only technically strong but also broadly aware of other business disciplines such as finance, sales, marketing, legal, production and human resources. They are also culturally aware of the need to work as a team with people across different regions and countries. Nowadays everyone is connected electronically and communication is rapid.

ARM is now the silicon IP supplier to the world. In 1990 ARM was a joint venture spin out from Acorn UK with cash from Apple and VSLI in USA. It had 12 good engineers and a hired experienced CEO in Robin Saxby, it had no revenue and no patents but did have a vision to become the global standard for embedded CPUs. By 2008 they had become the world leader with 2.5 billion chips supplied in 2007 and more than 10 billion to date. Today ARM employs 1800 people in 19 offices throughout the world. Revenue is €500 million, profit before tax is about 25% and R&D is about 25% of sales,

ARM recognised that although computers were not a new concept the need for powerful embedded computation was only just emerging. ARM's innovation was to offer the 32 bit RISC CPU as a cell-library element for use in Application-Specific Integrated Circuit (ASIC) designs and to make it equally available to everyone, to make it available from all major silicon foundries and to make it available for use in all major design tools. The focus is on improving MIPS per watt, MIPS per dollar and the time to market. The necessary integration and interworking was achieved by partnering and by sharing the risk and success through a licence and royalty revenue model. ARM is a business based on Partnership from the beginning.

ARM is active in Europe and since 1990 ARM has been, and still is, involved in 28 projects under the EU Future Framework Programme. ARM's contacts with Plessey, Nokia and others helped to promote ARM activity and concepts within Europe, and also gained support for ARM's methods and development of the embedded CPU concept when the rest of industry did not believe it was necessary. Parallel business developments in the USA and Japan are even more important, because they are bigger markets and are the locations of the headquarters of the leading semi-conductor companies.

ARM has partnered with world wide companies and has become more international with the development of skill centres outside Europe. High growth opportunities are frequently in those markets which are low value today. The USA is a major market but the fastest growing emerging markets are India and China, and none of them can be ignored. Today ARM has a connected community of over 300 world-wide partners and their activities include processors, system level IP, physical IP, development tools and software.

From our experience the lesson is to do only those projects which align with Corporate Interest, and to corporately believe in what you are trying to achieve. ARM made sure that collaborative R&D activity fitted with strategy and not the other way round, in other words don't just go for the money. The profile for successful product development is to employ only the best employees, chose the right strategic partners, use world-class universities for research and acquire viable companies which align with the corporate plans.

Hi-tech projects and businesses have become more global with teams working in different countries around the world. Out-sourcing occurs in all aspects of the work with overseas teams working together. It is important to pick those areas where UK operations have global leadership and then support and develop them. Good advice for a new company

would be to do only what you are world best at.

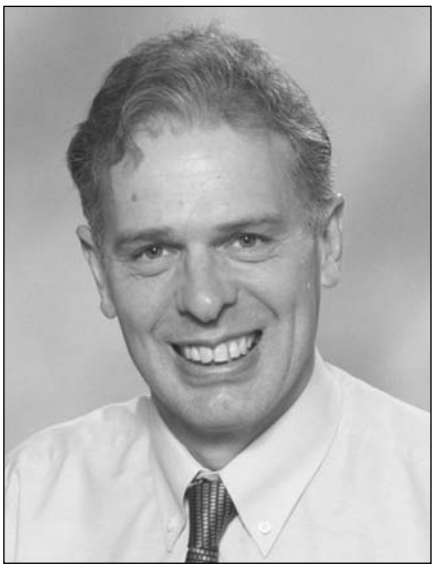
The Government also needs to provide leadership and support, and not just money. It has the opportunity to be both a catalyst for innovation as well as a customer. The opportunities are in such departments as the NHS, defence, energy and security.

The contribution that business makes to the national economy is important for our economic prosperity. The UK is just 1% of the world population but produces 5% of its economy. To maintain our position it is not enough to be world-class, we have to be world-beating.

A Marine Scientist and Engineer's view

Professor Ralph Rayner

Vice President, Institute of Marine Engineering Science and Technology



The Institute of Marine Engineering, Science and Technology (IMarEST) is an international professional membership body and learned society for all marine professionals. It is the first professional institute to recognise the need to bring together marine engineers, scientists and technologists to encourage a multidisciplinary approach to issues related to maritime safety, commerce and environmental protection.

The Institute is active in promoting the role of marine professionals in helping to address pressing societal challenges such as energy security and climate change.

The human population of planet Earth has grown from some 500 million in 1492 to over 6.6 billion in 2008, with a projected growth to 9.1 billion by 2050. This transition from an empty to a full world has created many challenges. Amongst the most critical is finding ways to meet ever growing demands for energy (without which adequate agricultural production, sufficient water supply and growing industrial economies cannot be maintained) at the same time as protecting the environment and especially mitigating the impact of human induced climate change.

The oceans play a crucial role in both aspects of this challenge. On the one hand a large proportion of the world's conventional energy in the form of oil and gas lies beneath them. They also hold an enormous potential as a source of renewable energy from winds, waves and tides. On the other side of the equation they are the critical driver of future climate, are a major natural sink for atmospheric carbon dioxide and present opportunities for enhanced sequestration of greenhouse gases.

Despite reductions in energy intensity in much of the developed world global demand for energy continues to grow. Projected rates of growth are of the order of 1.6% per annum with the fastest growth occurring in non OECD nations. Assuming no further increase in the rate of growth this translates into a global increase in energy demand of more than 30% in the coming two decades.

Despite the developing potential of renewable energy sources much of this growth will probably be satisfied by conventional hydrocarbons, a large proportion of which (more than 50%) are expected to be recovered from beneath deep ocean waters.

This presents huge engineering challenges. The biggest constraint on meeting these challenges is an acute shortage of suitably qualified and experienced engineers and scientists. This is already proving to be a major constraint on offshore developments. Order backlogs for many of the critical components in the supply chain for new developments are now measured in years with much of the constraint in supply being driven by a lack of suitably qualified and experienced engineers and physical scientists.

Similar skill shortages are impacting the rapidly growing marine renewables sector as this demands many of the same skills as are required for conventional offshore developments.

If you add to the demands on this already insufficient skill base the need for researching, developing and implementing means of separation and sequestration of greenhouse gas emissions from the burning of fossil fuels it is clear that we face a skill shortage which demands immediate attention.

On the other side of the energy and climate challenge there is a pressing need to reduce the very large uncertainties in projections of future climate if governments and businesses are to make informed decisions about the future.

Given the dominant role of the oceans in controlling climate, achieving the best possible projections of what will happen in the future demands a very good understanding of how the oceans work and how they are changing

through time. Yet commitment to systematic and sustained observation of the oceans remains woefully inadequate and poorly co-ordinated.

Here the critical need is for greater political recognition of the implications of this lack of commitment.

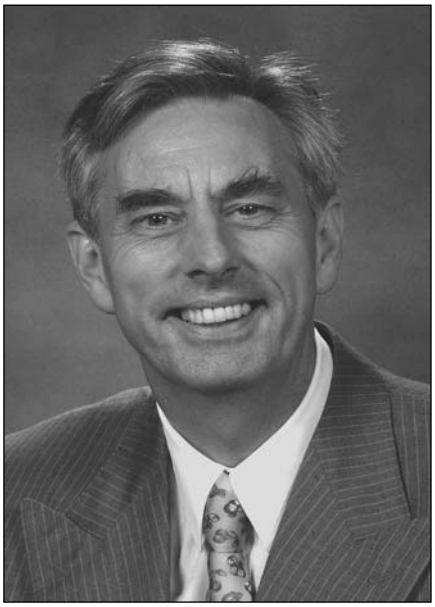
The need to commit additional resources and implement improved organisational structures to permit better understanding of the oceans was recognised in the recently issued House of Commons Select Committee report 'Investigating the Oceans'. Regrettably, the Government response failed to endorse the key recommendations of this well formulated and important report.

It is only by addressing the need for sufficient engineers and scientists that the challenge of meeting a growing demand for energy at the same time as ensuring environmental security can be satisfied. Their efforts must be guided by sound policy informed by an appropriately organised and resourced science base.

An Engineering and Technologist's View

Dr John Morton

The Engineering and Technology Board



Dr Morton said the Engineering and Technology Board (ETB) was created to promote engineers, engineering and technology. And to do this in partnership with industry, who are the customers for skilled engineers and technicians, and with the universities and colleges who are the suppliers. The ETB publishes an annual digest of engineering statistics called Engineering UK (2007) which includes information on the supply of, and demand for, engineers. The full report can be downloaded from www.etechb.co.uk/_db/_documents/EngUK07.pdf

On the supply side the number of engineers in Higher Education in the UK has remained almost constant for the last 10 years but since the total number of students in all subjects has increased by about 33% the proportion of engineers in the student population has decreased, giving the impression that engineering is becoming less popular.

India and China are often cited as producing large numbers of graduate engineers but until 2003 we produced more engineers per head of population than China, and we still produce far more than India does. In post-graduate education we have a large number of engineering PhDs per capita compared with India, China and even the USA, but more than half these PhD students are from overseas. We have world class universities and we make contributions to the science and technology base far beyond our size.

At the intermediate skill level in the Colleges of Further Education the picture is not so good. The number of students has fallen by 25% in the last 3 years and our performance does not compare well with, for example, Germany, Japan and the USA. To try to remedy this the Chancellor in the Budget yesterday announced a grant of £60 million over the next 3 years to provide new opportunities for people to gain skills, including apprenticeships.

There is a further problem that over the next 10 years there will be a 16% drop in the number of 16 year olds so it may become harder to recruit the young into engineering. One solution would be to encourage more women into engineering and encourage more returners back into the profession. At present 85% of engineering students are male and only 3% of professional engineers are female. Excellent work on encouraging women to take up a career in science and engineering is being done by the UK Resource Centre for Women in SET, WES and WISE (Dr Morton said he is the chairman of WISE). But there is much more to do.

On the demand side it is difficult to get a clear picture of what companies want. Data provided by our Sector Skills Council indicates that over the next 10 years we need to replace over 1 million skilled workers at all levels to replace those who will be leaving the workforce.

The ETB has carried out an informal poll of their Corporate Members. Many said that they had vacancies which were hard to fill because there were too few applicants and the applicants were of poor quality. Another comment was that starters lacked skills and work experience and some lacked motivation.

It was also pointed out that there are considerable differences between large companies and small companies. Small companies (who may be key parts of the supply chain) find it much more difficult than large companies do to afford the training needed in the workplace.

One example was of a high-tech company that hired only one or two graduates per year out of a workforce of 60. It takes two years to get full productivity from the new graduates and this is a huge overhead for a small company to carry.

The skills which companies say they want from tomorrow's engineers are the fundamentals of mathematics and physics and the ability to apply them to solve problems. They want engineers who are comfortable working in a group and who can communicate well, which is more than just being literate. They want engineers who have an entrepreneurial flair and who are aware of the roles of finance and marketing in a company's success.

Fortunately these challenges are recognised by the Government, by employers and by education providers. There are examples of good practice and we need to recognise them and build upon them.

Educating Engineers for the 21st Century

Professor Julia King CBE FREng
Vice Chancellor, Aston University

Professor King said that in a changing world with unprecedented global challenges there is a growing demand for engineers and scientists and a recognition that the nature of their jobs is changing, partly due to the greater complexity in the technical, management and financial systems which contribute to modern projects. The number of engineers in the UK is static at 24,000 but represents a low and falling percentage of the UK undergraduate population; in Japan and Germany the percentage of engineers is nearly twice as high. There are greater financial pressures on the universities and students and a shortage of good maths and physics teachers, which lower student motivation to start engineering courses and to stay in engineering after they graduate.

