

Spring 2005



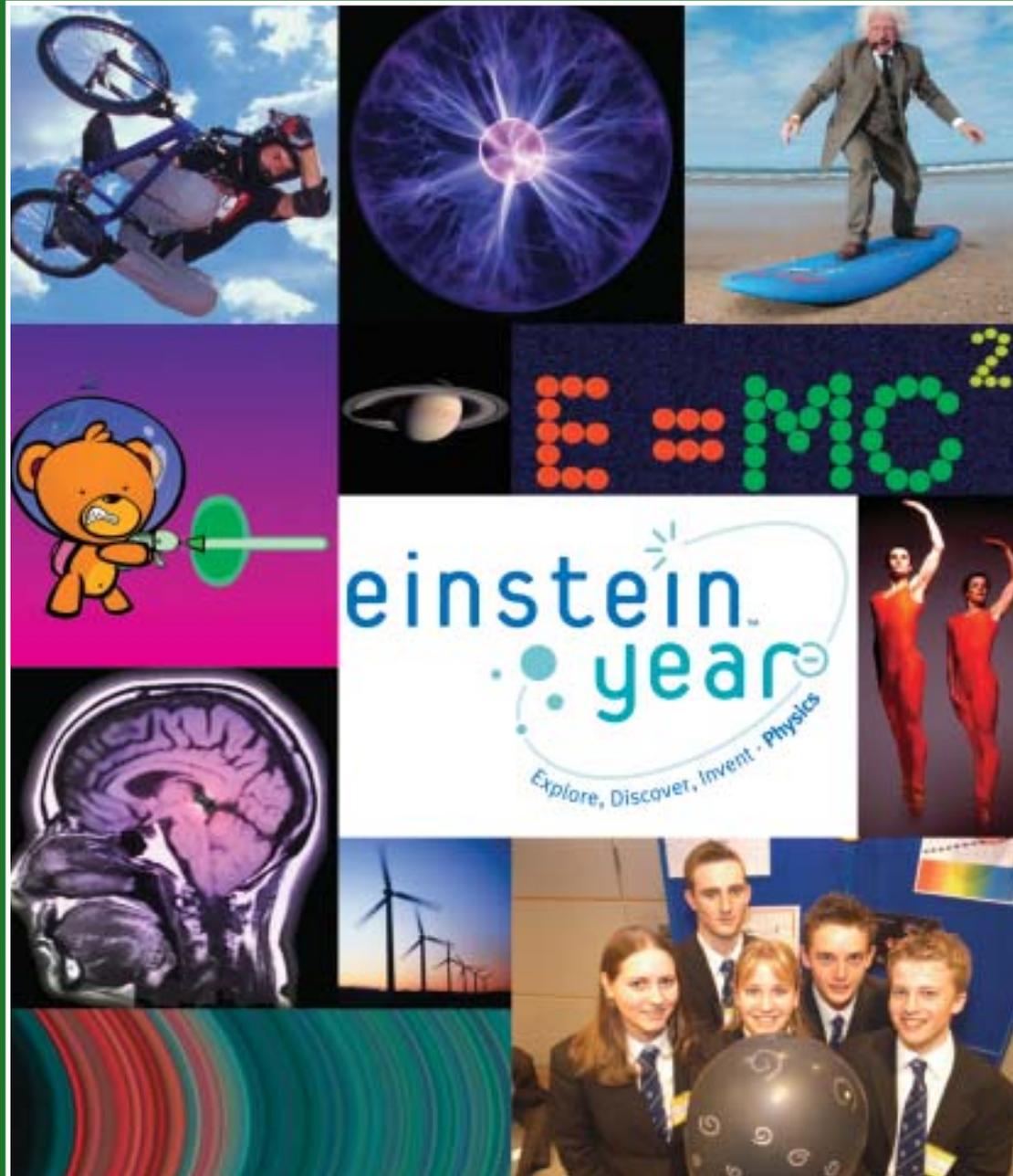
SCIENCE IN PARLIAMENT

Lib Dem
Science

65th Birthday

Animal
Research

Risk
Assessment



International Year of Physics 2005
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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.



In this issue which celebrates Einstein Year as is obvious from our front cover sponsored by the Institute of Physics, appropriately Sandra Gidley launches the Liberal Democrat science policy by reviewing fundamental problems. She emphasises the importance of teaching in schools where it is claimed girls no longer study A level science. Colin Blakemore translates research outcomes from the MRC for patient benefit. Colin Challen rations carbon emissions to save the planet, followed by the contraction and convergence proposed by Mayer Hillman. At the Risk meeting, Alastair Evans proclaims London as the insurance capital of the world, Philip Dale describes how the biotechnology community handles risk and its perception and Chris Elliott discusses management of system risk. The Committee's 65th Birthday is celebrated with George Smith's insights on the management of scientific research, David King's account of climatic impacts on government policy and Julia King's engineered future, where people, especially women, will be featured. At the meeting on animals, John Sulston ranges from Darwin to DNA, Tipu Aziz rejects the Early Day Motion banning primate research, which benefits humans afflicted by Parkinson's and Alzheimer's disease, and Robert Hubrecht who emphasises the three Rs, especially Refinement relating to animal husbandry. John O'Reilly moves to reverse the decline in numbers of undergraduates in engineering and physical sciences. Charles Wessner and Alan Hughes compare and contrast UK versus US styles of university and industry interaction, and there is more, much more.

Dr Douglas Naysmith MP
Chairman, Editorial Board,
Science in Parliament

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Liberal Democrat Science Policy

Sandra Gidley MP



Current Liberal Democrat science policy stems from concerns that over the past hundred years Britain has fallen behind international competitors in some areas of the scientific and industrial fields. It would be easy to make a case for more Government investment but there are some more fundamental problems which have to be tackled if Science is to become more prominent in public thinking and regard.

The National Curriculum was introduced in the eighties and for the first time ever there was a guarantee that all children would study science at school. In a perfect world this should have meant that more children would become enthused by science and seek a career in one of the science based areas. Sadly, this does not appear to have been the case.

There needs to be an urgent review of science teaching in schools so that we understand why children, particularly girls, decide not to study science at Advanced level. For some children the reason could be as simple as choosing “an easier option” but, fundamentally, we need to answer the basic question, “Is our science teaching good enough?”

There is some evidence that science teaching may not be good enough as there is a shortage of science teachers and a large number of children are taught by someone without appropriate qualifications. The Liberal Democrats have set aside funding to ensure that teachers receive appropriate training in the subject they are teaching.

Unless our brightest and best young people opt for science as a career then

we will lose further ground. Liberal Democrats believe that the Government’s current proposals for tuition fees and top up fees run counter to this aim. Many scientists are not well paid and the prospect of future debt means that future careers are chosen with earning power in mind.

In the near future Universities will have to devote a lot of time and attention to the problem of how they will fund bursaries. If this burden is lifted from them then they will be able to devote that time and energy to attracting more funding for research projects.

If we are to provide the scientists and the teachers for the next generation we have to reverse the diminishing science base in our Universities. It is of great concern that 79 science and engineering departments have closed down over the past six years, at a time when the higher education sector is expanding.

The Liberal Democrats will disband the DTI but this does not mean abolishing all of its functions. Science would transfer to a newly reformed Department of Education and Science.

More importantly, the Liberal Democrats will not cut the existing level of the science budget. The contribution made by the DTI will grow in real terms by 0.5% each year over the next Parliament. This will allow targeted public and private science and innovation spending to be regularly and thoroughly monitored for best practice.

We do not believe that existing Government plans for large increases in science subsidies to the private

sector are sensible, since they are badly targeted and will often simply replace private sector investment in science, at the taxpayer’s expense.

The structure of British R&D is different from that of our Continental trading partners. We share a desire to raise research and development expenditure as a part of GDP but believe that full account should be taken of the contribution from the private sector, UK multinational companies and our investments overseas especially in the USA.

In addition to this we need to consider whether our current research priorities are the right ones. Do we have the right balance between military R&D or should more money be diverted towards civil science and research? One thing is sure, in line with our “green” credentials we would want to prioritise research into climate change mitigations and cleaner production and consumption techniques.

Scientific developments create ethical challenges for any Government. In recent years there have been a number of highly emotive issues such as stem cell research and GM crops. There will be more in the future. The media delights in scaremongering and politicians of all parties have jumped on these bandwagons. The Liberal Democrats would like to see reasoned debate but on a private level I would contend that the lack of understanding of science in politics and the media fuels this anti-science feeling. I return to where I started in this article. There are so many reasons why improving science education will reap dividends in the long run.

Vision and Strategy for the Medical Research Council

Professor Colin Blakemore



I took over as Chief Executive of the MRC in October 2003. At that time, following extensive consultation, the MRC had recently published a long-term “Vision for the Future” (available on the MRC website). This focused on seven key drivers: Health priorities; Discovery science for health; From science to health care and public policy – translational approaches; Developing the workforce; Public expectation; Partnership working in the UK and abroad; and Providing a lead on good governance. These have not changed, and in fact are well reflected in the Government’s Science and Innovation Framework which was published in July of last year. Recently there has been an even greater focus on translating the outcomes of research for patient and population benefit.

The half century since the discovery of the structure of DNA has seen extraordinary advances in basic biomedical science. Much of this has been at the molecular level, understanding how molecules are formed, what their structures are and how they interact with each other. In the coming decade, this knowledge will be increased, but there will also be a rapid extension to a more integrative level: increasing understanding of how cells, organs and organisms function, and the complex processes underpinning normal growth and development. This work will continue to require the use of animals, under the well-regulated conditions in the UK. In addition we will be extending our work on populations and on the social influences on health. The consequent benefits for the understanding of disease processes

will be immense. There is now widespread recognition, around the world, that the coming decade should see rapid payback to the public in benefits in health care. This may be expensive initially – new drugs and treatments often are – but costs will come down, and health benefits translate into economic benefits longer-term, through less use of services and a healthier workforce. To achieve these goals, we make a major effort to strengthen clinical research, through a partnership between academia, research funders, the NHS and industry. Our approach is two-fold: to promote strategic priorities and to seek out and nurture innovative ideas from the research community itself.

The key driver for the next decade for MRC is therefore the desire to work with partners to deliver health R&D goals, while maintaining the vitality of the underpinning research and skills base. We will continue to fund the best research with the potential to improve human health, but with the burden of disease playing an increasing role in influencing the decisions that the MRC makes about what research to support. The research the MRC supports will have an increasing relevance to disease, with a greater priority given to translational approaches at the basic/clinical interface. While we will make a special effort in the areas identified by the Department of Health for the UK Clinical Research Network – diabetes, Alzheimer’s disease, stroke and medicines for children – we will also continue to support other important areas. These include new and emerging infections, diseases of poverty (especially malaria,

HIV/AIDS, TB), cancer, mental health and understanding health behaviours.

How will we know if we are being successful? We expect there to be:

- more personalised, safe, effective prevention and treatment of disease;
- rapid responses to emerging and unpredictable infectious diseases;
- increased patient and public involvement in decision-making in health research, with greater focus on public preferences and valuations of health outcomes.

However, the size of the impact that the MRC can make will depend on the speed with which we can re-direct existing funding and on the volume of additional resources we can secure through SR2004 and future Spending Reviews. I remain extremely optimistic for the future of medical research in this country. There are opportunities to be grasped; and researchers are keen to respond to those opportunities and to the needs of the country.

MRC Mission

- To encourage and support high-quality research with the aim of improving human health.
- To produce skilled researchers, and to advance and disseminate knowledge and technology to improve the quality of life and economic competitiveness in the UK.
- To promote dialogue with the public about medical research.

How We Can Save The Planet

Colin Challen MP

Having recently been on a diet, I can attest to the validity of the comparison Mayer Hillman makes between counting the calories and curbing carbon emissions in his recently published paperback. Both activities demand a personal commitment and an understanding of the impact of excess consumption so that individuals can change their behaviour to achieve the required objective. Hillman's book is an excellent place for individuals to start their quest to become responsible environmental citizens. Understanding the difference we can make is the key to success – as long as people do not believe that they can personally make any difference, it is unlikely that government targets will be met. Ultimately, consumer behaviour will be the final arbiter of whether greenhouse gas emissions will be reduced sufficiently to avert a global climate change catastrophe. Like Hillman, I do not hold the view that technological advances on their own will do the trick – indeed, the danger is that the slow development of environmental technologies, such as hydrogen, merely offer false, early hopes which lull us into complacency. Hydrogen is too far off to be helpful now.

The solution Hillman proposes is to ration carbon emissions on a per capita basis, and for those rations to submit to the rule of contraction and convergence, so that emissions are reduced year on year, and eventually for each individual around the globe, converge at the same sustainable level. Such a proposal is socially as well as environmentally just, being predicated on the irrefutable logic that no human is born with a greater entitlement to pollute than any other, whether or not they can afford an SUV.

The fairness agenda has to be central to tackling global warming – we have to recognise that profligate energy use is a moral issue when the consequences are so dire for poorer peoples. But how does one set about convincing the western public that an energy diet is good for them? Doesn't such a prospect spell political suicide?

I don't think so. The alternatives are all politically worse (if we rule out the "let's leave this till later" option). Carbon taxes have been mooted, but like all environmental taxes are likely to be unpopular. The bitter after taste of the fuel protests, combined with the increasing costs of fossil fuels make it difficult to see how any government could significantly raise duties without a self-defeating backlash. The voluntary approach (eg Defra's "Are You Doing Your Bit" campaign) was widely seen to have failed. Without a critical mass of people participating, others often lose interest.

We are also witnessing a more concerted opposition to technological solutions such as wind power, the mainstay of the Government's alternative energy policy. It never pays to ignore the impact that nimbysism has on demolishing consensus around the greater good.

Carbon rationing, combined with a trading scheme, provides a way forward. Indeed, the Government and the European Union have long accepted that carbon emissions trading schemes work, and the roll-out of the EU ETS in January is testament to that.

Would an ETS for the general public work? I don't see any reason why not, and my ten minute rule bill on domestic tradable quotas is the first attempt to provide a



legislative glimpse of how such a scheme might work. Going back to the analogy with dieting, the concept of controlling one's energy intake is well established, and food products are now sold with an abundance of information on the label to guide the consumer. Dieting clubs like Weightwatchers provide easy-to-follow guides to help calculate the impact a certain product will have on the waistline. Calories (kcal) are no more mysterious than kg CO₂.

Using the tables in *How We Can Save The Planet* makes it easy to find out how much we each contribute to global warming. UK households are responsible for over 24mt CO₂ equivalent each year. Given that global emissions are said to be around 6 billion tonnes – one tonne for each of us – it is easy to see how disproportionate western energy use is. The earth's capacity to absorb greenhouse gases is about 3 billion tonnes a year. This is the longest suicide note in history.

If we act now, the worsening crisis could be ameliorated if not totally averted. But some people say it's already too late. Hillman has tried to anticipate the arguments of the fatalists and those who would indulge in displacement activities. But unless we start fleshing out what we mean by "everybody must do something" it will be very difficult indeed to take any more political speeches on the environment very seriously. *How We Can Save The Planet* should at the very least be mandatory reading for all those who write such speeches.

Reference

How We Can Save the Planet, Mayer Hillman with Tina Fawcett, Penguin Books, 2004, 195p, ISBN 0-141-01692-2, £7.99 (PB)

RISK PERCEPTION & RISK ASSESSMENT VERSUS HAZARD REDUCTION INSURANCE - BIOTECHNOLOGY – ENGINEERING - TRANSPORT

MEETING OF THE PARLIAMENTARY AND SCIENTIFIC COMMITTEE ON MONDAY 25TH
OCTOBER 2004

Risks and hazards are objective factors with potential impacts that are amenable to scientific evaluation and their controlled reduction. The perception of risk on the other hand is subjective and reflects a fear of risk that varies between individuals. Government is a risky business, but how can the objective and subjective aspects of risk be managed together in order to benefit from our past mistakes “so that they never happen again”?

Alastair Evans describes how London underpins the world’s economy by managing financial aspects of risk. Phil Dale has extensive experience as a research scientist of risk assessment applied to GM crops and contributes his experience with biosafety issues. Chris Elliott combines practical engineering skills with those of a barrister having experience of advising Government on risk with a particular interest in transportation by rail.

London: the Insurance Capital of the World?

Alastair Evans, Head of Government Affairs, Lloyd’s



The London Market

The UK insurance industry is the third largest in the world, following the US and Japan. It writes about £160 billion premium income annually¹. The risks insured and reinsured range from life insurance to motor and household risks and extend to complex commercial and multinational risks.

The London Market is an integral part of the UK insurance industry. It comprises Lloyd’s, insurance and reinsurance companies, marine Protection and Indemnity Clubs and insurance brokers, almost all of which are located in the City of London. It provides a wealth of concentrated insurance expertise and an economic cluster of interrelated services.

It is the world’s leading market for internationally traded non-life insurance and reinsurance. The risks written by the market are diverse and typically include marine, aviation and transport risks, major property and complex liability risks as well as coverage of catastrophes. London provides a marketplace for high exposure and complex risks which local markets are unable to absorb.

The London Market writes more than £25 billion² of non-life business annually and is particularly significant in certain areas of business where its expertise helps to secure substantial percentages of the world’s insurance business as indicated below:

- 60%+ of offshore oil and gas risks
- 39% of the world’s aviation business
- 19% of the world’s marine business
- 15% of worldwide reinsurance, and
- 10-15% of large industrial insurance business worldwide.³

London faces strong competition in the general insurance and reinsurance markets. However, it remains our belief that London can accurately be described as the insurance capital of the world. We recognise that London’s ability to retain this position is conditional on demonstrating innovation, with an appetite for risk, highly efficient business processes and competitively priced products.

Lloyd’s

Lloyd’s is the world’s leading specialist insurance/reinsurance market. It is home to 44 Managing Agents who run 62 separate underwriting businesses known as syndicates who write almost £14 billion⁴ worth of premiums with an unrivalled concentration of underwriting expertise and talent. It is also a global trader and writes business from over 100 countries⁵. The risks underwritten are therefore geographically diverse. The major markets are the US, UK and EU. Lloyd’s has a reputation as an innovative market trusted to insure the world’s toughest and most complex risks. It is financially strong and secure and has an unrivalled track record for paying valid claims. It is the second largest commercial lines insurer and the sixth largest reinsurer in the world⁶.

The market has changed from one backed wholly by private capital to a much more diversely financed market and from a self-regulated market to being regulated by the FSA. Annual accounting has replaced three year accounting. Co-operative programmes have been launched to address business issues

such as faster production of policies, quicker movement of monies and greater contract certainty at inception. A new governance structure has also been created around a franchise concept to improve market performance and brand leverage.

As a result Lloyd's rating has increased when many others have declined. The market has returned to profitable trading post 11 September. Lloyd's delivered strong financial results in 2002 and 2003, generating profits of £834m and of £1,829m respectively on a pro-forma annual accounted basis. This has strengthened the market's capital base. Its net resources (the Lloyd's equivalent of shareholder funds/stockholder equity) totalled £10.1bn at year end 2003, a 35% increase on 2002⁷. Lloyd's central assets have also grown following a recent £500 million subordinated debt issue. Lloyd's has now achieved its target of central assets exceeding \$1bn, which was set after September 11⁸ and it can be said with confidence that Lloyd's has become a success story again.

Insurance and Risk

Insurance offers an intangible product, a promise to pay in the event of occurrence of an event specified within the insurance contract that causes loss. Risk can range from the more mundane, though important, everyday risks to individuals' property and wellbeing, to catastrophic risks, which can be both natural and man-made. Insurance provides a risk transfer mechanism through which an individual or company can protect itself against future misfortune by transferring the financial downside inherent in risk and uncertainty to a professional insurer.

Insurance works on mathematical principles. Insurers build up statistical records on the severity and frequency of particular risks which assist them in setting an appropriate price. They pool the insurance premiums of the many to pay the losses of the few. To be insurable, risks need to satisfy certain criteria: they must be fortuitous (ie not certain to happen), be financially measurable, satisfy a test of insurable interest, and be compatible with public policy.

The acceptance of risk can expose the insurance industry to severe financial claims. Whilst the cost to the whole industry of the recent East Coast US hurricanes is still being calculated, Lloyd's estimates its own exposure as being of the

order of £1.3 billion⁹. Following the 11 September attacks, the number of insurance and reinsurance policies triggered worldwide ranged from aviation through to property, life and business interruption. Lloyd's underwriters are meeting claims to the value of approximately £2 billion for that day.

Because insurers accept risk, they have to ensure that this exposure is within their financial forecasts and financial capacity. Doomsday scenarios have to be anticipated and reflected in financial modelling. At the core of Lloyd's own risk management process lie certain Realistic Disaster Scenarios that are designed to enable Lloyd's to forecast what the market's potential financial exposure to catastrophic events might be, in the aggregate and at individual business level.

There are 17 scenarios on which Lloyd's syndicates are required to report. Some of these envisage total losses to the insurance industry of up to \$70 billion¹⁰. These include:

- US windstorms
- Marine events
- Loss of a major complex in the North Sea
- Aviation collisions
- Liability risks
- Political risks
- Earthquakes in the US and Japan
- Terrorism events

The results are used in business planning, as input to Lloyd's risk based capital modelling and to enable syndicates to benchmark themselves against their market peers. It is all part of prudent planning.