The Royal Academy of Engineering has conducted a survey on engineering training by sending questionnaires to industry and to academia. They received 444 replies from industry and 88 replies from academia. Industries reported a worsening shortage of high calibre UK engineering graduates, although the best were as good as their peers in Europe. This shortage is having an impact on productivity, creativity and growth, and industry is looking for changes in engineering education. With new graduates industry is looking mainly for practical application followed by theoretical understanding and innovation. Team working and technical breadth are also important.

The academic questionnaire went to all university engineering departments and the replies showed a strong agreement with industry's concerns and enthusiasm for change. They wanted more multi-disciplinary teaching, more project and practical activities and more industrial involvement. Many universities supported the introduction of new engineering courses such as bioengineering and nanotechnology.

Universities are critical of their present system of funding, especially the decline in funding per student for teaching. They consider the Research Assessment Exercise is highly detrimental to teaching. They recommend that Government should recognise teaching excellence alongside research excellence for funding purposes, and they should increase funding for teaching to cover its true cost, including such initiatives as visiting professors and lecturers and for industrial placements, especially in small companies.

The universities are seriously concerned about the underfunding of engineering degrees. A review by the Engineering Professors Council and the ETB showed that engineering departments needed an increase of 14% just to stand still, and significantly more to move forward for the 21st Century. Without this investment we face the possibility of losing the quality and reputation of our courses which attract students both from home and overseas. 11% of our students are from overseas and they make a net contribution to the UK economy estimated at £3.8 billion per year and, together with academic visitors, are estimated to generate 24,000 additional jobs.

Professor King concluded by putting forward recommendations to the universities, industry and the institutions. Universities need to strengthen their links with industry and enhance the design of their courses so that they can deliver the engineering knowledge, skills and

competencies, new world-class engineering degree courses with a strong technical content in areas which appeal to students and deliver industry's needs. For this purpose universities should recognise excellence and innovation in the design and delivery of their courses and reward such excellence in promotion criteria, bonuses and salaries. Also they need to engage actively in promoting science and engineering initiatives in schools.

Industry is recommended to commit to active long-term relationships with university engineering departments, for example, by supporting advisory boards and providing visiting professors, lecturers and industrial tutors. Two-way staff exchanges, mentoring of young academics, student placements and visits would also be helpful, as would feedback on the quality of graduates and the relevance of their education. Industry can also help by promoting science and engineering in schools and engaging with the institutions in the accreditation of professional engineering.

The institutions are invited to recognise excellence in university teaching, for example through high profile awards for excellence and innovation and by sharing best practice in education by supporting interest groups and by the organisation of education events and conferences. Universities seeking to establish multi-disciplinary degrees would welcome support from the institutions by setting up processes to create, develop and give accreditation to such courses.

In their recent report entitled *Educating Engineers for the 21st Century* the Royal Academy of Engineering has made a number of recommendations about engineering education to meet the evolving requirements of industry as well as motivating students to become engineers on graduation. One recommendation was that a working group of experts from academia and industry should be set up to develop an experience-led engineering degree which integrates technical, operational and business skills. The RAEng has submitted a proposal to DIUS.

In the general discussion a number of members of the audience raised questions concerning the best methods of advising the young about careers in science and engineering before they make their career decisions. Reportedly these decisions are often made in junior school, but in general schools and teachers are not particularly well informed about the work of scientists and engineers. Too many schools were said to be driven by league tables. Teachers who are responsible for careers advice need more opportunity to gain experience and knowledge of industry.

When selecting scientists and engineers to visit schools under the Schools Ambassador Scheme it may be preferable to chose the younger candidates because pupils may be better encouraged and inspired by meeting someone closer to their own age.

It was agreed that degree courses should be designed to encourage innovative skills and that we need to try to increase the number of science and engineering graduates.

Parliamentary and Scientific Committee News

Annual General Meeting
Election of Office-holders

At the Committee's Annual General Meeting on Tuesday 22nd April the Lord Soulsby of Swaffham Prior retired as President; Mr James Paice MP retired as Hon Secretary; Professor Jane Plant and Mr Robert Goodwill MP retired from their positions as Vice-Presidents and Professor Julia King retired from the Advisory Panel. The following office-holders were elected:

President:
The Rt Hon Lord Jenkin of Roding

Hon Secretary:
Mr Robert Goodwill MP

Vice-Presidents:
Mr Ian Taylor MBE MP
Professor Julia King CBE FREng

Advisory Panel:
Dr Robert Kirby-Harris

All remaining office-holders were re-elected for the year.

New Members

We are delighted to welcome three new members in the House of Commons: **Mr Adam Afriye MP, Mr Colin Challen MP** and **Hon Bernard Jenkin MP.**

LETTERS TO THE EDITOR

From the Members of the Stratigraphy Commission of the Geological Society of London

Sir,

The Anthropocene Epoch: today's context for governance and public policy

Change has been ever-present in human history, but this has accelerated since the beginning of the Industrial Revolution. As generation has succeeded generation, each has lived in an environment marked by novel technological, societal and cultural phenomena; these changes have affected also the external environment, for example via the felling of forests and straightening of rivers. It is becoming clear now that the extent of change has so intensified to make our present interval comparable to major global perturbations of the geological past. Living in the Anthropocene will present novel challenges to government policy, both national and international.

The term Anthropocene was coined, informally a few years ago, to denote the time interval – the last two centuries – in which humans began to supplant natural forces as the main drivers of environmental processes at the Earth's surface. Since then, the term has been increasingly used by earth and environmental scientists, and analysis suggests that a new geological epoch, worthy of formalization, may indeed have commenced. Moreover, there has been a marked acceleration to human-caused changes in land, sea, air and ice over the past few decades, and this acceleration continues today.

Both environmental modelling and Earth history analysis suggest that the changes will be greater than any encountered since human civilization began, and will develop, in part unpredictably, over many millennia. Their manifestation, as regards changes in global temperature and precipitation patterns, changing biodiversity and rising sea level, will profoundly impact settlement and agriculture, particularly in developing countries marked by poverty and rapidly expanding populations.

We note that these global changes will form an effectively permanent backcloth to virtually all areas of government policy and action, all over the world. Their scale demands a commensurate response. How the changes now under way are managed will determine, perhaps more than anything else, the course of human history.

Members of the Stratigraphy Commission of the Geological Society of London:

Dr. Jan Zalasiewicz (Chair: University of Leicester), Dr. Colin Waters (Secretary; British Geological Survey), Dr. F. John Gregory (Publications Secretary; Natural History Museum), Dr. Tiffany L. Barry (Open University) Dr. Paul R. Bown (University College London), Professor Patrick Brenchley (University of Liverpool), Dr. Angela L. Coe (Open University), Dr. Andrew Gale (University of Portsmouth and The Natural History Museum), Professor Philip Gibbard (University of Cambridge), Dr. Mark Hounslow (University of Lancaster), Dr. Andrew Kerr (University of Cardiff), Dr. Robert Knox (British Geological Survey), Dr. John Marshall (University of Southampton), Dr. Michael Oates (British Gas), Professor Paul Pearson (University of Cardiff), Dr. John Powell (British Geological Survey), Dr. Alan Smith (University of Cambridge), Dr. Philip Stone (British Geological Survey), Professor Peter Rawson (University College London), Dr. Mark Williams (University of Leicester).

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ZALASIEWICZ, J., WILLIAMS, M , SMITH, A., BARRY, T.L., BOWN, P.R., RAWSON, P., BRENCHLEY, P., CANTRILL, D., COE, A.E., COPE, J.C.W., GALE, A., GIBBARD, P.L., GREGORY, F.J., HOUNSLOW, M., KNOX, R., POWELL, P., WATERS, C., MARSHALL, J., OATES & STONE, P. 2008. Are we now living in the Anthropocene? ***GSA Today***, **18** (2), 4-8.

From Lord Vinson of Roddam Dene

Sir,

In the Spring edition 2008 of Science in Parliament, I was delighted to see you had a full report of a Discussion Meeting on Global Population Growth – Is it Sustainable?

The Climate Change Bill has taken some eight weeks to grind through the House of Lords and I think I was the only speaker who raised the question of global over-population and the negative impact this will have on any attempts to reduce the extent of Climate Change by other means.

Some of us also took a contrarian view on carbon trading which could be a charter for international cheating through bogus assessments and fraudulent verification. Trading our carbon outputs with the under-developed world is the modern equivalent of selling one's sins to gain redemption.

The debate on carbon reduction, if there is a problem, seems dominated by the desire to chase the moonbeams of as yet unproven technologies rather than embrace the one current tested technology that could give us masses of base load non-intermittent CO_2-free electricity – nuclear – hopefully followed by fusion.

The Government could introduce a rapid programme of electrification so based to give us not only electric lighting, heating and trains but electric cars, and pledge a programme to build a nuclear power station a year for the next thirty years, something well within our economic capabilities. Meanwhile, this would give time for the sensible development of alternative sources of energy and our carbon footprint would be reduced so massively that aircraft emissions would be comfortably offset, enabling us to continue travelling cheaply and hopefully into the future.

The prerequisite being, of course, that the world birth control problem be solved simultaneously. The alternative, I fear, is standing room only.

Lord Vinson
House of Lords

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 new 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.

A change of name

The House of Commons passed a motion on 11th March 2008 to change the name of the Innovation, Universities and Skills Committee to include the word science in the title. This follows the recommendation in the Last Report of the Science and Technology Committee and underlines the inclusion of science in the Committee's remit and the Committee's role in scrutinising science across Government.

Oral Evidence

The Use Of Government Statistics in Evidence-Based Policy-Making

On 19th March 2008 the Committee held a one-off session with Ms Karen Dunnell, National Statistician, and Mr Mike Hughes, Director of the National Statistics and Policy Group, Office for National Statistics. The session focused on the use of statistics by Government in evidence-based policy-making, ahead of the UK statistics authority coming into operation in April 2008.

Current Inquiries

Renewable electricity-generation technologies

On 28th November 2007 the Committee announced an inquiry into renewable electricity generation technologies. Building upon the inquiry previously announced by the former Science and Technology Committee, the new inquiry has focused on issues common to all renewable technologies. It has considered the state of renewable electricity-generation technologies in the UK including their funding and support, technology transfer and their commercialisation, intermittency of supply and connection with the national grid. In addition, it has considered the establishment and role of the Energy Technologies Institute, Government policy towards enabling existing technologies to meet targets and the UK skills base to underpin the development of renewable technologies.

The Committee has held four oral evidence sessions in connection with the inquiry. It has heard from Government officials and the Minister of State for Energy, as well as energy generators, operators of the grid, academics and interest groups. A Report is expected in the early summer.

The Science Budget Allocations

The Committee has concluded the evidence-taking process for their inquiry in connection with the Science Budget Allocations. The Committee has held three evidence sessions and heard from academics, learned societies, unions, Research Councils, the Director General of Science and Innovation, DIUS and the Minister of State for Science. A Report was published on 30th April.

Biosecurity in UK research laboratories

On 6th December 2007 the Committee announced an inquiry into biosecurity in UK research laboratories. The inquiry has focused on the capacity for research on dangerous pathogenic material in the UK, the state of biological containment facilities, inspection regimes and the licensing system, maintenance and recording practices, storage and transportation of dangerous pathogens and the measures implemented when pathogenic material cannot be accounted for, as well as both biosafety training and the role of universities in overseeing security clearance for research students working with dangerous pathogens.

The Committee has held three evidence sessions, hearing from the regulators, funding agencies, organisations running high containment laboratories, scientists working in this area,biological safety officers and Government Ministers. A Report is expected in the summer.

Engineering

On 29th January 2008 the Committee announced an inquiry into engineering. The inquiry will focus on the role of engineering and engineers in UK society, the role of engineering and engineers in UK's innovation drive, the state of the engineering skills base in the UK, including the supply of engineers and issues of diversity (for example, gender and age profile), the importance of engineering to R&D and the contribution of R&D to engineering and the roles of industry, universities, professional bodies, Government, unions and others in promoting engineering skills and the formation and

development of careers in engineering.