Long-tail risks pose particular challenges to insurers. Exposure to individuals to certain environments (eg noise, asbestos etc) can cause latent problems which do not manifest themselves, perhaps for decades. Victims seek legal recourse against those who owed them a duty of care and were negligent. The underwriting of long-tail liability risks has to cope with such challenges. Insurers accept and price risks against a known legal and scientific background but may face claims, which dwarf the level of premiums received, decades later in a very changed legal and scientific environment. This is not said as a complaint. It is a fact of underwriting life which the industry accepts and copes with.

The challenge for insurers in assessing and pricing risk becomes

yet more complex in the case of new and emerging risks. Insurers need to try to keep themselves abreast of scientific developments if they are to avoid underwriting misjudgements with potentially expensive consequences.

These judgments have to be exercised against an evolving claims background which some commentators have described as a growing "compensation culture". Opinions differ as to whether a compensation culture really exists or whether it is simply a media-led campaign. For insurers, the key is not newspaper headlines but whether the frequency and severity of claims is or is not increasing or may increase in the future, since the cost of claims has to be reflected in prices. Actuaries have said that the compensation culture is costing UK plc about £10 billion a year – and rising at 15% per annum¹¹. The average cost of an employers' liability claim has increased by over 100% over the last five years¹². Clinical negligence which cost the NHS £6 million in 1975, cost nearly half a billion by 2002¹³. Compensation and legal costs have risen to £100 million in the Ministry of Defence¹⁴. Society (whether via Parliament or the courts) has, and should have, the right to decide that compensation should be awarded in a particular set of risk circumstances and those costs have to be sourced. Insurance provides a crucial mechanism in modern society for helping to ensure that victims are properly compensated.

Conclusion

We believe that London remains the insurance capital of the world. This belief is not advanced with any sense of hubris. Competition is fierce in the global insurance and reinsurance industry and that position will only be maintained by continual modernisation and being at the top of our game. The challenge which London faces is to continue to provide cost-effective, innovative solutions to the world's voracious demand for risk transfer.

¹ IFSL, City Business Series, 2004, Insurance (p3)

² IFSL, City Business Series, 2004, Insurance (p15)

³ All percentages from: IFSL, City Business Series, 2004, Insurance (p19)

⁴ Lloyd's Worldwide Markets, 2004

⁵ Lloyd's Worldwide Markets, 2004

⁶ S&P Global reinsurance Highlights, 2004

⁷ Lloyd's Finance Department, April 2004

⁸ Lloyd's Finance Department, April 2004

⁹ Lloyd's Risk Management, 2004

¹⁰ Lloyd's Loss Modelling, 2004.

¹¹ Actuaries' Working Party report "The Cost of Compensation Culture", reported on www.thenetrisk.com 17/12/02

¹² Association of British Insurers, "Liability Insurance", August 2002

¹³ "Making Amends", Chief Medical Officer, June 2003

¹⁴ NAO Report "Ministry of Defence- Compensation Claims", 18 July 2003

Biosafety of GM Crops: How the biotechnology community handles risk and its perception

Philip J Dale, John Innes Centre, Norwich



Introduction

Over the past 20 years it has become possible for plant biologists to isolate genetic material (DNA) from a range of organisms to genetically modify (GM) crops. GM methods provide plant biologists with opportunities to modify crops in novel ways. It is important, for instance, that we find sustainable crop based substitutes for our diminishing oil and mineral reserves, and explore ways to produce crops adapted to changing climatic conditions. GM crops are cultivated in 18 countries by 7 million farmers and worldwide cover over twice the land area of the UK (67.7 million hectares in 2003).

Highly developed methods of risk assessment have evolved in recent years to assess the safety of GM crops, and this is one of the few areas of scientific innovation where the process of risk assessment is carried out proactively, rather than reactively. Proactive risk assessment has many merits, but it does tend to focus disproportionate attention on risk, and frequently ignores benefit.

I shall discuss three topics associated with risk: its assessment, acceptability and perception. I shall conclude with thoughts on other dimensions of risk.

Risk Assessment

In assessing risk we address a series of questions. In some cases sufficient scientific knowledge and experience is available to answer them. In others, new scientific data has to be generated. Some key questions in risk assessment are:

- How does the introduced gene modify the crop?
- Are there changes in toxicity or allergenicity?
- Is the crop more invasive or persistent (weedy)?
- Are there effects on friendly organisms (eg ladybirds)?
- What is the likelihood and consequence of pollination?

The general consensus within the scientific community is that there is no generic difference between the risks of growing GM and non-GM crops. Each GM crop must be evaluated case by case.

Risk acceptability

What “yardstick” do we use to determine whether an impact is acceptable or not? A view out of an aeroplane window confirms that agriculture has a dramatic impact on our rural landscape, compared with how it must have looked a hundred or even twenty years ago.

Over 70% of the UK land area is farmed in some way, so agriculture largely defines our landscape and rural environment.

In assessing the risk of GM crops, the EU regulatory process requires a comparison with similar non-GM crops. The difficulty with this is that different crops (oilseed rape, maize, sugar beet) themselves can have fundamentally different impacts, as was illustrated by the four year Farm Scale Evaluations (FSEs).

The aim of the FSEs was to assess the impact on farmland wildlife of three GM crops (oilseed rape, maize, sugar beet), each made tolerant to one particular herbicide to improve crop weed control. The comparator of impact (or the “yardstick” of acceptability) for each GM crop was a non-GM variety of the same crop. The results of the paired comparisons were that the GM maize was found to be associated with more wildlife compared with the non-GM variety, and the GM oilseed rape (spring sown) and sugar beet were found to be associated with a reduction in wildlife compared with the non-GM varieties. Decisions on commercialisation were based largely on these direct comparisons.

A fundamental weakness of comparisons of this type is that they fail properly to take a holistic view of the impact of agriculture on wildlife. The FSEs established that there were significant variations between crops (whether GM or non-GM) on wildlife. Oilseed rape is generally better for wildlife than maize. There were also significant differences in wildlife between locations and seasons. The outcome of the decision made on commercialisation was that there was no regulatory mechanism to limit the continuous cultivation of non-GM maize (damaging to wildlife) but it would prevent the cultivation of a GM oilseed rape break-crop (beneficial to wildlife). The results also fail adequately to emphasise that any method of efficient weed control in crops (hoe, flame thrower, mechanical cultivation) is also likely to have a significant negative impact on wildlife in agriculture because weeds often provide nourishment for wildlife food chains.

This emphasises the need to refine the precise objective of risk assessment. Its ultimate aim is surely to minimise any adverse impacts of GM crops on the environment. But this only makes sense when it is done in concert with (ie against a common yardstick) comparable judgments applied to damaging non-GM crops and existing farming practices.

A further anomaly is that certain crop modifications are possible by GM and non-GM methods (eg glyphosate herbicide tolerant ryegrass). A GM glyphosate tolerant ryegrass would be unlikely to be approved by the current GM regulatory process; whereas a non-GM herbicide tolerant ryegrass, with closely comparable environmental impacts, would proceed into agricultural use without comparable regulation.

Risk perception

It is fair to say that the biotechnology community finds the

area of risk perception to be difficult territory. This is because the rules of engagement between the various interest groups are very different.

The biotechnology community largely uses scientific evidence and reasoning to reach a conclusion in risk assessment. Where there is inadequate knowledge, they explore ways of managing risk. This is not to say that value judgements are not part of this process, but they are usually within a particular scientific and agricultural context.

The campaigning groups, and sections of the campaigning press, typically use a different currency. In basic terms, their concerns focus around who has power over food and the environment. The GM Nation report acknowledges that GM crops have become an icon for a range of concerns. Issues raised in the debates included: globalisation, the influence of big business, industrialisation of agriculture, trust in government and a range of environmental issues. Discussions that begin with GM crops often move rapidly to broader issues of power.

A particular difficulty with risk perception is that people rarely weigh information symmetrically. A grain of doubt can far outweigh a mountain of reassuring evidence. This is so even when there is no scientific evidence to support a concern. During recent years there have been extensive campaigns against GM crops by sections of the press and activist groups. Once a campaign is adopted it seems that balance and integrity of information is often a casualty. While mistakes have undoubtedly been made in GM crop commercialisation, biotechnology companies face litigation if they make false claims for their products, whereas false allegations of risk carry no such penalty.

Other dimensions of risk

The biotechnology community faces ongoing demands for greater public

transparency of their risk assessments. As a consequence, the activist groups are provided with the information they need to destroy GM field plots. Largely as a result of GM crop destruction, the number of GM field trials in the UK has reduced to almost zero in recent years.

As the UK aspires to have an innovative science and technology based economy, the consequences to research of crop vandalism are serious and could be devastating in the longer term for the following reasons.

- (a) An important role of field research with GM plants is to provide an analytical tool to understand important crop characters (eg environmental stress tolerance; pest & disease resistance; oil, starch and protein production). Basic knowledge in plant biology is relevant to all methods of crop improvement.
- (b) The major crop biotechnology companies have decided to move their GM research and development programmes out of the UK eg Bayer Crop Science, Syngenta. One Chief Executive told me that if biotechnology companies have to move their field crop evaluation out of the UK, it is logical to move their research programmes abroad also (mostly to the USA). Biotechnology companies take with them an extensive knowledge base and infrastructure for all aspects of crop biology.

The ability to do GM field research is of enormous significance to our crop research capability in the UK, and has parallels with the importance of stem cell research in medical science. If strategic and applied research involving GM field evaluation is denied, the UK is destined to become a backwater in innovative crop biology.

The management of system risk: Safety and environmental risk in engineering and transport

Dr Chris Elliott FREng, Pitchill Consulting Ltd



What is risk?

Ever since a caveman decided to bring fire into the cave, we've been living with risk. That caveman knew that fire was dangerous, but he decided that the benefits of a warm home and cooked food more than compensated for the risk that his home might catch fire. Since then, it is hard to think of any beneficial innovation, social or technical, that didn't bring with it the possibility of harm.

It is helpful to distinguish hazard (anything that can cause harm) and risk (the chance that a hazard will cause harm, and the extent of that harm). The objective is then to manage the risk, not to eliminate the hazard. The caveman knew that fire was a hazard, but he realised that, if he kept it in the hearth and made his children stand back, the risk was low enough to be worth taking in order to have a warm cave.

A serious ethical challenge arises where individuals cannot decide for themselves whether to take a risk, either because they do not have sufficient information or because they do not have sufficient control. This is made even harder when the benefits and potential harm do not fall to the same people, especially if the benefits occur now and the potential harm is to future generations.

Many engineering and transport risks are like that – I want to explore how a responsible and ethical engineer meets social demands when he knows, at least statistically, that what he is doing will injure or kill people or harm the environment.

The legal and ethical duty

There are two principles:

- *risk is the responsibility of the person who creates it* - "...it shall be the duty of every employer...", Health and Safety at Work Act 1974, Polluter Pays Principle, Art 130R(2) EC Treaty
- *risk cannot be eliminated* - "As Low As is Reasonably Practicable" (ALARP), "Best Available Technology Not Entailing Excessive Cost" (BATNEEC).

But what does "reasonable" mean? It's a common word in our law. You may use reasonable force in self-defence or to evict a trespasser, and you are not negligent if you use reasonable skill. What is reasonable at any time is what society believes to be reasonable, but there are very few rulings by Courts that provide much guidance on where to draw the line between reasonable and unreasonable.

One way of expressing society's view of what is reasonable is to

estimate how much it is willing to pay to avoid a risk. When deciding whether to adopt a safety measure or to permit an activity, we work out how much it will cost or save and how much risk it will cause or remove. We can then estimate the cost-effectiveness – how much safety we will buy per pound that we spend. The National Institute for Clinical Excellence does this for medical treatments and ranks them in order of cost-effectiveness. The budget for the NHS then determines how far we can go down this list before the money runs out. The Department for Transport publishes an annual figure for the Value of Preventing a Fatality (VPF). We can compare this with the cost of a safety measure in terms of Cost per Fatality Avoided (CPF).

This hard-nosed economic approach puts an important demand on engineers. We have no right to plead that a safety measure is not cost-effective unless we are confident that our costs are under control. We should not rule out a safety measure as too expensive if its high cost is a result of our incompetence.

But we don't let this hard-nosed economic approach be the only thing that determines what we will permit or forbid. We recognise that society cares more about some kinds of risk than others, and that

we must reflect what public opinion demands. That then begs the question – how do we determine what public opinion demands?

Where do we find representative public opinion? Certainly not in the news media. Even the broadsheet newspapers present at best an incomplete view of risk, and in many cases they actively distort the truth to print an eye-catching story. Railways have been grossly misrepresented – the number of fatal train accidents and the number of passengers killed were both fewer after privatisation than before. The nuclear power industry struggles against a perception that it is more dangerous than “safe” coal or gas power, and parents wrestle with the belief that paedophiles lurk around every corner.

As a result, people simultaneously hold two views. They believe that the train or food is safe enough and nothing more should be spent on safety, but that it is outrageous that accidents are allowed to occur and the Directors of the companies responsible should be punished. What should the responsible engineer do now? Should he lower an already low risk because people are outraged, taking resources away from other more serious causes of harm, or should he deal directly with the feeling of outrage? The second approach brings him into the territory of Corporate Social Responsibility.

The traditional view of social responsibility was that people vote for Parliament and Parliament, through legislation and Ministerial oversight, reflects their views. That is no longer enough. Civil society

embodies a wide range of interest, pressure groups and extra-parliamentary political processes and the responsible engineer has to engage with all of them to gain and retain his informal licence to operate. If he does that, he can do what society demands, which is to provide the proper balance of safety, cost and performance

Back to systems

My definition of a system is “*a set of parts that, when brought together, exhibit properties that were not present in the parts alone*”. Those properties, including risk or safety, cannot be managed by managing the parts alone; you have to manage them as a system. This raises two important risk management issues: how to apportion risk between the parts and what about risk that emerges from the interactions of the parts?

We can apportion risk – the total risk arising from a system can be shared out, so that each part has to present no more than its share of the total. A proper risk-based process can lead to the conclusion that it is not necessary to take any further action to mitigate the risk. The hazard is still there, but the risk is properly controlled. That sort of process is the most robust defence against against knee-jerk reactions and misrepresentation.

But what happens when the risk arises solely from the interaction of the parts of the system. You can't then apportion the risk to each part – it makes no more sense than to try to describe the sound of one hand clapping. Instead, we try to define what each part will do rigorously so that their interactions are wholly predictable. In practice,

of course, specifications are rarely perfect (especially when there's software involved). This is the area where engineers' approaches to risk are weakest, and where caution and hazard management may take precedence over risk assessment.

System risk is compounded when the different parts of the system are under different ownership or management, such as in transport. The fundamental principle of holding the risk's creator responsible means nothing, because no one person did create it. If the interface specification is not perfect, we may find that some risk has two owners, who may not agree on how to manage it, and there may be orphan risk with no owner. Who then is responsible?

In conclusion

We have a well-defined approach to managing safety and environmental risks, but two challenges remain. The first is to find a clearer way to judge what society demands of duty holders, in a climate of rational debate. The second concerns fragmented systems, where concepts like duty holding and the Polluter Pays Principle start to break down. Then the companies that make up an industry must work together to find solutions that address the whole problem and produce the optimum outcome for the industry as a whole.

Safety-critical industries can rise to these challenges – they do not want the alternative of more State intervention – but they need a constructive dialogue with Government, Parliament, Regulators and wider civil society.

In discussion the following points were made:

How does the London insurance market keep ahead of science? This is appraised in a variety of different ways by insurers and scientists, however it is the assessment of premiums that matters when considering the likelihood and severity of claims. This is complicated by new and emerging risks such as ecological damage, for example, where there is no jurisprudence at present, requiring a guarded approach. There is a problem trying to weigh up different types of evidence when assessing risk. Science is very complex and although consensus may be obtained, there is constant risk of disputes and outrage fuelled by the media who need to learn how science works. Hence there is also a risk of accusing the media of causing a problem, when this is actually due to mismanagement, requiring better self regulation. Outrage arises from lack of early public interaction on decisions perceived to carry risk. Factors for consideration include the identification of any beneficiaries of risk, if taken; the extent of risk to workers and the public, the identification of those responsible, and risk-benefit analysis. Is there any benefit from GM crops for example to the customer in the supermarket? There needs to be a clear benefit that the consumer or a “representative person” could identify with if the risk is to be considered acceptable. This need also arises when training engineers to understand the public where emotion may predominate over rational discussion, resulting in an ongoing requirement to bridge the gap between CP Snow's two cultures. Would the motorcar ever have been developed if the risks had been properly assessed?

STANDING ON THE SHOULDERS OF GIANTS (Sir Isaac Newton 1676)

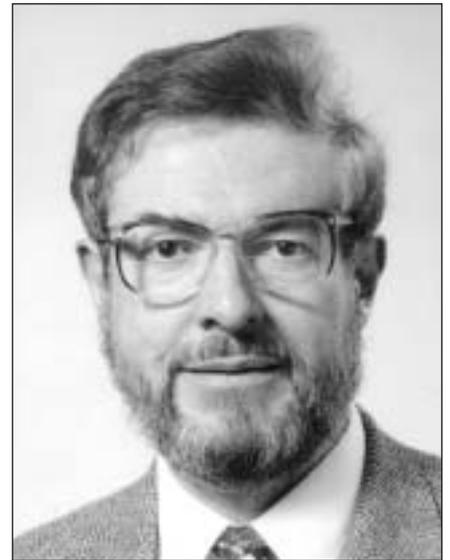
MEETING OF THE PARLIAMENTARY AND SCIENTIFIC COMMITTEE ON MONDAY 15TH NOVEMBER 2004

Gordon Brown's canny science investment helps the UK Ltd's innovative industries retain world class status and attract school leavers considering science and technology. The money is now in place but what do the the UK Scientific and Engineering Community intend to do about it? Our 65th birthday provides an opportunity to consider the drivers and future direction of UK Science and Engineering. We need to lay out our objectives and begin to allocate the new resources created by the Chancellor's investment if it is not to be squandered on increased bureaucracy.

The Parliamentary and Scientific Committee provides a successful and dynamic model for bringing science and politics together in a Parliamentary context. George Smith presents his view of the challenges facing the exciting, unpredictable and largely undiscovered potential of the materials world. David King considers Global Change is more important than Terrorism and provides insights into how this affects policy and scientific investment. Julia King lays out her strategy at Imperial College where she directs 10 world class Engineering Departments.

A Personal Perspective on UK Scientific Research

*Professor George Smith
Head, Department of Materials, Oxford University, and
Chairman, Polaron plc.*



Summary

In the past Britain held a pre-eminent position in many areas of science. Present achievement is more pedestrian, especially in the Physical Sciences and Engineering. There are clouds hanging over the future, because of the inherently conservative nature of the current peer review process for research proposals, and the ever-increasing micro-management and regulation imposed by Government. Paradoxically, as the degree of control has increased, the output performance of scientists at the very highest level appears to have declined.

There is no doubt that British science and technology has a glorious past. Basic scientific discoveries include the laws of gravity, motion, electromagnetism; elementary particles such as the electron, proton and neutron; the

atomic nucleus; vaccination, antibiotics, and the structure of DNA. In the area of invention, British ingenuity led to the steam engine, locomotives, railways, electric motors and generators, bulk steel production, the modern bicycle, television, radar, the jet engine, hovercraft, the pocket calculator, and a host of new materials including Portland cement, stainless steel, superalloys, polythene, polyester, carbon fibres, and liquid crystals. Britain was also responsible for the world's first electrical power station, the first civil nuclear reactor, the first jet passenger aircraft, the first supersonic passenger jet, useful devices such as traffic lights, cats' eyes, flush toilets – and even Viagra!

So what about the present state of our scientific achievements? It depends on what you measure, and how you measure it. At a routine

level, things look pretty healthy. The proportion of the world's scientific papers written by British scientists is high in relation to our total number of scientists, our citation levels are ranked second only to the USA, and our scientific "value for money", in terms of the cost to the nation of each paper that is produced, is arguably the best in the world. But are these the right measures? What about the episodes of real genius, the inspired achievements that set the world alight? At this top end of the range, I believe we have more reason to be concerned. A German academic, Wolfgang Schoellhammer, carries out a regular survey of Nobel Prize awards, analysing them by the institution and country of the winners. His most recent (2003) data on the proportion of prizes awarded to British scientists is summarised here.

UK Nobel Prizes

Percentages of prizes awarded to UK scientists

	1901-2002	1978-2002	1988-2002
All categories %	15%	8%	7%
Chemistry	18%	10%	6%
Physics	13%	2%	0
Physiol/Medicine	15%	14%	15%

Source: Wolfgang Schoellhammer, Nobel Prize Survey 2003

In Physiology and Medicine, we are maintaining an excellent record, but in Chemistry the performance has slipped. In Physics, the decline has been steeper, redeemed slightly by the award of the 2004 Physics prize to expatriate Anthony Leggett, of the University of Illinois.