Two case studies have been announced which will form part of this inquiry. The first of these will be plastic electronics and will focus on the current and future roles of engineers in the field of plastic electronics, the potential for plastic electronics in the UK/global economy, how universities, industry, venture capital and Government are involved in the development of the UK plastic electronics sector and whether the UK engineering and manufacturing sectors are set up to handle growth in this area. The second case study will be nuclear engineering and will focus on the UK's engineering capacity to build a new generation of nuclear power stations and carry out planned decommissioning of existing nuclear power stations, the value in training a new generation of nuclear engineers versus bringing expertise in from elsewhere, the role that engineers will play in shaping the UK's nuclear future and whether nuclear power proves to be economically viable and the overlap between nuclear engineers in the power sector and the military.

After Leitch: Implementing Skills and Training Policies

On 4th March 2008 the Committee announced an inquiry into the implementation of skills and training policies following the Leitch Report and how responses to the agenda set out in the Leitch Report will affect the broader structures of further education, higher education and lifelong learning. The inquiry will focus on the responses of RDAs to Leitch and how coherent and structured these are, what the existing regional structures of delivery are and what sub-regional strategies may be required, the role of the Learning and Skills Council and Sector Skills Councils in this context, the respective roles of the further education and higher education sectors in delivering a region-based agenda for Leitch and their co-ordination with one another and the impact on students of these initiatives, particularly in the context of policies for lifelong learning.

The Office for Fair Access (OFFA)

On 26th March 2008 the Committee announced a short inquiry into the work and operation of the Office for Fair Access (OFFA). OFFA's aim is to promote and safeguard fair access to higher education for under-represented groups following the introduction of variable tuition fees in 2006-07. The inquiry will focus on how effective OFFA is in promoting and safeguarding fair access to higher education for under-represented groups and how the effects of OFFA's work are measured.

Reports

The UK Centre for Medical Research and Innovation.
On 23rd January 2008 the Committee published its First Report of Session 2007-08, *UK Centre for Medical Research and Innovation,* HC 185.

The work and operation of the Copyright Tribunal
On 20th March 2008 the Committee published its Second Report of Session 2007-08, *The work and operation of the Copyright Tribunal,* HC 245.

Withdrawal of funding for equivalent or lower level qualifications (ELQs)
On 27th March 2008 the Committee published its Third Report of Session 2007-08, *Withdrawal of funding for equivalent or lower level qualifications (ELQs),* HC 187.

Government Responses

Three Government Responses to Reports by the former Science and Technology Committee have been received by the Innovation, Universities, Science and Skills Committee.

The Funding of Science and Discovery Centres
On 16th January 2008 the Innovation, Universities, Science and Skills Committee published its First Special Report of Session 2007-08: *The Funding of Science and Discovery Centres: Government Response to the Eleventh Report from the Science and Technology Committee, Session 2006–07,* HC 214.

The Last Report
On 24th January 2008 the Innovation, Universities, Science and Skills Committee published its Second Special Report of Session 2007-08: *The Last Report: Government Response to the Science and Technology Committee's Thirteenth Report of Session 2006–07*, HC 244.

Investigating the Oceans
On 19th December 2007 the Government submitted a response to the Science and Technology Committee's Tenth Report of Session 2006-07, Investigating the Oceans, HC 470-I. The Response was published on the internet on 9 January 2008 pending further evidence with the Secretary of State for Environment, Food and Rural Affairs.

The Government Response to the Innovation, Universities, Science and Skills Committee's First Report has also been received:

UK Centre for Medical Research and Innovation
On 31st March 2008 the Innovation, Universities, Science and Skills Committee published its Third Special Report of Session 2007-08: *UK Centre for Medical Research and Innovation: Government Response to the First Report from the Committee, Session 2007-08,* HC 459.

Further Information

Further information about the work of the Innovation, Universities, Science and Skills Committee or its current inquires can be obtained from the Clerk of the Committee, Dr Lynn Gardner, the Second Clerks, Glenn McKee and Edward Waller or from the Committee Assistant, Ana Ferreira on 020 7219 2792/8367/0859/ 2794; 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 iuscomm@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/ius where all recent publications, terms of reference for all inquiries and press notices are available.

House of Lords Science and Technology Select Committee

The members of the Committee (appointed 13 November 2007) are Lord Colwyn, Lord Crickhowell, Lord Haskel, Lord Howie of Troon, Lord Krebs, Lord May of Oxford, Lord Methuen, the Earl of Northesk, Lord O'Neill of Clackmannan, Lord Patel, the Earl of Selborne, Lord Sutherland of Houndwood (Chairman), Lord Taverne and Lord Warner. Baroness Walmsley and Lord Soulsby of Swaffham Prior were co-opted on 14 January 2008 for the purposes of the Systematics and Taxonomy inquiry and Lord Broers and the Earl of Erroll were co-opted on 25 March 2008. for the purposes of the Personal Internet Security follow-up.

Personal Internet Security

The Committee's report on *Personal Internet Security* was published on 10 August 2007, and was widely reported in the broadcast and print media. The inquiry, chaired by Lord Broers, looked at a broad range of security issues affecting private individuals when using the Internet. Key recommendations included:

- Increasing the resources and skills available to the police and criminal justice system to catch and prosecute e-criminals;
- Establishing a centralised and automated system, administered by law enforcement, for the reporting of e-crime;
- Incentivising banks and other companies trading online to improve data security by establishing a data security breach notification law;
- Encouraging better security standards in new software and hardware by taking the first steps towards the establishment of legal liability for damage resulting from security flaws;
- Encouraging Internet service providers to improve the security offered to customers by establishing a "kite mark" for Internet services.

The Government response to the Committee's report was published as a Command Paper (Cm 7234) on 24 October 2007. The Committee has sought comments on the Government response from those who gave oral evidence during the original inquiry. The Committee will publish a short follow-up report in the summer and it is expected that both the original report and the follow-up report will be debated by the House by the end of the current session.

Allergy

The Committee's report on allergy was published in September 2007. The Government published its response on 27 November and a debate took place in the House on 8 May.

Radioactive Waste Management

The Select Committee's report *'Radioactive Waste Management: an update'* was published on 4 June 2007 and Government's response was received on 25 June. The Committee's report was debated on 29 October 2007. The Government response was published on 7 February 2008.

Air Travel and Health

The Committee's report on Air Travel and Health – an Update was published on 12 December 2007 and was widely reported in the media. The Government response was received at the end of February and will be published with a commentary in late spring 2008.

Waste Reduction

Last year the Select Committee appointed a Sub-Committee, chaired by Lord O'Neill of Clackmannan, to inquire into Waste Reduction. In November and December the Committee heard from civil servants, academic experts and the Environment Agency on the various types of legislation which impact upon waste reduction. Since January, the Sub-Committee has looked in more detail at the various roles that designers, manufacturers and retailers can play in reducing waste. The inquiry has examined a range of sectors and evidence has been heard from industry organisations including British Glass, the Aluminium Federation, EEF, the Manufacturers' Organisation, the Chemical Innovation KTN and INCPEN. In addition, evidence has also been taken directly from companies, including Hewlett Packard, Panasonic, Sony, Philips, Proctor and Gamble, Unilever and Marks and Spencer.

In March the Sub-Committee visited two companies in Uxbridge: Xerox, which has pioneered a remanufacturing approach to reusing its products; and Martin-Baker, a small company which has managed to significantly reduce its waste by making changes to production processes

In April, Members undertook a trip to Brussels where they spoke to officials at the European Commission, heard about waste reduction strategies in the Flanders region and visited companies which exhibit good waste reduction practices. The Sub-Committee will continue to hear oral evidence until mid-May and expects to publish its report in the summer of 2008.

New inquiry: Genomic Medicine

The Select Committee has appointed a second sub-committee, chaired by Lord Patel, to hold an inquiry into genomic medicine. The call for evidence was published on 25 February with a deadline for submissions of 21 April. The inquiry will examine the policy framework in this area, the latest research and scientific developments, translation opportunities into the clinic, genomic databases and the use of genetic information in a healthcare setting. The Committee will hold public meetings from late April. It is expected that the Committee's report will be published at the end of 2008.

Systematics and Taxonomy

The Select Committee is currently undertaking a short inquiry into systematics and taxonomy. A call for evidence was published in December. The inquiry is a follow-up investigation from the Committee's past inquiries into this subject (in 1991 and 2002) and is looking at the UK's capability in this field, taxonomic data collection and management, and the skills base. The inquiry is also looking at the application of taxonomic data, for example, in environmental change monitoring. The Committee has taken evidence from, among others, Government officials, the Research Councils, the Royal Botanic Gardens Kew and Edinburgh, the Natural History Museum, the Systematics Association and Linnean Society of London. It is expected that the Committee's report will be published in July 2008.

Further information

The written and oral evidence to the Committee's inquiries mentioned above, as well as the Calls for Evidence on the Committee's new inquiries, can be found on the Committee's website www.parliament.uk/hlscience. Further information about the work of the Committee can be obtained from Cathleen Schulte, Committee Specialist (schultec@parliament.uk or 020 7219 2491). The Committee's email address is hlscience@parliament.uk.

Parliamentary Office of Science and Technology

Recent POST Publications

Ecological networks
February 2008 *POSTnote 300*

Ecological networks are intended to maintain environmental processes and to help to conserve biodiversity where remnants of semi-natural habitat have become fragmented and isolated. This POSTnote considers the possible conservation benefits of ecological network implementation in the UK.

Smart Metering of Electricity and Gas
February 2008 *POSTnote 301*

Smart metering enables accurate measuring of energy usage and the provision of improved information to consumers, suppliers and the market. The 2007 White Paper on Energy identified smart metering as a possible energy saving measure. It also outlined the expectation that smart meters will be installed in all of the UK's 25 million homes over the next ten years. This POSTnote examines the potential benefits, costs and policy considerations involved.

Autism
February 2008 *POSTnote 302*

Autism affects how a person communicates, socialises and interprets the world. This can lead to wide ranging difficulties in every day life including forming relationships and living independently. Recent evidence that autism is more prevalent than previously recognised has put pressure on service providers and highlighted the need to train professionals to improve awareness of autism. This POSTnote describes autism and autism research, and considers policy approaches.

Invasive Non-native Species
April 2008 *POSTnote 303*

Non-native invasive species are a significant threat to biodiversity and their ecological impacts are difficult to reverse. They also affect economic interests particularly within agriculture, horticulture and forestry. This POSTnote explores the forthcoming strategy on invasive non-native species in Great Britain.

Current work

Biological Sciences – Alternatives to Custodial Sentencing for Young Adult Offenders, Inter-species Embryos, Single Embryo Transfer, UK Vaccine Industry, Animal Cruelty and Interpersonal Violence, Developing New Anti-infectives.

Environment and Energy – Marine Protected Areas, Electricity Storage, Wildlife Diseases, Biological Indicators, Energy Security.

Physical sciences and IT – Next Generation Broadband Access, Digital Preservation.

Science policy – International Migration of Scientists and Engineers, Large Scientific Facilities.

Seminars

During the period POST has organised two seminars held in the Attlee Suite, Portcullis House, both of which pushed the capacity of the room to its limits.

On 22nd January POST and the Oxford Internet Institute (OII) held a seminar on "Gov 2.0, or Truly Transformative Government". Leading figures from academia, industry and government discussed the challenges of large government IT projects before moving on to consider how the public sector could improve on its use of the internet to engage the general public. Speakers included Professor Ross Anderson, Professor of Security Engineering at Cambridge University, and Tom Steinberg, founder and director of www.mysociety.org, and John Suffolk, Government Chief Information Officer. Alun Michael MP and the Earl of Erroll chaired the session. Further details and copies of the presentations are available on the OII's website at www.oii.ox.ac.uk.

On 4th March POST and the Westminster Energy Forum (WEF) held a seminar on "Regional and Sectoral Issues in World Energy". This event was specially designed to bring together parliamentarians, representatives from London embassies and high commissions and of private sector companies in the energy sector, and explored subjects such as fossil fuel supply prospects, nuclear security and potential future transport fuels. Further details are available on the WEF website at www.westminsterenergy.org

Staff, Fellows and Interns at POST

New POST doctoral fellows:

Fay Collier, Imperial College London, British Ecological Society Fellowship
Nathalie Doswald, Durham University, Natural Environment Research Council Fellowship
Dr Michael O'Brien, Cambridge University, sponsored by the Judge Institute for Management Studies
Stephen Smith, Imperial College, sponsored by POST
Amber Teacher, Institute of Zoology, Natural Environment Research Council Fellowship

International activities

In February the Director participated in a European Commission sponsored workshop on Transparency in Risk Assessment, held in Stockholm, and also visited the new technology assessment unit at the Swedish Parliament and the NGO, Vetenskap och Allmänhet (Science and the Public).

In April staff members, Drs Sarah Bunn and Chandrika Nath, attended the 2008 Practitioners' Workshop organised under the auspices of the European Parliamentary Technology Assessment network by the Norwegian Board of Technology, held at Lillehammer, Norway, while Simon Evans, Royal Society of Chemistry fellow, attended the ESRC Genomics Network meeting in Amsterdam, the Netherlands.

House of Commons Library Science and Environment Section

Research Papers

The following are summaries 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 www.parliament.uk/parliamentary_publications_and_archives/research_papers.cfm

Planning Bill: Committee Stage Report

Research Paper 08/24

The Bill would establish an Infrastructure Planning Commission (IPC) to decide development consent for major infrastructure projects in England and Wales, on the basis of Government statements of national policy. This procedure would introduce a single consent regime for a wide range of infrastructure projects currently approved under separate pieces of legislation. The Bill contains enabling legislation to allow regulations to establish the Community Infrastructure Levy. The Bill would also introduce a new procedure for planning appeals for minor applications like householder development.

The Paper deals with the Committee Stage of the Bill. The Bill was not substantially amended in Committee but some changes were agreed to the definitions of major infrastructure projects of national importance that would be decided by the IPC.

Food Products (Marketing to Children) Bill

Research Paper 08/35

The Bill is a Private Members' Bill introduced by Nigel Griffiths MP. Under the provisions of the Bill, it would be an offence for a person or body to advertise or promote to children food (including drink products) which are classified as 'less healthy'. The Bill would introduce a 9pm watershed for television advertising of unhealthy food, as

well as significant restrictions on non-broadcast marketing.

The Bill has received broad support from various health and consumer organisations including: the British Heart Foundation, Cancer Research and Which?.

Energy Bill: Committee Stage Report

Research Paper 08/40

Key features of the Bill include the creation of the legal framework to require power companies to cover waste and decommissioning costs in the event of new nuclear build; banding of the Renewables Obligation to differentiate levels of support to renewable technologies; and encouragement of investment in gas supply and carbon capture and storage.

The Paper deals with the Committee Stage of the Bill. The passage of the Bill through the Committee Stage was largely consensual and the Minister was often able to provide reassurance to opposition party concerns. Many of the controversial areas have been on what is not in the Bill rather than what is in it. At Committee Stage the "Miscellaneous" section of the Bill was used to try to generate debate about provisions not in the Bill such as smart-metering, pre-payment meters, electronic electricity devices, social tariffs and the role of Ofgem.

On the provisions that were included in the Bill, the sections on the Renewables Obligation (RO), and nuclear issues generated the most debate.

Human Fertilisation and Embryology Bill

Research Paper 08/42

The Bill would revise and update legislation for assisted reproduction and also change the regulation and licensing of the use of embryos in research and therapy. It includes provision for research on different types of embryos, and proposes changes to definitions of legal parenthood for cases involving assisted reproduction.

Climate Change Bill

The Bill contains provisions to create a legally binding target of carbon dioxide emission reductions for the UK of at least 26% by 2020 and 60% by 2050 compared to 1990 levels.

Key features of the Bill include provisions to require the Government to publish five yearly carbon budgets as from 2008 and create a Committee on Climate Change to advise on the levels of carbon budgets to be set. The Bill also places a duty on the Government to assess the risk to the UK from the impacts of climate change and provides powers to establish trading schemes for the purpose of limiting greenhouse gases.

On other matters it includes powers to create waste reduction pilot schemes and amend the provisions of the Energy Act 2004 on the renewable transport fuel obligations.

Selected Debates and Parliamentary Questions & 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 8th January to 3rd April 2008 from both Houses of Parliament can be found on the website:

www.scienceinparliament.org.uk

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

Agriculture

Animal Welfare: Infectious Diseases
Debate in the House of Lords on Monday 10 March

Baroness Byford rose to ask what improvements have been made in the management of infectious animal diseases with particular reference to bluetongue, avian flu, foot and mouth and bovine TB specifically. The Minister was asked whether he is satisfied with the plans to deal with future outbreaks of bluetongue and especially the application and availability of vaccines and animal testing for the presence of bluetongue. Cost sharing arrangements must provide the industry with an incentive for action.

Bovine TB is a menace to cattle and badgers alike and continues to spread unabated. The number of fresh outbreaks in 2007 amounted to 4137 which is a new record for modern times. The incidence of TB – that is the proportion of herds tested resulting in a breakdown – increased by 18 per cent on the previous year. Some 28,000 plus cattle were slaughtered as TB reactors, inconclusive reactors or dangerous contacts, and 6532 farms were under TB restrictions in 2007 because of a TB incident. That TB outbreak is costing taxpayers more than £90 million annually and heartbreak to farmers. A recent

report from the Royal Society indicated that a significant proportion of the 75 per cent of new TB outbreaks that are caused by local effects in high-risk areas, are attributable to contact between badgers and cattle. Cattle movements also have an important part to play. TB will never be brought under control without tackling the reservoir of the disease in the badger population. The disease is now out of control and action is urgently required. The Royal Society recommends a multifaceted approach including vaccination, effective biosecurity in farms, increased frequency of testing and greater use of gamma interferon. The Independent Scientific Group on Cattle TB (ISG) Report of 2007 acknowledged that the removal of infected badgers can have a beneficial effect in parts of the country where there is a high incidence of TB in cattle.

The Government's record of managing outbreaks of foot and mouth leaves much to be desired. The 2001 epidemic when thousands of cattle and sheep were slaughtered was a disgrace due to the Government's failure to address the original outbreak with the urgency that was needed and as a result the disease spread rapidly throughout areas of the country. It is still uncertain whether the Government are prepared to use vaccination rather slaughter in the first instance should a new outbreak occur. The outbreak at Pirbright appeared to be an ideal situation in which the use of vaccination for the whole of Surrey could have been tested in a controlled trial. Was this opportunity lost due to lack of vaccine or a decision not to do so?

Government proposals for cost sharing for future animal diseases have been viewed with alarm. Farmers recognise their responsibility for maintaining strong biosecurity measures on their farms, and they believe that Government should be robust in keeping out animal diseases from this country and should have strong, foolproof emergency measures in place. The livestock industry is not wholly opposed to cost recovery, but it would like to know exactly what it will be charged for.

Lord Krebs: The scientific evidence relating to bovine TB and the policy options available have been reviewed more than a dozen times in the past decade, including in my 1997 review, which demonstrates that the problem is intractable, the science is incomplete and the experts disagree. However, some facts are beyond dispute. First, there is no reasonable doubt that badgers are only part of the problem. They harbour the disease and transmit it to cattle. With that wildlife reservoir the disease will be very hard to eliminate from cattle. The long term solution must be a vaccine. In the mean time the disease will decrease by a simple combination of more frequent testing and better husbandry, encouraged by offering incentives to keep badgers away from cattle as is being trialled in Wales. Will the Minister consider adopting the Welsh approach and recognise that large-scale culling is not the answer?

Lord Soulsby of Swaffham Prior: With regard to TB, I repeat what the Environment, Food and Rural (EFRA) Select Committee said, "The impact of the disease (that is, TB) has reached a stage where further procrastination is unacceptable". I agree with that comment. The Minister has heard me recommend before that further work be done on vaccines, especially a vaccine for badgers. Can the Minister enlighten the house on what is in progress?

Several exotic threats to livestock and humans were then outlined. Antibiotic resistance has now become widespread as a pathogen in humans – but is also spreading widely in animals. As global trade in food animals increases this becomes a more important factor in human health. In particular, enzymes such as extended spectrum beta-lactamases (ESBL's) are increasing at an enormous rate and produce dangerous levels of infections in food. An example is the recent report of imported chicken meat as a source of Escherichia coli producing ESBLs. Were that to be eaten in an undercooked state by humans, serious bowel disorders might result. What monitoring procedures are in place to detect these dangerous pathogens that are resistant to antibiotics? Other exotic diseases of immediate concern include African horse sickness, West Nile fever, Bluetongue, which is already with us, and Avian flu. What are the vaccination policies for these infections? What surveillance policies are in place? Will the Minister enlighten the House on how the new technologies have been brought into play for the purpose of extending and improving vigilance towards diseases from exotic areas?

The Minister of State, Department for Environment, Food and Rural Affairs (Lord Rooker): I shall not be able to do justice to all the points raised. On issues that I have not dealt with, I promise that I will put together a full letter. Defra's cost and responsibility sharing programmes have been published for discussion at a national seminar and 13 other seminars around the country. These are intended to help construct a policy, to be followed by further consultation. References to animal health and animal welfare should not be confused and refer to different specific issues in Defra.

Last year avian influenza, bluetongue and foot and mouth all had very serious consequences for the farming industry which are still with us today with movement restrictions, disrupted markets, prices affected and exports halted, which are absolutely tragic for some areas of the country. Although normal trading conditions have resumed, we have been left with the legacy of those outbreaks, which is substantial among hill farmers. These exotic outbreaks have been tackled against a backdrop of the ongoing threat of bovine TB which is costing the taxpayer £80 to £90 million a year, in addition to the even greater cost to farmers. Vaccine research is ongoing. It is illegal to vaccinate cattle for TB but as we do not have the vaccine the issue does not arise. Who will pay for vaccine for badgers? The Government have made it clear that they will not, nor will they organise or pay for any cull of badgers. The complexity of the issue cannot be overstated.

An order for 22.5 million vaccination doses has been

placed for bluetongue (2.5 million for Wales and 20 million for England). These will be available from May and will have temporary certification with the Veterinary Medicines Directorate. The efficacy will not be known until the vaccine is administered. 40,000 cases of bluetongue have been tested and ongoing surveillance is enormous. It will return, as it has either overwintered in the British midge or will come across the Channel in plumes. With regard to avian influenza, vigilance is maintained, good biosecurity is applied which has not always been the case in the poultry industry, with rapid reporting of any suspicious symptoms among both wild and domestic stocks.

The unfortunate outbreak of foot and mouth (at Pirbright) which spreads easily through the air is quite different. Vaccination was not an issue this time. The second outbreak was part of the first and had not been anticipated hence there was no apparent need for vaccination. There is no argument in principle against the use of vaccination, unlike 2001.

The management of exotic diseases by Defra staff last year was magnificent. We were hit by problems, one after another. Everybody knew what they had to do from the decision tree and bird tables. It could not have been done without co-operation of the industry.

Renewable Transport Fuels Obligation: Crops
Question and Written Answer on Monday 31 March

Mr David Anderson (Blaydon): To ask the Secretary of State for Transport what steps she is taking to ensure that the Renewable Transport Fuels Obligation will not result in a conflict between the need to grow crops for both food and fuel.

Jim Fitzpatrick: The Renewable Fuels Agency (RFA) will have a statutory duty to report annually to Ministers on the effects of the Renewable Transport Fuel Obligation (RTFO), including the indirect effects such as impacts on food and commodity prices. These reports will inform the development of the Government's longer term biofuel policies.