The figures in the table are expressed as percentages, but if absolute numbers of prizes are counted, a more disturbing picture emerges. Five of the seven prizes in Chemistry and Physiology/Medicine that were won by British researchers during the period 1988-2002 were attributable to a single institution, the MRC Laboratory of Molecular Biology, in Cambridge. If this remarkable institution is removed from the data, then the overall number of awards to the rest of the UK looks thin indeed.

Why did the MRC laboratory perform so well, while the rest of the country has trailed? Obviously, the ability to attract world-class minds has been crucial. But I believe that part of the answer also lies in the organisation and funding of the institution. Recent accounts of the life and work of the legendary director of the laboratory, Max Perutz (1914-2002) have shed new light on this. By a mixture of luck and judgement, all efforts to integrate the laboratory fully into the departmental structure of Cambridge University failed. It was therefore largely immune from the vagaries of the Research Assessment Exercise (RAE), the need to write endless short-term, responsive mode research proposals for approval by Research Council Committees, and all the other multifarious (and nefarious!) reviews and audits to which the UK academic community is now subjected with increasing frequency and intensity. The MRC laboratory had bold, long-term objectives. Highly creative individuals were given the freedom

to develop their most adventurous and speculative ideas, sometimes over decades, and they handsomely repaid the confidence that had been placed in them. They changed the world, and laid the foundations of molecular biology and medicine.

My concerns about the loss of adventure in British scientific research are shared by others, for example Don Braben, former director of BP Venture Research:

“Until the 1970s a scientist with a radically new idea could scrape together enough funds to explore its potential. That’s not possible today. Researchers must now convince a committee before they can do anything. *Scientists are losing the freedom to be impartial.* Originality and adventurous research are discouraged because committees can’t be imaginative. We have more scientists today than ever before, but they must concentrate on refining existing knowledge. It’s easier to assess performance that way.”

(Don Braben, *Materials Today*, October 2004.)

The moves towards increased regulation and control of British science began in earnest in the 1980’s with the introduction of the concept of Research Selectivity, which tended to hit particularly hard those universities which worked most closely with industry. There followed a torrent of rules and regulations, onerous inspections of so-called “teaching quality” (which really only checked that all the forms were filled in correctly), and the full-blown Research Assessment Exercises that have taken up so much of our time and effort in recent years. Now Full Economic Costing (FEC) is due to be rolled out from October 2005. The provisional guidance and instruction documents for FEC already extend to more than 800 pages, and threaten to overwhelm an already overburdened University system.

“Career civil servants, who know very little of the world they are looking at, have produced a set of rules which are little short of lunatic in their notion that that which in the States is recognised as a time-consuming, difficult attribution of costs at the level of institution, should here be done at the level of each grant. Kafka couldn’t have dreamed this up!”

(Lord May, *President of the Royal Society*, interviewed by *The Guardian*, 20 July 2004)

In parallel with the introduction of FEC for universities, we are witnessing the development of a set of Public Service Agreement (PSA) target metrics for the UK research base. These will particularly affect the Research Councils. So far, the reaction from the academic world has been remarkably subdued, but here are a few of the more outspoken comments, which highlight the threat posed to adventure in research:

“There are some worrying aspects. For example, the section on managing the research base calls for an ‘integrated and efficient performance management system’. This may sound rather exciting to whoever wrote it, but it will make the room suddenly feel very cold to those creative researchers who thought the research councils were supposed to be dedicated to funding exciting scientific proposals.”

(Peter Cotgreave, *Director, Save British Science*, quoted in *THES*, 16 July 2004)

“It is impossible to see how the research councils will want to support anything but safe, well-trying areas of work with guaranteed outcomes.”

(Ian Haines, *chair of the UK Deans of Science Committee THES*, November 12 2004)

“What is the problem that this is supposed to be solving?”

(Paul Cottrell, *assistant general secretary of the AUT, THES*, November 12 2004)

Britain now has the most over-regulated, controlled and micro-managed scientific community anywhere in the developed world. Ironically, the increase in control has been matched by a progressive decrease in Britain’s scientific success at the very highest levels. These two things are surely connected. Let the final word on risk and creativity in research go to Bill Gates, businessman and wealth-creator par excellence:

“If all your projects succeed, you have failed.”

(Bill Gates, *briefing the first Director of the Microsoft Laboratory in Cambridge, UK*)

So let us try to restore the spirit of risk and adventure to British research before it is too late.

Note: The opinions expressed in this article are, unless otherwise stated, purely those of the author, and do not represent the official views of any organisation to which he is affiliated.

Impacts of a Changing Climate on Government Policy

Professor Sir David King, Chief Scientific Adviser



I see climate change as the greatest challenge facing Britain and the World in the 21st century. In a speech given by the Prime Minister on 14 September 2004¹, he called climate change the world's greatest environmental challenge.

The weight of evidence for climate change, and the causal link with greenhouse gas emissions, most notably carbon dioxide, is in my view now unarguable. The evidence comes on many fronts: melting icesheets, receding glaciers, and increased and more frequent flooding to cite just a few. Over the past century the global climate has warmed by an average of 0.6C, with much of this seen over the past 30 years. The science is clear that this rise in temperatures will continue and will accelerate, leading to a rise in the range of 1.4C to almost 6C by 2100. At the same time, global average sea levels are also predicted to rise, by between 9 to 88 cm by 2100.

Recent experience in the UK and the rest of Europe shows that extreme events can have significant human and economic costs. In the UK, the hottest day

ever recorded in Britain occurred 10 August 2003, when the temperature reached 38.1 deg C (over 100°F) in Gravesend. The heat-wave also affected much of Europe and caused some 30,000 premature deaths. And had an estimated direct economic cost of \$13.5bn², making it the worst natural disaster in Europe for 50 years. The heat wave was particularly severe in France leading to some 15,000 premature deaths. A recent study published in the journal *Nature*, by the Hadley Centre³ demonstrates that it is very likely that increased concentrations of greenhouse gases in the atmosphere, due to human activity, have more than doubled the risk of occurrence of a hot European summer like that of 2003, and statistical analyses from the study show, with 90% certainty, that roughly half of the severity of this extremely hot summer can be attributed to global warming.

More extreme rainfalls are also expected to be a feature of climate change. The impacts of these could be significant. In 2002, the severe floods in Europe caused 37 deaths and had an estimated direct cost of \$16bn. A recent report from the

Association of British Insurers noted that in 2000 the UK experienced its wettest autumn for almost 300 years, with heavy rainfall leading to damage to 10,000 properties and nearly £1 billion in insurance claims.

Claims for storms and flood damages in the UK have doubled to over £6 billion over the period 1998-2003, compared to the previous five years, with a prospect of a further tripling by 2050. It is too early to link such events unequivocally to climate change but they are an early warning for what we might expect.

The Third Assessment Report from the Intergovernmental Panel on Climate Change (IPCC)⁴ concluded that "most of the warming observed over the last 50 years is likely to have been due to increasing concentrations of man made greenhouse gases".

Carbon dioxide levels are approaching 380 parts per million (ppm), a concentration in the atmosphere not seen for at least 740,000 years and quite possibly for about 55 million years⁵. The current level is already well beyond that seen in

the atmosphere during Earth's "warm periods" between ice ages, and is consistent with the Earth's "hot periods", such as around 60 million years ago when all ice on the planet melted and when mammals would have found Antarctica one of the most comfortable places to live.

According to a NASA study, the Greenland ice sheet was retreating at a rate of around one metre a year in 2001. The latest study indicates its moving back at about ten metres per annum. If the Greenland ice sheet were to melt, the sea level would rise by between six and seven metres. That would create a major problem for cities like London, New York and all other cities located by the coast. This issue was explored at length in my recent Foresight report into flood and coastal defence management for the UK.

More intense rainfall events are expected to be a feature of climate change. If we do not prepare for these, the impacts could be significant. We already know the power and devastation that can be unleashed on our communities through extreme weather events, such as the flooding in Boscastle in Cornwall, Londonderry in Northern Ireland, and most recently Carlisle.

Although some climate change can always be attributed to natural cycles in the earth's climate system it would be impossible to explain the general trend over the last century without increasing human induced effects, due largely to fossil fuel usage and deforestation.

The international community must now make a concerted effort to limit the extent of global warming on the one hand, and adapt to those

changes in the climate which are now unavoidable. Effective action demands international agreement on processes, which engages the world community in tackling what is a truly global problem.

So where do we start? In 2002 I commissioned my Foresight team in the Office of Science and Technology, together with over 90 experts, to look at the threat of increased flooding and coastline vulnerabilities that we are likely to face from climate change. The group concluded that, in the highest emission scenario, by 2080, flood levels that are expected to occur once in 100 years could well be occurring every 3 years. This is an example of adaptation activity.

To mitigate against the long term climate change, various global levels of action are required. First of all, the Kyoto Protocol, which was ratified by Russia in December, will come into force on February 16. Although I am pleased to see it come into force it is just the start of a process and will need to be ratcheted up so that we can really bring emissions under control. It is important that in the extension of the process the USA, Australia, India, China and Brazil are brought on board.

Ratification of the Kyoto protocol presents a raft of business opportunities in sustainable growth and an unprecedented opportunity to accelerate the move to a low carbon economy. It will also provide a platform for the UK and EU to lead by example.

In 2003 the UK Government published an Energy White Paper. Four goals for our energy policy are laid out to put ourselves on a path to cut the UK's carbon dioxide emissions – the main contributor to global

warming – by some 60% by about 2050, with real progress by 2020; to maintain the reliability of energy supplies; to promote competitive markets in the UK and beyond, helping to raise the rate of sustainable economic growth and to improve our productivity; and to ensure that every home is adequately and affordably heated.

Although a 60% reduction in CO₂ emissions seems an ambitious target, we have already put in place measures that should help us achieve it; the first one is simply by improving energy efficiency – a win-win situation.

The Government is also investing in developing new energy technologies that can replace fossil fuels. The limits of providing energy from low carbon sources are endless but we should not second guess which new technologies to chase. Rather we must set up the right economic framework and let the marketplace choose the right mix.

At the start of this year the Government took over the presidency of the G8 and the Prime Minister has declared that climate change is one of just two priorities. The aim is to build on the already growing consensus amongst governments around the world and promote more vigorous action. Quite simply climate change is real and needs global action. Action is, and will be, affordable. Inaction won't.