The Government have also asked the Renewable Fuels Agency to lead an urgent review of the potential indirect impacts of biofuel production. This will, among other things, consider the risk that biofuel policies will affect international food commodity prices in the period to 2020. The terms of reference for this review are available via the Department for Transport's website at: http://www.dft.gov.uk/pgr/roads/environment/rtfo/

Education

Science Teaching
Debate in Westminster Hall Tuesday 15 January

Dr Brian Iddon (Bolton, South-East): My contribution to this debate is not about the supply or quality of science teachers because they have been covered in two Select Committee reports. One was published by the House of Lords in the 2005-06 Session of Parliament and the other was published by the House of Commons in the 2001-02 Session of Parliament. Many of us who became scientists would probably agree that it was the enthusiasm of the science teacher that attracted us to pursue such a career. Some science teachers can make the sciences sound extremely complicated, or boring, probably because they do not enjoy teaching the subject or because they do not understand the basic principles. The lack of specialist teachers is part of the problem and that situation has worsened recently. The worst science teachers make no attempt to embellish the curriculum by taking their students out of the classroom to listen to an outside lecture or to visit an outside facility that is trying to make science interesting to students. They are also reluctant to invite scientists or engineers into their classroom to talk about their experiences and they make minimum effort to run practical classes. Their sole aim appears to be to cover the curriculum so that their students will achieve the highest grades possible in examinations, even by abandoning many of the practical classes if that should prove necessary.

Recent surveys by the Science Museum in Kensington and the awarding bodies have shown that hands-on practicals in laboratories and visits and excursions outside school are the most enjoyable aspects of studying the sciences. I am aware of The Times Education Supplement published in October last year which revealed that a third of teachers had cancelled school trips, with cost cited as the problem by 40 per cent, and form-filling cited as the problem by 36 per cent of the teachers surveyed. The Government have responded by publishing a manifesto entitled "Learning Outside the Classroom" and pledging £2.7 million towards encouraging school trips, for which I am extremely grateful. I would like to pay a tribute to the 12,000 or more volunteers who take part in the Science and Engineering Ambassadors in Schools (SEAS) programme, which is organised in partnership with the Science, Technology, Engineering and Mathematics Network (STEMNET). Unfortunately, pressures from the Research Assessment Exercise in recent years have reduced the number of younger university academics willing to visit schools.

Bob Spink (Castle Point): Part of the problem in schools is that specific sciences are often not taught by specifically science-qualified teachers, but by generalists or non-science-qualified teachers. It is therefore essential for us to fill the planning gap by ensuring that we have decent science teaching, that we encourage women into science teaching and that we have good-quality science labs that will encourage students and teachers in schools and support science teaching in our economy.

Dr Ian Gibson (Norwich, North): Lord David Sainsbury has just produced a document entitled "The Race to the Top: A Review of Government's Science and Innovation Policies", in which he talks first about the need for a "major campaign to enhance the teaching of science and

technology", including raising the number of qualified science teachers, increasing the number of young people studying triple science, improving careers advice, establishing a national science competition and rationalising the many schemes to inspire young people to take up careers in science and engineering.

Mr Mark Lancaster (North-East Milton Keynes): It is vital that teachers receive the opportunity constantly to retrain, which is why it is slightly disappointing to discover that science teachers are not entitled to science-related continual professional development.

Dr Evan Harris (Oxford, West and Abingdon): There is a fundamental problem: the shortage of specialist teachers. It creates a vicious circle; if students are not inspired to study science subjects at university, because they have not had an inspiring specialist teacher, they will not graduate in that subject and at least consider the option of a teaching career – in the state sector especially.

Annette Brooke (Mid-Dorset and North Poole): The latest Government figures show that at more than 1,500 state schools – about half the schools in England – fewer than 50 per cent of pupils reach the required standard of two grade Cs or above in science. An accompanying downturn in the number of state education pupils taking science A-levels has been reported by the Cambridge Assessment exam board: although 33.3 per cent. of grammar school and 27.7 per cent of independent school pupils go on to study chemistry A-level, only 14.8 per cent of pupils at comprehensives do so.

Mrs Maria Miller (Basingstoke): The pharmaceutical industry is at the heart of the success of my constituency, so I know at first hand how important science is to local business employers. The Leitch report clearly says that the demand for science and technology professionals will increase by 18 to 30 per cent between 2004 and 2014 – far higher than for any other occupational group. We have heard figures on the shortfall in the number of specialist science teachers: only 19 per cent of science teachers have specialisms in physics, and only 25 per cent in chemistry. Indeed, one in four schools in the state sector do not have a specialist physics teacher.

The Minister for Schools and Learners (Jim Knight): We want more students to continue to study science, to make it their career and to engage with scientific issues as citizens. I want to explain today how we will achieve that by inspiring young people with science throughout their journey through the various stages of school. We know that to help students enjoy and achieve success in science we need more specialist teachers; specialists who can communicate their love for and depth of knowledge of their subject. We are encouraging people to train and to qualify as science teachers by offering a teacher training bursary and a golden hello in the subjects that we need. That is working: the number of trainee science teachers recruited in a year has just reached more than 3,000 for the first time for conventional initial teacher training, but there are still not enough specialist physics and chemistry teachers.

Mrs Miller: I should like to pick up on the point that the Minister made about the importance of imaginative practical work. The National Endowment for Science, Technology and the Arts has estimated that 87 per cent of science teachers have been prevented from letting their students undertake practical work because they believe that health and safety regulations prohibit them from doing so. What work are the Government doing to help science teachers in this area?

Jim Knight: We agree that school trips are important. That is why we have developed the "Learning Outside the Classroom" manifesto to promote the value of trips and help overcome some of the associated obstacles, such as insurance and risk management. Equally, outside the timetable, 250 science and engineering after-school clubs are harnessing the interest and potential of thousands of 11 to 14-year-olds, bringing the real-world application of science into schools for them: how their iPod works or what chemistry is going on inside their brains when they fall in love.

As the study of science improves in numbers and quality up the school, I would expect more students to decide to carry on with science at A-level. Our "Next step" strategy, published in 2006, set out the targets, and in 2007 we saw a small rise to 23,932 in the number of A-level physics entries: the first increase since 1998. That is underpinned, equally, by expansions in the numbers doing physics at AS-level, and in the past few years there have been increases in the numbers of students doing chemistry. We are turning the corner in that regard.

One of the drivers of more students studying science at A-level and beyond will be the opportunities that are opened up in careers in science. We are working with schools, scientists and young people to let students see that science in the real world is well paid and works in various occupations. One day one of those occupations might be to follow the hon. Member for Bolton, South-East and be another passionate advocate for science in Parliament. We are increasing the number of ambassadors.

Energy

Concentrated Solar Power

Debate in the House of Commons on Thursday 28 February

Dr Howard Stoate (Dartford) Concentrated solar power represents a vast source of energy that holds the promise of a carbon-free, nuclear-free electrical future for the whole of Europe, if not the world. A CSP plant uses mirrors to concentrate sunlight and create heat which is used to drive turbines and generators. Heat can also be stored in melted salts so that electricity generation may continue at night or on cloudy days. Europe's first commercially operating CSP plant has opened in Spain, outside Seville, and generates about 11MW of electricity, enough to power up to 6,000 homes currently but with the potential to produce sufficient power for the needs of

Seville's 600,000 residents. North African deserts offer the greatest potential as each square kilometre of hot desert annually receives solar energy equivalent to 1.5 million barrels of oil. The world's entire electricity needs could be provided by covering less than 1 per cent of the world's deserts with CSP plants. The power generated by CSP can be transmitted on high-voltage direct current (HVDC) lines as only 3 per cent of the power is lost for each 1000 km. Hence solar electricity could be imported from north Africa to London with a power loss of only 10 per cent. Indeed, 90 per cent of the world's population live within 2700 km of a hot desert and could be supplied with solar energy from there.

The Trans-Mediterranean Renewable Energy Co-operation or TREC – a group of scientists and engineers in Europe, the middle east and north Africa – is trying to identify ways of exploiting the energy-generating potential of hot deserts. TREC is calling for the creation of an HVDC supergrid to enable the transmission across the region of energy derived from north African CSP plants.

The Minister for Energy (Malcolm Wicks) Interesting, unusual and important points have been made about solar power. The world has huge solar resources on which solar power technology can draw. Our role is currently modest. Two small studies were commissioned in the 1990s on behalf of the DTI. We in the UK have played our part in the work.

Building and maintaining an infrastructure of HVDC transmission lines and managing a network that feeds into national grids across Europe is an enormous and expensive task. Fair, open and well regulated markets are the best way to achieve the massive investment in the clean energy needed. CSP could have a part to play along with other technologies. A focus is needed on climate change objectives and renewable technologies that have a more immediate short to medium term application in Britain. On solar power, there is an increasing number of solar panels on people's houses, which use a relatively cost-effective renewable technology and photovoltaics which produce not just hot water but electricity. The Government will continue to follow developments in concentrated solar power and long-distance electricity transmission.

Energy: Renewables
Debate in the Grand Committee on Thursday 6 March initiated by Lord Beaumont of Whitley who sadly died on 8th April

Lord Beaumont of Whitley asked what plans have been made to develop the production of renewable energy in the United Kingdom so as to reduce the UK's vulnerability to global gas and oil price fluctuations. The provision of affordable local and renewable energy is needed by everyone in this country today, and the question is whether the Government are doing enough to that end. The most obvious answer is that they are nor doing enough, that there is real fuel poverty in the country and that people are suffering through the inability to access renewable energy supplies on good financial terms. At the moment it is being suggested that if you want renewable energy, you have to have vast wind farms operating on a very large scale. That is not necessary. Local energy is available at a low price for those who take the trouble to seek it out, and here I pay considerable tribute to the London Borough of Merton on its initiative to provide its residents with as much locally available energy as possible. It is no credit to this Government that it has been left to Merton to develop an initiative in this way. The good thing is that Merton is now able to carry on with its initiative, helped by a Private Member's Bill which is going through Parliament at the moment.

The Parliamentary Under-Secretary of State, Department for Business, Enterprise and Regulatory Reform (Baroness Vadera) We face two major energy policy challenges: tackling climate change and ensuring energy security. The Government are absolutely committed to renewable energy as a key contributor to meeting climate change goals. The Department for Communities and Local Government recently published Planning Policy Statement 1 (PPS1), which requires local authorities to consider climate change and renewables in local planning frameworks. We also provide grants for low-carbon building programmes. In addition, we launched a strategic environmental assessment on a plan for up to 25 gigawatts of new offshore wind development. We have also launched a feasibility study into a possible tidal power generation scheme on the River Severn, with the potential to provide 5 per cent of the UK's electricity needs. In April we will introduce a renewable transport fuel obligation and reforms for the planning regime, which will remove some of the main barriers to renewable deployment.

We have concerns about the sustainability of biofuels. The current biofuel production capacity in the UK is 1000 kilotonnes per annum. Security of supply is about reliability and affordability. Renewables could play a key role in reducing or increasing dependence on imported fossil fuels. Intermittent renewal sources, such as wind and wave power, display some regenerating capacity. We will need additional low-carbon base-load capacity to be sure that we have sufficient responsive generation to deal with the effects of intermittency. We strongly support the European Commission's proposed legislation to develop transparent, well regulated EU gas markets, bringing benefits to consumers throughout the EU and remain completely committed to the EU's 2020 renewables target and will introduce a new renewables strategy next spring.

Health

Homeopathic Hospitals
Debate in the House of Commons on Tuesday 19 February

David Tredinnick (Bosworth): In the UK we have four homeopathic hospitals, one in Scotland and three in England. The Scottish hospital is protected since a successful campaign in 2004, but that is not the case for

the three English hospitals – the Royal London, Bristol and Tunbridge Wells homeopathic hospitals which are fully integrated into the NHS. What has gone wrong? Eight primary care trusts have withdrawn their contracts from the Royal London in the last 18 months and patient referrals are down by 20 per cent on the same period last year. There is great uncertainty about the intentions of the host PCT Camden and its neighbour Islington.

As for the other two hospitals, West Kent PCT is responsible for the Tunbridge Wells hospital and it will withdraw its support from April 2008. That decision has been temporarily rescinded pending a legal challenge by patients. Bristol homeopathic hospital has also suffered considerable cuts.

White Papers that have been published in recent years all suggest that choice will increase. "The NHS Improvement Plan", published in 2004, states: "By 2008, patients referred by their GP will be able to choose any provider able to meet NHS standards and to deliver care at tariff." The December 2003 document, "Building on the Best: Choice, Responsiveness and Equity in the NHS" stated that NHS services should be "more responsive" to patients. The January 2006 document, "Our health, our care, our say" states: "We will give people a stronger voice" – so that they can see a service improvement. The 2004 White Paper stated the intention to give the public more informed choices as regards their health. The Government are certainly failing to do that as far as the homeopathic hospitals are concerned.

The Parliamentary Under-Secretary of State for Health (Mr Ivan Lewis): I have articulated clearly the Government and NHS position on complementary therapies, so I hope that any documents that have been circulated and that give a false or misleading perception will be corrected by the record. Beyond that, primary care trusts in every part of the country have a clear set of priorities that the Government lay down for the outcomes that they are expected to achieve with regard to health and well-being in their local communities. Under the present Government an unprecedented level of resources has been invested in the national health. Any system will require commissioners to make difficult choices. Based on the needs of their local population, based on what patients and carers tell them about what matters most, and based on evidence and outcomes, commissioners will be required to make those choices. Beyond the clear national priorities and the NHS operating framework that we issue to chief executives of primary care trusts, it is not for Ministers sitting in offices in Westminster and Whitehall to tell PCTs how they ought to make those daily difficult decisions.

Folic Acid: Flour
Question and Written Answer on Thursday 27 March

Mr Todd (South Derbyshire): To ask the Secretary of State for Health (1) what plans the Food Standards Agency has in relation to their proposals for the mandatory fortification of flour with folic acid; what matters relating to the proposals are under consideration by the Agency; over what timescale he expects the Agency to proceed with their proposals; with whom the Agency will consult on the proposals; and how he plans to consult the natural health products industry on the likely *(a)* financial and *(b)* health effects of the proposals;

(2) what recent representations he has received from *(a)* manufacturers and *(b)* retailers of food supplements on the proposed introduction of limits on the levels of folic acid permitted in such products as a result of the proposals of the Food Standards Agency (FSA) for the mandatory fortification of flour with folate; and whether the FSA plans to undertake further modelling of the implications of its proposals.

Dawn Primarolo: In June 2007, the Food Standards Agency (FSA) recommended mandatory fortification with folic acid of bread or flour alongside controls on voluntary fortification and guidance on supplement use to United Kingdom Health Ministers. In October 2007, the Chief Medical Officer (CMO) wrote to the FSA to request a further expert view of the evidence on folic acid and colorectal cancer (CRC) risk.

On the basis of expert advice FSA have advised the CMO that they will defer agreeing their final advice on CRC risk until the results of ongoing trials are available in early 2009.

In the mean time, FSA officials will continue their discussions with industry about controls on voluntary fortification in food and caps on the levels of folic acid in supplements as there are 106,000 people in the UK exceeding the upper limit for folic acid from dietary and supplement sources. It is therefore important to control voluntary fortification and intake through supplements to ensure there is no further increase in these numbers.

The FSA has received representations from the trade associations of food supplements manufacturers and retailers regarding proposed controls on folic acid containing food supplements, capping folic acid at 200 micrograms. Information has been provided to the FSA on the types of products on the market containing folic acid and the recommended daily dosage. The FSA will undertake further modelling and the results will be discussed with the supplements industry.

Biosimilar Medicines
Debate in the House of Commons on Wednesday 2 April

Dr Brian Iddon (Bolton, South-East): When a patent runs out on a parent conventional medicine, any other company can start to produce and distribute it as a so-called generic medicine or drug. A drug is the active constituent of a medicine. Generic prescribing is encouraged by the National Health Service because, in general, generic drugs are substantially cheaper than the originally marketed parent drug. That is because companies that market generic drugs do not have to

conduct the research that led to the discovery of the parent drug, thus avoiding expensive clinical trials to establish its safety and efficacy in human use.

Today, more than 200 drugs are produced by the biotechnology industry, in living cells or in reaction vessels using gene technology, to treat various cancers, AIDS, neurological disorders, heart disease, diabetes, and rare genetic diseases. Those so-called biopharmaceuticals, or biological drugs, benefit about 325 million people worldwide. The biopharmaceutical industry is an essential component of the British biotechnology industry. So far, the patents have run out on five of the parent branded biological drugs, but that number will increase significantly in the next few years.

When another biotechnology company produces one of those biological drugs, using a process different from that used by the company that discovered the parent drug, the resultant tangled molecule will not be quite the same as the parent one. Thus copies of biological drugs are not identical to the parent drug and are called biosimilars. For their use as drugs, we have to be sure that biosimilar drugs are as close in structure to the parent drug as possible. Otherwise their clinical profile including safety and efficacy, will be different.

The Minister of State, Department of Health (Dawn Primarolo): I welcome the opportunity to clarify the general regulatory position on biosimilar medicines. Special European regulations are in place to ensure that biosimilar manufacturers supply comprehensive data to regulators to demonstrate the safety, quality and efficacy of the product and its similarity to the original medicinal product. Regulatory authorities also perform periodic inspections of the manufacturing process. We are working with other European regulatory authorities to ensure that health professionals who report adverse reactions to biosimilar products know that they should provide the brand name and batch number of the suspected product. It is the existing policy and current practice of the Medicines and Healthcare products Regulatory Agency (MHRA) to apply the black triangle symbol to all new medicinal products, including biosimilar medicines, for the first two years of marketing. The symbol denotes intensive monitoring of the new product and encourages reporting of all suspected adverse reactions through the yellow card scheme. After two years the products safety profile is reviewed and decisions are made about whether the intensive monitoring can be lifted. The MHRA encourages companies that manufacture biosimilar medicines to give them a brand name so that there is no possibility of the pharmacist substituting another biosimilar product when dispensing a prescription.

Cancer: Research
Question and Written Answer on Wednesday 2 April

Andrew Rosindell (Romford): To ask the Secretary of State for Health what research and development schemes into new cancer treatments his Department sponsors; and if he will make a statement.

Dawn Primarolo: The Department funds national health service research and development through the National Institute for Health Research (NIHR). The NIHR research programmes support high quality research of relevance and in areas of high priority to patients and the NHS and are open to researchers investigating new cancer treatments.

The NIHR Health Technology Assessment Programme focuses specifically on the effectiveness, costs and broader impact of health care treatments and tests for those who plan, provide or receive care in the NHS and is funding a range of research on cancer treatments. In addition, the NIHR National Cancer Research Network provides NHS support for trials and other well designed cancer studies.

In partnership with Cancer Research UK, the NIHR is funding 15 experimental cancer medicine centres across England. A further two centres are in development. This initiative brings together laboratory and clinical patient-based research to speed up the development of new therapies by evaluating novel drugs and biomarkers, thus individualising patient treatment.

The Department works in close partnership with United Kingdom cancer research funders through the National Cancer Research Institute (NCRI). NCRI initiatives such as the NCRI Prostate Cancer Collaboratives – to which the Department contributes over half of the total £11.6 million funding – are discovering and developing new cancer treatments.

The Department does not normally take on the role of sponsor under the Medicines for Human Use (Clinical Trials) Regulations 2004.

Science Policy

Daresbury Science and Innovation Campus
Debate in Westminster Hall on Tuesday 1 April

Mr Mike Hall (Weaver Vale): The Daresbury laboratory – now the Daresbury science and innovation campus – has been delivering world-class science for 40 years and has contributed to Britain being at the international forefront of accelerator science research. In 2000-01 Daresbury faced a problem. The Government made the stupid decision to locate Diamond, the successor to the synchrotron radiation source that had been developed at Daresbury, at Rutherford Appleton. Daresbury therefore faced the challenge of finding a new project to ensure that it remained at the forefront of international science. A commitment is now required from the Science and Technology Facilities Council (STFC) to ensuring that the Accelerators and Lasers In Combined Experiments (ALICE) project at Daresbury can be funded beyond the stage of energy recovery being proven and to exploit fully the potential of the prototype. This will require investing more money into the project and working with the Northwest Regional Development Agency (NWDA) which has committed £30 million to the project already. That is

essential because it will provide the possibility of a new light source which will be based on the fourth generation light source (4GLS) discussed in the Government document "Science & Innovation Investment Framework 2004-2014". That is essential because

1) it will provide a new light source which has been developed by the staff at Daresbury;

2) if it is fully exploited this will help retain scientific staff at Daresbury and

3) it will ensure that science and innovation is retained at Daresbury.

That will send a clear message that the Government believe that regions such as the north-west are entitled to have world-leading science and that they are behind the concept. The Minister could send another positive message by saying that a person will be appointed to the STFC specifically to act as an advocate for Daresbury. They would then have confidence in decisions made in the future about the new light source and the future of the science and technology campus.

When the STFC announced an £80 million shortfall in its £1.9 billion budget over three years, and that it would call for 25 per cent staff cuts and 25 per cent cuts in project grants to fill what is a very small funding gap, if one exists at all, it was feared at Daresbury that 350 jobs would go. Compulsory redundancies have been called for at Daresbury but not at the two other sites covered by the STFC. Those compulsory redundancies relate to the running of the synchrotron radiation source, which we accept will finish at the end of this year. Only 110 people are working on the synchrotron radiation source but we are now told 180 jobs must go.

Andrew Miller (Ellesmere Port and Neston): What would be the impact of any reduction in the scientific centre in Daresbury on the science-based industry in the region? The use that companies such as Unilever make of Daresbury is incredibly important. It is part of the fabric of the region and is one reason why industry invests in the north-west.

Adam Afriyie (Windsor): Speaking not only as Opposition Front-Bench spokesman, but having also served on the STFC, it is clear that Whitehall has delivered a headbutt to scientists over science funding. There is no question that the £80 million shortfall in the STFC's budget will impact on the work done throughout the country. It is important that the Minister faces up to the fact that his and his Department's decisions have caused the pressures at Daresbury. Professor Martin Rees, President of the Royal Society, stated that "the STFC has been constrained in its priority-setting by the Ministry, and…there was inadequate consultation with the relevant communities."

The Minister for Science and Innovation (Ian Pearson): The Government remain absolutely committed to developing Daresbury as a world-class campus for science and innovation. It is clearly Government policy to develop Daresbury and Harwell as science and innovation campuses. The delivery plan for the STFC would not have been recommended for approval if that plan did not include proposals to develop Daresbury as a science and innovation campus. There is no regional policy as such, research council decisions are made on the basis of a peer review of science. However, individual delivery plans must be in accordance with the strategic priorities of the Government, which includes a clear regional element including the development of Daresbury as a world-class centre for science and innovation. The argument that there needs to be a critical mass of world-class scientists undertaking research at Daresbury is accepted.

Graham Stringer (Manchester, Blackley): It was a Government commitment that the STFC would be left with no legacy issues and yet because of the overrun of the costs of Diamond by £75 million, the STFC has been left with a deficit. We are seeing part of the problems of dealing with that deficit in Daresbury, are we not?

The Minister for Science and Innovation (Ian Pearson): I want to make it clear that the STFC will develop the Daresbury science and innovation campus as a joint venture with the North West Development Agency, the private sector, universities and Halton Borough Council. Furthermore, Daresbury will continue to be a major plank in the Government's national science and innovation agenda. The medium-term strategy is clearly to continue to develop the campus, both on the science side, where we need to have world-class expertise, and on the innovation side. The STFC will complete the current investment in the Energy Recovery Linac Prototype project as a technology demonstrator. I cannot confirm that ALICE will go ahead as a project because decisions are awaited from the STFC. So this will be a difficult limbo situation for some time to come. I will be visiting Daresbury to make an important public announcement on a further phase of investment in the Daresbury science and innovation campus. This will be the first in a series of announcements that will demonstrate the Government's resolve to make a world-leading success of the Daresbury campus.