¹ <http://www.number-10.gov.uk/output/page6333.asp>

² UNEP/DEWA-Europe, 2004, "Impacts of summer 2003 heat wave in Europe", Early Warning on Emerging Environmental Threats 2, <http://www.grid.unep.ch/product/publication/earlywarning.php>

³ Human contribution to the European heatwave of 2003, Peter A. Stott, D. A. Stone & M. R. Allen, *Nature* 432, 610–614 (2004);

⁴ Intergovernmental Panel on Climate Change: <http://www.ipcc.ch>

⁵ J F McManus, *Nature* 429 (2004), 611

Engineering the Future

Dr Julia King
Principal, Faculty of Engineering, Imperial College London



Introduction: engineering is changing

In September 2004 I returned to academia after 10 years spent mainly in industry. What struck me most are the changes since I left Cambridge University in 1994. Engineering is now responding to the needs of industry and business, of healthcare, and of the environment and encompasses a dynamic set of disciplines that can do more, and more quickly, to save millions from dying of water-borne diseases than the best new drug development programme. Engineers will deliver the solutions to global warming. Engineers will design the reactors and the processes to grow stem cells into replacement organs and play a major role in almost everything that is important. And yet we are failing to get these positive messages across to young people and the public. The numbers of UK students studying physics and maths at school, proceeding to read engineering at university and taking up jobs in engineering continues to fall. As engineering changes, the way we teach engineering and the ways we recognise and reward excellence need to change as well.

People and systems: people in systems

Engineering is about people – we are its end users and its creators, a key part of how it works – customers, users, maintainers, practitioners, researchers... But as technology advances and the products get more complex, the effect is to make many people feel alienated from the engineering that should serve them. In a country

where over half the population is female, less than 13% of graduate engineers are women and a much smaller proportion is involved in designing and making the products we buy and use.

A human-centred approach to engineering is needed to ensure that “how will a person use this” is a key part of any product specification. It is also needed as systems get larger and increasingly complex. Most organisations are struggling with the challenge of networking “key” systems, often communication and information systems. Many approaches to this assume that it can all be done, cost effectively, with technology, but have failed spectacularly. It is essential to recognise that people will remain at critical nodes and interfaces in large networks for the foreseeable future. Therefore designing these systems with an understanding of human behaviour in the operational environment is critical. Yet how many of our engineering degree courses have traditionally covered these issues?

But things are changing.

Shortly after I joined Rolls-Royce in 1994, I was sent to spend a month with American Airlines, Rolls-Royce’s largest customer. The biggest impact of my visit – spent holding flashlights for maintenance crews changing engines at Chicago airport at night or inspecting the new arrivals each morning at the overhaul base in Dallas – was my early morning talks with a friendly technician who took me on the morning round of the engines and told me about the problems. He

was keen to know where the “best” engineers in Rolls-Royce worked, so I told him about all the latest technology developments in the Trent 800 – the 3-D aerodynamics in the compressor, the new materials, the dynamic impact modelling for the fan case... He quietly pointed out that they very rarely saw these parts of the engine at the base. Most of their time, and much of the cost, was involved in unravelling the spaghetti of pipes and wires that form the engine dressings around the outside of the fan case, to correct an oil leak or a minor electrical fault. Access amongst the mass of tubes was difficult and replacing them under the cowling was almost impossible. The customer’s view of the engine was very different from mine: an area of major impact to the customer was a Cinderella area to me.

But Cinderella does get to the ball. A comparison of the RB211 with the dressings on a current Trent 500 engine demonstrates how this issue has been addressed. I spoke to Keith Thomas, the head of the team responsible for Externals Engineering at Rolls-Royce plc, who commented “After a period of seeing Externals Engineering as a low technology – because parts like pipes and brackets are simple to make – and therefore something we don’t need to develop core capability for within Rolls-Royce, we have now gone full circle. Over the last few years we have worked very hard on developing our tools and people in externals design. On the Trent 900, designed for the Airbus A380 super jumbo, we have achieved a further big step forwards

in externals design quality – leading to improved maintainability/aesthetics as well as far fewer snags and changes in the development programme – compared with the Trent 500.”

I currently chair the Defence Scientific Advisory Board for the Ministry of Defence. It is an opportunity to see engineering in practice in an environment where we rely so heavily on the people. A soldier in action could be carrying over 50lbs of kit. He may well be tired, anxious... Will performance be enhanced by concentrating our engineering resources on giving him more technical capability or less to carry? If the soldier were a woman, how would this change the assessment? Similar considerations need to underpin much more of our engineering activity.

Engineering the Future

The emphasis over the past 10 years has moved towards sustainability, environment, healthcare and well-being in undergraduate engineering courses, as well as in research and industry.

We can now grow tissue on a silicon microchip – showing the compatibility between engineering and life. It is not difficult to envisage the possibility of tissue growing to form contacts in a circuit, delivering some life-supporting function – replacing a damaged optic nerve to restore sight – or monitoring a person's condition. This area of “engineering life” for the rich world could mean proactive healthcare – continuous monitoring via your mobile phone from implanted sensors so that your GP or clinician can call you in before any real concern arises. Or the vision of intelligent stem cells: control of stem cell growth, initially in a reactor vessel and subsequently after implantation into the body, to develop the right types of cells for specific “human repairs” – early successes could be insulin producing cells to cure diabetes or bone marrow to cure leukaemia –

through real-time monitoring and control of the cells themselves and the growth environment.

For much of the rest of the world, the concept of engineering life is more basic – sanitation. Over 1.2 billion people lack access to clean water. The Asian tsunami disaster has served to remind us of the importance to human health and life of a clean water supply. 5% of all deaths each year are from TB, the spread of which is closely associated with the lack of clean water, and the figure is growing. To provide for those who still do not have clean water and meet the future needs of urban populations in the developing world, we will need to build sanitation systems for 350,000 people every working day – equivalent to a city the size of Belfast. The impact of appropriate engineering could be immense.

Engineering and health is just one of the key areas for engineers.

Between 1900 and 1999 per capita resource consumption and waste generation increased four times, accompanied by a four times increase in population – multiplying by sixteen our impact on the planet. In the first 50 years of the 21st Century it is estimated that resource consumption will double again, with a further population increase factor of 1.5. So our impact on the earth from 1900 to 2050 will have increased fifty fold¹. It is not surprising therefore that the effects of our activities are increasingly apparent.

Other essential areas for engineering include solutions for sustainable energy and reduction in our impact on the environment, combined with wealth creation. Engineering will be successful where product design focuses on the user.

Future Engineers

Moving from product-centred to people-centred engineering enables us to recruit bright students who have not been strongly engaged hitherto. On engineering courses

only about 13% of undergraduates are women. On the new bioengineering degree course at Imperial College, which started in 2001, women now make up 50% of the students. A packed syllabus includes plenty of engineering: imaging – for biomedical applications; mechanics – of the body and skeletal repair; electronics – for prosthetic repair of the nervous system; sensors – for biological agents and systems; combined with cardiovascular, connective tissue and respiratory medicine.

The training of engineers will continue to change. Engineers increasingly need to be able to think through systems, include human behaviour and performance at the centre of their approach and consider the ethical and environmental implications of their work, whether that relates to controlling the growth of stem cells or emissions from a new form of personal transport.

The Challenge

Communicating the changing nature of engineering and getting more of our best and brightest young people to study it is a major challenge. The example of bioengineering is encouraging. To quote a Nature editorial “Getting bright young scientists and engineers interested in the world's water problems is vital... There are prominent role models to show that scientific excellence and the application of appropriate technologies can go hand in hand.”²

We must not let outdated perceptions of “excellence” stop the changes that are happening. The way we assess and value engineering must recognise excellence in customer focus and appropriate delivery for people.

References

¹ T. Homer-Dixon “The Ingenuity Gap” Vintage Canada, 2001

² Nature 422, 243 (20th March 2003) Canada, 2001

In discussion the following points were made:

Investment in innovative science and engineering penalises research institutes that undertake routine environmental monitoring required by the Hadley Centre to predict global warming impacts. Investment should be divided between academia, industry and the research institutes. Cost benefit analyses are needed before additional levels of regulation are imposed on researchers. There is no comparable research assessment exercise in the USA. The London market is too short term, and this has negative impacts on science compared with government-led tax incentives, as in Singapore and innovative business clusters in the USA, requiring a culture change in the UK. Action on global warming is needed immediately if London is to survive for 1000 years!

ANIMAL CONTRIBUTIONS TO SCIENCE AND SOCIETY

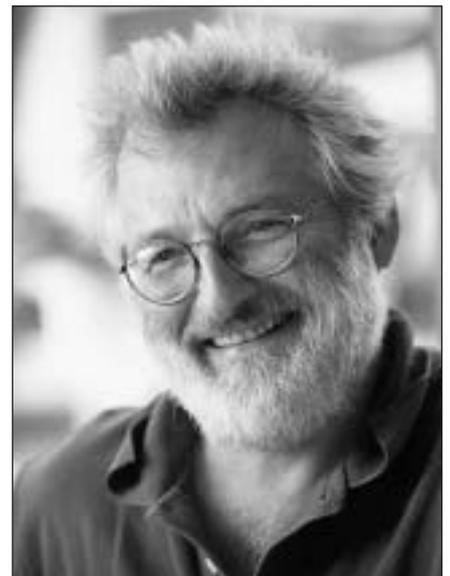
MEETING OF THE PARLIAMENTARY AND SCIENTIFIC COMMITTEE ON MONDAY 13TH DECEMBER 2004

John Sulston sets the scene with a scientific justification of the need for modern animal experimentation, commencing with the Darwinian and Mendelian models of genetic evolution in living organisms, followed by the Crick-Watson-Franklin-Wilson revelations of DNA structure that underpin the modern genomic library. He promotes the case for unrestricted public access to information about our genes and other life forms in a constructive spirit of human co-operation between all concerned. Tipu Aziz demonstrates the crucial need for experimentation on primates alongside surgery on the human brain in the search for understanding the causes and treatment of Parkinson's and Alzheimer's diseases. Robert Hubrecht discusses animal welfare versus human needs in the context of the 3Rs proposed by Russell and Burch, where Replacement of animals in scientific procedures, Reduction of animal use and Refinement of procedures and housing to reduce suffering, are the three principles accepted world-wide which form the basis of all attempts to find alternatives to animal use in experimentation.

Animal Contributions to Science

Sir John Sulston

Wellcome Trust Sanger Institute, Cambridge



I'm here because of the discovery 51 years ago of the structure of DNA. The important, truly revolutionary, aspect of this discovery was that DNA carries a four letter code that is biological information. This was the starting point for modern biology. From that moment, humans had the ambition to read out (or sequence) our own DNA code (or genome), and in recent years we have realised that goal. Part of the job was carried out at my own Wellcome Trust funded lab in Cambridge.

We can now conceptually zoom in onto our DNA, seeing the genes (the portions that translate into the structures of our bodies), then the internal structure of the genes, and finally the underlying code. And we can compare the genome of one creature, like ourselves, with that of another, the mouse for example, and see how similar they are in the areas that matter. Because we are

very like mice in the number and order of genes that code for us.