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

European Union – Digest

Monthly digests of European legislaiton, taken from the Official Journal of the European Communities, 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

Identifying cystic fibrosis biomarkers

The study of cystic fibrosis (CF) is important not only for patients, but also for use as a model gene for other inherited diseases. Proteins from the expression of CF genes were analysed and compared with complementary products from non-CF individuals. CF is one of the most common life-shortening inherited diseases. The CF gene results in the production of a chloride ion channel important in the creation of sweat, digestive juices and mucus. Mutations in this gene can therefore cause a range of problems in all systems involved with these secretions. The original overall objective of the EU-funded CF-CHIP project was to develop a new gene array technology platform. The aim was high-throughput diagnosis of CF and related diseases as well as use as a model for other genetic disorders. The University of Lisbon selected three cell lines and then analysed gene expression changes which could be linked to the presence of a CF mutation by comparison with the human micro-array from MWG-Biotech UK Ltd. As a result, genes were identified that were consistently up- or down-regulated in CF tissues when compared to samples from non-CF patients.

Turning water and sunlight into hydrogen energy

A technologically advanced reactor can turn water and sunlight into hydrogen energy, unlocking the door to an endless source of carbon-free energy for humankind. Using hydrogen as a source of energy for transport and electricity production is environmentally attractive. Currently, however, the most feasible methods of hydrogen production are linked with emissions to the atmosphere that negatively impact air quality and contribute to climate change. Unfortunately this means hydrogen has little advantage over conventional fossil fuels. Research funded through FP5 could turn things around. The Centre for Research and Technology Hellas (CERTH) co-ordinated the Hydrosol project with the goal of making hydrogen from water and sunlight. Combining their expertise with that of researchers from three other EU Member States, they designed and tested a novel solar reactor where solar radiation is used to superheat water to the point where it dissociates to form hydrogen and oxygen. A catalytic coating inside the reactor helps to reduce the temperature required for water splitting to occur. Ceramic components and a honeycomb monolith structure further enhance the reactor's efficiency.

Putting cleaner vehicles on the street

A successful campaign implemented in the framework of the Vivaldi project helped to put more than 160 alternatively-fuelled vehicles on the roads of Bremen, Germany. Emissions from vehicles not only degrade local air quality, they also contribute to global climate change. Engineers are constantly striving to reduce these emissions and to make transport more sustainable. Impressive emission reductions have been achieved with alternative fuels such as compressed natural gas (CNG), yet the market has been slow to adopt this technology. The Growth programme charged the Vivaldi consortium with boosting CNG usage across all sectors. ECOLO, a Vivaldi partner based in Bremen, implemented an extensive campaign in its hometown by firstly educating the public about the environmental benefits of CNG and then by targeting a wide range of stakeholders ranging from car dealers to taxi companies, service stations and driving schools. In addition it was also necessary to provide financial incentives since CNG-powered vehicles are still slightly more expensive than gasoline-powered vehicles. Subsequently 250 applications were received for CNG vehicles resulting in 160 vehicles in circulation in Bremen.

Double Antennas deliver double the signal

Digital television transmission techniques that deliver most benefit in the worst reception environments have been developed by a consortium of European researchers. The technologies promise to reduce the network infrastructure needed for mobile television, while minimising the power demands and complexity of mobile television receivers of the future. In a typical broadcast transmission, radio signals bounce off objects in the environment, reaching the receiver over multiple paths. Distortion from multipath signals can produce fading, resulting in temporary failure of reception. EU Researchers in the PLUTO project led by Broadreach Systems (UK) demonstrated that splitting the transmit power between multiple antennas can provide substantially more effective coverage than using a single antenna.

Inexpensive polymer-based optics

Low-cost, complex-shaped and multifaceted high-density polyethylene (HDPE) optics were used in thermal infrared device applications intended for detection and imaging within the TECH-TIR project. Prior to this development HDPE had not been used as optical material in high-end imaging applications despite its extensive use in low-end non-imaging applications, mainly due to poor transmittance properties compared with semiconductor crystals or chalcogenide glasses. The outcome was the design, testing and manufacture of low cost HDPE solutions. The huge cost reductions in the production of optics using plastic-based micro-optical parts opens new avenues in imaging and detection capabilities.

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Biotechnology and Biological Sciences Research Council

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The BBSRC is the UK's leading funding agency for academic research in the non-medical life sciences and is funded principally through the Government's Science Budget. It supports staff in universities and research institutes throughout the UK, and funds basic and strategic science in: agri-food, animal sciences, biomolecular sciences, biochemistry and cell biology, engineering and biological systems, genes and developmental biology, and plant and microbial sciences.

Economic and Social Research Council

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Natural Environment Research 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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AIRTO represents the UK's independent research and technology sector - member organisations employ a combined staff of over 20,000 scientists and engineers with a turnover in the region of £1.5 billion. Work carried out by members includes research, consultancy, training and global information monitoring. AIRTO promotes their work by building closer links between members and industry, academia, UK government agencies and the European Union.

Biochemical Society

Contact: Dr Chris Kirk
Chief Executive,
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Tel: 020 7280 4133 Fax: 020 7280 4170
Email: chris.kirk@biochemistry.org
Website: www.biochemistry.org

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

BIOSCIENCES FEDERATION

Contact: Dr Richard Dyer, Chief Executive
Biosciences Federation
PO Box 502, Cambridge, CB1 0AL
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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 51 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 Association for the Advancement of Science - the BA

Contact: Sir Roland Jackson Bt, Chief Executive
The BA, Wellcome Wolfson Building,
165 Queen's Gate, London SW7 5HD.
E-mail: Roland.Jackson@the-BA.net
Website: www.the-BA.net

The BA (British Association for the Advancement of Science) exists to advance the public understanding, accessibility and accountability of the sciences and engineering. The BA aims to promote openness about science in society and to engage and inspire people directly with science and technology and their implications.
Established in 1831, the BA is a registered charity which organises major initiatives across the UK, including the annual BA Festival of Science, National Science and Engineering Week, programmes of regional and local events, and the CREST programme for young people in schools and colleges.

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
Website: www.nutrition.org.uk

2007 was the 40th Anniversary of the British Nutrition Foundation. This scientific and educational charity 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.

BRITISH PHARMACOLOGICAL SOCIETY

Today's science, tomorrow's medicines

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

British Society for Antimicrobial Chemotherapy

Contact: Tracey Guest, Executive Officer
British Society for Antimicrobial Chemotherapy
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Website: 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.

BVA British Veterinary Association

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www.bva.co.uk

BVA's chief interests are:

* Standards of animal health
* Veterinary surgeons' working practices
* Professional standards and quality of service
* Relationships with external bodies, particularly government

BVA carries out three main functions which are:

* Policy development in areas affecting the profession
* Protecting and promoting the profession in matters propounded by government and other external bodies
* Provision of services to members

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.

Campden & Chorleywood Food Research Association

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An independent, membership-based industrial research association providing substantial R&D, processing, analytical, hygiene, best practice, training, auditing and HACCP services for the food chain worldwide.
Members include growers, processors, retailers, caterers, distributors, machinery manufacturers, government departments and enforcement authorities. Employs over 300; serves over 2,000 member sites; and has a subsidiary company in Hungary. Activities focus on safety, quality, efficiency and innovation. Participates in DTI's Faraday Partnerships and collaborates with universities on LINK projects and studentships, transferring practical knowledge between industry and academia.

Cavendish Laboratory

UNIVERSITY OF CAMBRIDGE

The Administrative Secretary, The Cavendish Laboratory,
J J Thomson Avenue, Cambridge CB3 0HE, UK.
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http://www.phy.cam.ac.uk

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

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

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

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

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

Chartered Institute of Patent Attorneys

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Secretary & Registrar
The Chartered Institute of Patent Attorneys
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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

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Website: www.ctechinnovation.com

An independent innovation and technology development organisation. Activities range from contract and grant funded research to commercialisation of technology, exploitation of intellectual property, multi-disciplinary innovation consultancy and process and product development.

C-Tech now has almost 40 years experience of the management and delivery of major technology and innovation based business support projects both nationally and regionally.

The Engineering and Technology Board

Contact: Clare Cox
2nd Floor, Weston House
246 High Holborn, London WC1V 7EX
Tel: 020 3206 0434
Fax: 020 3206 0401
E-mail: ccox@etechb.co.uk
Website: www.etechb.co.uk

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

Freshwater Biological Association

Contact: Dr Michael Dobson, Director.
Freshwater Biological Association, The Ferry Landing, Far Sawrey, Ambleside, Cumbria, LA22 0LP, UK.
Tel: 01539 442468 Fax: 01539 446914
www.fba.org.uk info@fba.org.uk
Registered Charity Number : 214440

The FBA welcomes collaboration with Government and Agencies. Founded in 1929 the Association promotes freshwater science through; innovative research, serviced facilities, a programme of meetings, scientific publications, and sound independent advice. The FBA houses one of the world's finest freshwater information resources and is the custodian of long term data sets from sites of scientific significance. Membership is offered on an individual or corporate basis.

Health Protection Agency

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

The Health Protection Agency is an independent organisation dedicated to protecting people's health in the United Kingdom. We do this by providing impartial advice and authoritative information on health protection uses to the public, to professionals and to government.

We combine public health and scientific expertise, research and emergency planning within one organisation. We work at international, national and regional and local levels and have many links with many other organisations around the world. This means we can respond quickly and effectively to new and existing national and global threats to health including infections, environmental hazards and emergencies.

Human Fertilisation and Embryology Authority

Contact: Tim Whitaker
21 Bloomsbury St
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Website: www.hfea.gov.uk

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

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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76 Portland Place, London W1B 1NT
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Website: www.iop.org

The Institute of Physics supports the physics community and promotes physics to government, legislators and policy makers.

It is an international learned society and professional body with over 35,000 members worldwide, working in all branches of physics and a wide variety of jobs and professions – including fundamental research, technology-based industries, medicine, finance – and newer jobs such as computer games design. The Institute is active in school and higher education and awards professional qualifications. It provides policy advice and opportunities for public debate on areas of physics such as energy and climate change that affect us all.

Institute of Physics and Engineering in Medicine

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Website: www.ipem.ac.uk

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

IChemE

Institution of Chemical Engineers

IChemE is the hub for chemical, biochemical and process engineering professionals worldwide. We are the heart of the process community, promoting competence and a commitment to sustainable development, advancing the discipline for the benefit of society and supporting the professional development of over 27,000 members.

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www.icheme.org

Institution of Civil Engineers

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Website: www.ice.org.uk

ICE aims to be a leading voice in infrastructure issues. With over 75,000 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 from energy generation and supply, to sustainability and the environment.

Institution of Engineering and Technology

Contact: Tony Henderson
Institution of Engineering and Technology
Savoy Place, London WC2R 0BL
Tel: 020 7344 8403
E-mail: tonyhenderson@theiet.org
Website: www.theiet.org

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

KEW GARDENS

PLANTS PEOPLE POSSIBILITIES

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

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

Contact: Prof Simon J. Owens
Tel: 020 8332 5106
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Email: s.owens@kew.org
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Two stunning gardens-devoted to building and sharing knowledge

LGC

Setting standards in analytical science

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LGC, a science service company, is Europe's leading independent provider of analytical and diagnostic services and reference standards. LGC's market-led divisions - LGC Forensics, Life & Food Sciences, Pharmaceutical & Chemical Services, Research & Technology and LGC Standards - operate in a diverse range of sectors for both public and private sector customers.

Under arrangements for the office and function of the Government Chemist, LGC fulfils specific statutory duties and provides advice for Government and the wider analytical community on the implications of analytical chemistry for matters of policy, standards and regulation.