But now look back further to see how this revolution came about. 150 years ago Charles Darwin taught us that all living beings on earth are related to one another. That meant that it would be useful to study biological processes in any form of life, because the findings would have at least some relevance to other life forms including ourselves. At about the same time another scientist, Gregor Mendel, was working in eastern Europe. He bred pea plants in his monastery garden, studying the inheritance of character traits, such as tall/short stems and yellow/green seeds. He showed that the seemingly haphazard patterns of inheritance could be rationalised on the assumption that they were controlled by pairs of factors. Unlike that of Darwin his work went unrecognised at the time, but

it was rediscovered a century ago. The laws that he uncovered became known as Mendel's laws in his honour, since it was seen that they applied equally to most animals and plants. So Mendel's research was an early example of the use of a model system to facilitate biological discovery. Other models became important. It was proposed that the tiny darkly staining bodies (called chromosomes) that formed and separated in dividing plant cells might carry Mendel's factors, or genes as they now became known. The role of genes in the development of animals was elucidated in growing detail by work on fruit flies. DNA was recognised as the key substance in the chromosomes. And the nature of DNA was revealed by Watson and Crick in Cambridge, using data generated here in London by Franklin and Wilkins. This was the beginning of a tremendous surge of

discovery, because, as Francis Crick pointed out: “now one could ask the right questions”.

The next phase of molecular biology, as it was now called, took place in even simpler models – bacteria and the tiny viruses (bacteriophage) that prey on them. Their simplicity and rapid growth allowed breeding experiments to be conducted at great speed, and in a few years the central machinery of biological information flow was laid out.

My own entry into this excitement came when Sydney Brenner invited me to join his group working on a tiny roundworm just 1mm long called *Caenorhabditis elegans*, or the worm for short. Sydney had been one of the pioneers in that first surge of discovery, and like many of his contemporaries he now wanted to see how these findings could be translated into knowledge of animals like ourselves. Humans are too complex, and anyway one can't do experiments on them. Even fruit flies are too complex if we want to look in detail at the individual cells, but the little fast growing worm is ideal for that purpose. My own initial role was to follow the cell lineage of the worm from the single cell of the fertilised egg to the roughly 1000 cells of the adult. Unusually for an animal the cell lineage of the worm is very nearly invariant, and over several years I and my colleagues worked it all out.

Among other things we noticed the predictable occurrence of programmed cell deaths, and this in turn allowed us and our successors to discover the genes that control cell death. It turned out that a number of these genes are closely similar to the corresponding genes in humans, and so are important in medical conditions where cell death happens too much (eg neurodegeneration) or too little (eg cancer). Once again the value of a model system becomes apparent.

But I am getting ahead of the story. Back in the early 80s, when the cell

lineage was complete, I found myself absorbed by a new problem. The purpose of all our research was to discover the role of genes through classical genetics: just like Mendel, we selected strange looking worms and cross bred them. But now in the age of molecular biology the aim was of course to go further, to peer inside to see what was going wrong, and to isolate and study the very genes involved. This was difficult. By 1980 we had thousands of mutations in hundreds of genes, but it was taking scientists years to find each gene in the haystack of the worm genome (100 million letters long). There had to be a better way, and a few of us (including Alan Coulson in Cambridge and Bob Waterston and his colleagues in the US) set out to map and finally sequence the genome so that everyone could find their chosen genes easily. We were successful enough that the worm led the way in the genomic analysis of higher organisms, and its example, with the evident benefits to research that genome sequencing brought, helped to usher in the international human genome project, which was successfully completed last year. Though in many ways this is actually the beginning, for we are only just starting to understand this 3000 million letter goldmine and shall be looking at it for centuries to come.

Thus the worm became a model in another and unexpected way. Georgina Ferry and I told this story in our book “The Common Thread”, partly because it's a good tale, but also because we ran into a spot of bother which is significant in its own right. In the international human genome consortium we released our data to everyone, just as we had always done for the worm; but we were challenged by a corporation that started to sequence the human genome inaccurately and rapidly, in order to keep the data private and sell it to subscribers. It struck me as extraordinary that anyone would

do that, given that the human genome is our common heritage, and as even more extraordinary that so many people would approve. Not only would such a practice be unfair to those unable to pay, thus creating even deeper divisions in the world that we have already, but it would be counterproductive for communications even among the cognoscenti. For, if one is the proprietor of a private database, then one must contract with each of one's clients not to redistribute the data. But because the data is so complex and poorly understood, this restriction means that researchers are unable to publish properly the results of their work. Fortunately we won this battle, but only thanks to the funds of the Wellcome Trust. It bothers me that our national policymakers still do not seem to appreciate the importance of freely available fundamental information to the success and integrity of our society.

In this short talk I've tried to illustrate how our biological knowledge and understanding is helped by the unity of life, first propounded by Darwin and now borne out in ever finer detail by our acquisition of the actual codes of life – the genomes – of many different organisms. Biologists can study many organisms (eg virus, bacterium, yeast, roundworm, fruit fly, *Arabidopsis*, rice, fish, chicken, mouse, human), and learn something from each. Each teaches us something different, all give clues as to how life works, and all contribute to medical progress.

In thinking about appropriate ways forward in our use of animals in research, we should bear in mind that life is complex. We do not yet understand even the simplest organism, so calculations cannot replace animal experiments; research must be open ended if we are to advance our understanding and skills in ways that are valuable to both human and veterinary medicine.

Acknowledgements

I would like to thank the Medical Research Council Laboratory of Molecular Biology, the *C. elegans* community, the Wellcome Trust Sanger Institute, the International Human Genome Sequencing Consortium, and the public databases. They made it possible for me to be here today, but I am speaking in a personal capacity, and mistakes are mine alone.

The Contribution of Animals to Human Health and Wellbeing

Professor Tipu Z Aziz

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Introduction

There is not a person alive today who has not benefited from animal research. This is a basic and undeniable fact. In the past 100 years human life expectancy has dramatically increased as a result of better nutrition, better sanitation and discoveries in biological sciences. Yet, despite this fact there are people who believe that somehow animals have rights that place human welfare at risk. As a neurosurgeon and neuroscientist I feel this is an unacceptable stance and it also worries me that 220 MPs have signed up to a motion banning the use of primates in research. This will endanger efforts to alleviate some of the most devastating conditions that affect man. In this briefing I will summarise some major contributions of animal research to science and society based on my experience.

Parkinson's Disease

Parkinson's disease affects 2% of people over the age of 60. It manifests itself by uncontrollable tremor, rigidity, slowness of movement and imbalance. Until 1969, sufferers had only recourse to often crippling neurosurgical procedures in the belief that inducing a degree of

paralysis was preferable to the condition. In 1961 Hornykiewicz demonstrated that the chemical dopamine was depleted in the parkinsonian brain and in 1969 a precursor L-Dopa was used clinically by Cotzias to treat the condition with dramatic reversal of the symptoms. However within 10 years of its introduction it was recognised that after 5 years' therapy, 70% of these patients would suffer crippling side effects from the drug therapy with uncontrollable thrashing of limbs, psychosis, on-off effects etc. In the absence of an animal model of the condition future developments were bleak. However, in 1979 an unexpected breakthrough occurred. A Californian drug addict who had taken a modified version of the painkiller pethidine (called MPTP) acquired severe parkinsonian symptoms. He responded dramatically to L-Dopa, as did several of his customers who had developed the same effects. Following his death brain studies showed the changes seen in true Parkinson's disease. In 1983 MPTP was reported to induce parkinsonism in the monkey which was drug responsive and so a model for

the condition became available.

Primates and indeed higher primates are central to such studies. They are bipedal like man with neural pathways that are identical. Their brains contain neuromelanin that binds MPTP, unlike lower primates, and hence they offer a stable parkinsonian model. Without this model it is hard to conceive how future therapies would be developed.

The next five years showed an explosion of understanding of the condition using the primate model. By 1989 an area deep in the brain, the sub thalamic nucleus (STN), was identified as being overactive and central to driving the symptoms. Prior to these primate studies the STN had never been thought to have a role in the mechanisms of the condition. By 1990, selective destruction of the STN was shown to dramatically reverse parkinsonism in the primate and render them drug free. Given that destroying such a target had major risks to it, an alternative therapy, that of implanting electrodes into the STN to electrically stimulate it till it stopped functioning was shown to have a similar effect. Within two years of these primate

studies. the first clinical study in people was reported with equal effect. Today, as a result of such studies, over 30,000 people have had deep brain stimulators – a sort of pacemaker for the brain – implanted to control their Parkinson's disease. Many such people are able after years of suffering to reduce or stop medications altogether.

That is not the end of the story. Advanced parkinsonian patients do not respond to either drugs or surgery. About one in five people diagnosed as having Parkinson's disease develop resistance to drug therapy and are unable to move, the parkinson-plus syndromes. They are locked in a frozen nightmare.

Recent primate research into parkinsonism has shown that stimulation of another nucleus, the pedunculo-pontine nucleus (PPN), may well selectively improve the ability to move. The work is so convincing and the need so imperative that clinical studies are imminent. Such surgery alleviates the condition but repair may be a real possibility. Viruses infect cells and selecting a virus that infects nerve cells, taking out most of its genes and replacing them with the genes to produce dopamine is now possible. In the parkinsonian primate, injections of such viruses into the brain has been shown to dramatically improve the condition, rendering them drug free with no obvious side effects. This is also very near clinical trials in people. Further studies are needed to make stem cell transplant a possibility in man.

Alzheimer's Disease

Alzheimer's disease robs people of their minds. Using transgenic mouse models and primates, drugs have been developed that

slow the loss of intellect. In Alzheimer's disease protein deposits develop in selective areas of the brain destroying intellect. In a transgenic mouse model of the condition a vaccine against this protein was shown to be effective in treating the condition. The implications were such that without an intermediate primate investigation human trials were started. The study was abandoned because the vaccine induced brain inflammation in man. More recent studies of newer vaccines that do not induce brain inflammation but bind to the protein whilst in circulation show promise. However these will need trialling in primates prior to man.

Higher primates are central to such research again because as they grow old certain species develop dementias with brain deposits identical to the human condition.

Other developments in neurological disease based upon animal research are clot dissolving drugs for strokes, newer drugs for epilepsy, immunotherapy for multiple sclerosis, drug therapy for migraine, drugs to treat brain tumours, nerve growth factor studies to help recovery from brain and spinal cord injury.

Present day medical therapy is inseparable from animal research. No drug, no implants, no surgical procedure can be done today free of this provenance. Present day regulations for animal research in the UK are very rigorous and experiments carefully regulated such that all are done humanely and with respect for the animals. The numbers used have dropped over the last decade and certain species such as chimpanzees and other great apes are banned from research. Animal care also

benefits from such work.