LGC has its headquarters in Teddington, South West London, and other UK operations in Bury, Culham, Edinburgh, Leeds, Risley, Runcorn and Tamworth. It also has facilities in France, Germany, Italy, Poland, Spain, Sweden and India.

London Metropolitan Polymer Centre

LONDON metropolitan university

Sir John Cass Department of Art, Media & Design

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

The London Metropolitan Polymer Centre provides training, consultancy and applied research to the UK polymer (plastics & rubber) industry. Recently, LMPC has merged with the Sir John Cass Department of Art, Media & Design (SJCAMD) to provide a broad perspective of materials science and technology for the manufacturing and creative industries. SJCAMD 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.

Lilly and Company Limited

Lilly 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.

Marks & Spencer Plc

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Main Business Activities

Retailer – Clothing, Food, Home and Financial Services

We have around 760 stores in 33 territories worldwide, employing 75,000 people.

We offer our customers quality, value, service and trust in our brand by applying science and technology to develop innovative products and services.

MERCK SHARP & DOHME

Merck Sharp & Dohme Research Laboratories

Contact: Dr Tim Sparey
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Merck Sharp & Dohme is a UK subsidiary of Merck & Co Inc a global research-driven pharmaceutical company dedicated to putting patients first. Merck discovers, develops, manufactures and markets vaccines and medicines in over 20 therapeutic categories directly and through its joint ventures. Our mission is to provide society with superior products and services by developing innovations and solutions that improve the quality of life.

The National Endowment for Science, Technology and the Arts

NESTA Making Innovation Flourish

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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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Newcastle University has a well-balanced portfolio of research funding with one of the highest levels of research projects funded by UK Government Departments, as well as a very significant portfolio of FP6 EU activity of more than 140 projects involving some 1,800 partners. A member of the Russell Group, Newcastle University is committed to 'excellence with a purpose' - a commitment it is taking further through the development of Newcastle Science City and as a partner in the N8 group of Northern research-intensive universities.

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 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 six 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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Website: www.raeng.org.uk

As Britain's national academy for engineering, we bring together the country's most eminent engineers from all disciplines to promote excellence in the science, art and practice of engineering. Our strategic priorities are to enhance the UK's engineering capabilities; to celebrate excellence and inspire the next generation; and to lead debate by guiding informed thinking and influencing public policy.

The Royal Institution

Ri The Royal Institution of Great Britain

Contact: Dr Gail Cardew
Head of Programmes
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The core activities of the Royal Institution centre around four main themes: science research, education, communication and history. It acts as a unique forum for engaging people in scientific debate, and has a UK-wide programme of informal science learning and mathematics enrichment. The building has been closed for the last three years, and will open in summer 2008 when the public will have access to an extended museum, new social spaces and upgraded facilities in the historic lecture theatre. There will also be a new focus for the Davy Faraday Research Laboratories.

The Royal Society

THE ROYAL SOCIETY CELEBRATING 350 YEARS

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Email: peter.cotgreave@royalsociety.org
Website: www.royalsociety.org

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

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

RSC Advancing the Chemical Sciences
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 RSS is a leading source of independent advice, comment and discussion on statistical issues. It plays a crucial role in promoting 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, most notably during the passage of the Statistics and Registration Service Act 2007.

semta

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E-mail: dwinstanley@semta.org.uk
Website: www.semta.org.uk

Semta (Science, Engineering and Manufacturing Technologies Alliance) is the Sector Skills Council for the science, engineering and manufacturing technology sectors.

Our **mission** is to ensure that our industry partners have the knowledge and skills required to meet the challenges faced by the workforce of the future.

Our sectors account for a significant proportion of the UK economy. There are about 2 million people employed in about 76,000 establishments in the core Science, Engineering and Technology sectors, and currently contributes over £74 billion per annum – about ten per cent – of total UK GDP.

Society for general Microbiology

Contact: Public Affairs Administrator
Marlborough House, Basingstoke Road,
Spencers Wood, Reading RG7 1AG.
Tel: 0118 988 1843 Fax: 0118 988 5656
E-mail: pa@sgm.ac.uk
Website: http//www.sgm.ac.uk

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

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

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

Society of Chemical Industry

SCI where science meets business

Contact: Andrew Ladds,
Chief Executive
SCI International Headquarters
14-15 Belgrave Square, London SW1X 8PS
Tel: 020 7598 1500 Fax: 020 7598 1545
E-mail: secretariat@soci.org
Website: www.soci.org

SCI is an interdisciplinary network for science, commerce and industry. SCI attracts forward-thinking people in the process and materials technologies and in the biotechnology, energy, water, agriculture, food, pharmaceuticals, construction, and environmental protection sectors worldwide. Members exchange ideas and gain new perspectives on markets, technologies, strategies and people, through electronic and physical specialist conferences and debates, and our published journals , books and the respected magazine *Chemistry & Industry.*

Society of Cosmetic Scientists

FOUNDED 1948 SCS SOCIETY OF COSMETIC SCIENTISTS

Contact: Lorna Weston,
Secretary General
Society of Cosmetic Scientists
G T House, 24-26 Rothesay Road, Luton, Beds LU1 1QX
Tel: 01582 726661
Fax: 01582 405217
E-mail: ifscc.scs@btconnect.com
Website: www.scs.org.uk

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

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

Universities Federation for Animal Welfare

UFAW Established 1926

Contact: Dr James Kirkwood,
Scientific Director
The Old School, Brewhouse Hill
Wheathampstead, Herts. AL4 8AN.
Tel: 01582 831818. Fax: 01582 831414.
Email: ufaw@ufaw.org.uk
Website: www.ufaw.org.uk
Registered 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

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

Tuesday 13 May 08.30
Biosimilar Medicines
Speakers: Dr Antonio Pagliuca, Consultant Haematologist, Kings College Hospital
Mr Michael Summers, Vice Chairman, The Patients Association
Breakfast Briefing

Tuesday 20 May 17.30
Chemicals in Food, Water and Consumer Products
Speakers: Professor David Coggon, Chairman, Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment
Dr Kerr Wilson, Chief Executive, Pesticides Safety Directorate
Gwynne Lyons, Director, Chemicals, Health and Environment Monitoring (CHEM) Trust

Tuesday 17 June 17.30
Emergent Human Diseases: Allergies, Autism and ME
Speakers: Professor the Baroness Finlay of Llandaff, Chairman, House of Lords Select Committee Enquiry into Allergies
Professor Simon Baron-Cohen, Director, Autism Research Centre, Cambridge
Sir Peter Spencer KCB, Chief Executive, Action for ME

Tuesday 1 July 08.30
Defence Science
Breakfast Briefing

Tuesday 15 July 17.30
Towards 2020 Science and the European Science Initiative
Speakers: Dr Andrew Herbert FREng, Managing Director and a Microsoft Distinguished Engineer, and Professor Stephen Emmott, Director, Computational Science & Head of Computational Biology, Microsoft Research, Cambridge

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The Royal Institution

The Royal Institution's lecture theatre has reopened, and the rest of its refurbished building will open in September 2008. 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.

Wednesday 21 May 19.00
How to win the Nobel Prize
Dr Tim Hunt

Monday 2 June 19.00
Feast
Prof Martin Jones

Wednesday 4 June 19.00
The culinary alchemist
Heston Blumenthal

Thursday 5 June 20.00
Close encounters of the third kind
Film screening

Sunday 8 June 18.00
Engineering the gold
Prof Kristan Bromley, Dr David James and Dr Martin Strangwood
Town Hall, Cheltenham

Monday 9 June 19.00
The fiction lab

Tuesday 10 June 19.00
Under my skin
Nick Percival and Philip Sykes

Wednesday 11 June 18.00
Peak performance
Dr Hugh Montgomery

Monday 16 June 19.00
People in space: the big debate
Dr Philip Ball and Dr Kevin Fong

Monday 23 June 20.00
In the shadow of the moon
Film screening

Tuesday 24 June 19.00
Technology ace
Tom Allen and Dr David James

Monday 30 June 19.00
Trust in me?
Prof Bill Durodie, Dr Dominic Johnson and Marek Kohn

Thursday 3 July 20.00
Forbidden planet
Film screening

Saturday 5 July drop in between 11.00 and 16.00
Family fun day

Thursday 10 July 19.00
Elegant solutions
Dr Philip Ball

Monday 14 July 19.00
The fiction lab

Wednesday 16 July 19.00
The science of beer
Alex Bell

Thursday 24 July 19.00
Thousand mile song
David Rothenberg

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 2 and Tuesday 3 June 2008 (all day)
Synthetic biology

Monday 30 June – Thursday 3 July
Summer Science Exhibition 2008
Opening times:
Monday 30 June 6-9pm
Tuesday 1 July 10am-9pm
Wednesday 2 July 10am-4.30pm
Thursday 3 July 10am-4.30pm
The exhibition is FREE to attend and open to all.

Please see royalsociety.org /events for the full events programme, more details about the above highlights and web casts of past events.

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

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 9 June 17.30
Electropalatography in the analysis of Tongue Dynamics During Normal and Disordered Speech
Professor William J Hardcastle FBA FRSE

Monday 30 June 18.00
Structures and Granular Solids
Professor J Michael Rotter FREng FRSE FICE FIStructE FASCE FIEAust

Tuesday 1 - Wednesday 2 July Full Day(s)
Structures and Granular Solids - Conference

Royal Pharmaceutical Society of Great Britain

Contact: science@rpsgb.org
www.rpsgb.org
Events are held at the Royal Pharmaceutical Society of Great Britain, London

Wednesday 4 June 10.00-16.30
Pharmacogenetics in Context
A joint symposium of the Academy of Pharmaceutical Sciences and the Royal Pharmaceutical Society of Great Britain
Held at the Royal Pharmaceutical Society of Great Britain

Thursday 12 June 10.00-16.30
Combating Counterfeit Medicines
Joint Pharmaceutical Analysis Group
Held at King's College London –Waterloo campus

Monday 30 June 09.15-16.55
Ophthalmic Drug Delivery: What is currently available and where are we going?
A joint symposium of the Academy of Pharmaceutical Sciences and the Royal Pharmaceutical Society of Great Britain
Held at the Royal Pharmaceutical Society of Great Britain

Institute of Materials, Minerals and Mining (IOM3)

1 Carlton House Terrace, London, SW1Y 5DB

Thursday 12 June
New Materials and Processes in Jewellery
Part of Coutts London Jewellery Week
www.iom3.org/events/jewellery

Monday 23 June
Materials in Armour
www.iom3.org/events/armour

Monday 30 June
Boost Your Career in Science and Engineering
www.iom3.org/events/boost

Tuesday 17 – Wednesday 18 June
International Ocean Stewardship Forum 2008
A forum facilitating the effective integration of marine science, policy and law within ocean governance.
National Oceanography Centre, Southampton, UK
www.oceanstewardship.com
Further information: info@oceanstewardship.com or 01453 839228

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Science in Parliament
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SCIENCE IN PARLIAMENT
Published by the Parliamentary and Scientific Committee, 3 Birdcage Walk, London SW1H 9JJ.
Published four times a year. The 2008 subscription rate is £66.80. Single numbers £16.70
ISSN 0263-6271
All enquiries, including those from members wishing to take the front or back covers, advertise in the journal or appear in the directory to Mrs Annabel Lloyd, Tel 020 7222 7085

Typeset and printed by The Bridge Press.

PARLIAMENTARY LINKS DAY 2008

Tuesday 24 June
Attlee Suite Portcullis House
House of Commons
10.30am – 12.45pm

The Royal Society of Chemistry organises *Parliamentary Links Day* on behalf of the scientific and engineering community. ***Links Day*** is the largest science event on the annual calendar of Parliament. Attendance is free.

Putting Science at the Heart of Parliament

For further details
Contact Julie Smart smartj@rsc.org

RSC | Advancing the Chemical Sciences