Recently, the argument is raised that animal research has harmed people by introducing dangerous drugs into clinical use. In drug development roughly 1000 animals (usually rodents and some dogs) might be used and if there are no contraindications a safety trial is started using perhaps 100 volunteers and if safe, efficacy trials in approximately 3000 patients will be carried out prior to a drug being released. The animal tests can be relied upon to find certain major side effects and, when combined with non-animal tests and intense medical supervision, protect those taking part in clinical trials. However, none of these approaches – animal, non-animal or even human – will identify every possible side effect in every patient. These will emerge with general use on a much larger scale. All drugs can cause side effects even deaths in certain situations. To demand development of a perfectly safe drug to justify animal research is foolhardy.

Suffering is not a part of animal research. The procedures I perform on my monkeys is the same that I do clinically in patients. Regulations dictate standards of animal welfare in all UK laboratories which in turn are monitored by Home Office veterinarians.

In conclusion, reflecting the fact that 220 MPs have signed an Early Day Motion to ban primate research I ask would they also be happy to sign away the rights of others to freedom from Parkinson's disease, Alzheimer's disease and other diseases and conditions that I have been unable to cover. Such Motions and their implications for the future of mankind must be carefully considered.

Balancing Human and Animal Needs

*Dr Robert Hubrecht,
Universities Federation for Animal Welfare*



The use of animals in research is an ethical issue that arouses strong feelings on both sides of the debate. Numbers are frequently quoted to make a point but these should be treated with caution. Whilst the numbers of animals used in one area of human activity cannot be used to justify the numbers used in another, a comparison can help to put the figures into perspective. Last year, 2.79 million procedures on animals were started under the Animals (Scientific Procedures) Act 1986 that, by definition, may have caused pain, suffering, distress or lasting harm. This number is tiny compared with the numbers of animals used in the food industry, many of which will suffer some welfare compromise in the processes of production and transport. For example, in 2003, 793.4m broiler chicks were used to produce 745.6m broiler birds (Defra Website 2004), and many broiler birds suffer welfare problems such as lameness (eg Weeks et al 2000 Butterworth et al 2002). Secondly, the published statistics on animal procedures are not a particularly good indicator of suffering. According to the Guidance on the Act:

“The assessment of the severity band for the project as a whole reflects the number of animals used on each protocol and the actual suffering likely to be caused as a result. It is based on the overall level of cumulative suffering to be experienced by each animal, not just the single worst possible case. It takes into account the proportion of animals

expected to reach the severity limit of the protocol and the duration of the exposure to that severity limit, the nature and intensity of the adverse effects, and the actions to be taken to relieve the suffering.”

Hence, data are not published on the numbers of animals that reach a particular severity limit, but instead projects are assigned an overall severity rating at their outset, and this can distort the perception of the extent of suffering resulting from animal experimentation. A retrospective system needs to be developed to provide an accurate assessment of the harms experienced by animals so that this can be used to refine procedures and inform the public. This is currently the subject of a joint project between the Animal Procedures Committee and Laboratory Animals Science Association.

Whilst there is undoubtedly public concern about animal experimentation, Mori Polls (1999 and 2002) and the recent House of Lords Select Committee report (2002) indicate that it is society's view animal experimentation should continue as long as there are proper controls and no unnecessary animal suffering.

It is here that UFAW has had a great impact. In 1956 The UFAW scholars, Professor William Russell and Rex Burch, published the principles of the 3Rs which have since become the ethical principles underlying the use of animals in experiments worldwide. The 3Rs are defined as follows:

Replacement of animals with non-sentient alternatives,

Reduction of the numbers of animals in the remaining experiments to a minimum, and Refinement to reduce the suffering of the remaining animals used in experiments to a minimum.

Let us begin with Replacement and Reduction. The statistics show that while animal use has shown an overall decrease since 1970, over the last 7 years the numbers have not continued to fall partly because of the development of new techniques, such as genetic research. However, the numbers of animals required per candidate medicine, has declined dramatically over the last 6 years. There are in fact good reasons other than welfare why scientists should seek to use alternatives to animals whenever possible as animals are expensive to keep and difficult to use. While some argue that Replacement should lead to an ongoing drop in numbers, Russell and Burch clearly understood that, for the foreseeable future, new requirements to use animals would arise, and therefore that there would be a continuing need to seek replacements. Just as scientists are likely to wish to use available replacements, they are similarly motivated to reduce the numbers of animals used to a minimum. However, Festing (2002) has drawn attention to the fact that there is considerable room for improvements in experimental design used in studies. More needs to be done to ensure that experimental designs are optimised. To this end The

Alternatives Section of the Laboratory Animals Science Association, of which I am a co-convenor, held a meeting this year.

Refinement has two components: Refinement of procedure, and Refinement of husbandry. These are equally important, and there has been substantial progress in both. Some of the most important developments in procedure refinement have been in the development of routine use of post-operative pain relief, and more recently in the detection of pain. Signs of pain in animals are not always obvious to human eyes, and ethologists are working on the detection and evaluation of non-obvious signs of pain. Refinement by training animals to co-operate in experimental procedures is another way of reducing the stress associated with routine procedures such as weighing or injection and this is an area of research that UFAW is currently supporting.

With respect to refinement of Husbandry it is a legislative requirement under the European Directive EEC 86/609 that any restriction on the extent to which an experimental animal can satisfy its physiological and ethological needs shall be limited to the absolute minimum. Yet, until recently animal housing was often barren, designed to ensure that animals were physically healthy but clearly did not meet the animals' ethological needs. This is an area where there has been improvement in this country. We need to ensure that improved standards of animal husbandry are disseminated to other countries both in the interests of animal welfare and to ensure that research in this country is not disadvantaged to the extent that research moves abroad where in some countries standards

may not be as high as in the UK.

The move away from traditional barren housing to more enriched housing has been led by the input of animal welfare scientists such as those supported by UFAW through its Research Fellowship, Pharmaceutical Housing and Husbandry Steering Committee studentships, and its Research Training Scholarships. Latham & Mason (2004) have identified conflicts between the natural behaviour of mice and laboratory housing to highlight potential welfare issues. Studies of laboratory animals have shown that abnormal behaviour may be more common than generally thought (eg Kroehn et al 1999, Hubrecht et al 1992), and such behaviour not only indicates that the housing conditions that result in these deficits is bad for the welfare of the animals but may also harm the science (Garner & Mason 2002). How then can we know what should be provided for animals? Ethologists have developed techniques to ask animals what they want in their environment and by training them to work for access to various features, to estimate how much they want it (eg Sherwin 1998, van der Weerd et al 1998), and there are now numerous studies that demonstrate the beneficial effects of enriching laboratory cages.

Scientists are sometimes reluctant to use enrichment because of concerns that it might interfere with their research. However, so-called standard environments can also have adverse effects on experimental outcomes, and enriched environments can improve validity (Damon et al 1998, Healy & Tovée 1999, Kuhnen 1999). Nonetheless, it is important to consider possible effects of enrichment on experimental outcomes and it may either increase

or reduce variation or have no effect (Augustsson et al 2003, Tsai et al 2003).

Enriching the animals' environment can have other benefits, for example, in a recent study (Hockley et al 2002) the authors used a genetically modified strain of mouse as a model for Huntington's disease (a genetic disorder of the central nervous system resulting in progressive loss of motor control). They found that even limited enrichment slowed the progression of the disease and speculated that their results could provide a basis to ameliorate the effects of Huntington's disease in humans.

To conclude, over the last 10 years or so there has been considerable progress in improving standards of laboratory housing in the UK. Before then, laboratory animal housing was designed largely to avoid the spread of disease and for the convenience of research and animal care staff. Today, with greater understanding of the interactions between animals and their environments and the development of animal welfare science, there has been an increasing emphasis on designing housing that meets the needs of the animals and this is exemplified in the draft revisions to Appendix A of The European Convention ETS 123. Nonetheless, we should not assume that all laboratory housing in this country is satisfactory; there is always a balance to be struck between practical issues, scientific requirements, and the needs of the animal. Moreover, more research is needed in this area, and we need to ensure that laboratory animal standards are raised not only in this country but world-wide.

References are available from the author on request.

In discussion the following points were made:

Drivers for animal testing include a need for the refinement of drugs and dosages for the average patient although all drugs are unsafe in certain circumstances. Primate housing and management requires careful design since behavioural traits might result in disturbance to deep brain implants. We do not understand how life works, hence experimental results are species specific with no easy transfer of data between species and no absolute safety when relating animal data to human use. The suppression of adverse results is unacceptable. Animal rights extremism feeds off scientists and organisations who shelter behind secrecy and anonymity. Hard core extremists are thought to number some 20 or so individuals which is not unmanageable. Other threats to UK animal testing arise from overseas competition. Irrational differences in the public perception of farm versus experimental animals focuses around the need for deliberate experimental intervention on the latter. Both academic and commercial laboratories need greater protection, and openness to society, if they are to continue to operate here.

Einstein Year gets off the ground



The Institute of Physics hopes that attitudes towards physics will begin to change in 2005.

On 5 January, the Institute of Physics enlisted the help of 18-year-old Ben Wallace, to launch Einstein Year, the UK and Ireland's contribution to International Year of Physics 2005. A member of Team Extreme, one of the world's top BMX stunt teams, Wallace performed the first-ever Einstein Flip, a stunt created with the help of physicist Helen Czerski of Cambridge University that showed young people that physics can be cool.

"Cool" is not a word that most people associate with physics, and it's no secret that, lately, physics has been suffering from an image problem. All too many people regard it as dull, difficult and irrelevant. But Einstein Year is all about bypassing such negative perceptions and creating a whole new set of associations, especially in the minds of 11 to 14-year-olds, the main target audience for the year's activities. At this critical age, children make lifelong decisions about who they are and what they like. For many, Einstein Year will be their first experience of physics, so it's vital that it's an enjoyable and positive one.

Changing perceptions of physics is a huge challenge – for many even the word "physics" is an instant turn-off. The name Einstein Year gets round that by focusing instead on an icon who is not just the world's most famous physicist, but one of the most recognized figures of the 20th century. Even those who turn away from physics warm to the image of the quirky old man with



Launch of Einstein Year at the Science Museum (BMX stunt-rider Ben Wallace)



Rambert Dance rehearsing "Constant Speed" on the London Underground

the mad hair, the non-conformist pacifist who refused to wear socks. And, of course, 2005 is the centenary of Einstein's *annus mirabilis*, when he published seminal papers on special relativity, the photoelectric effect and Brownian motion.

But we're not just relying on Einstein's name and image to change attitudes to physics. Far from being dull, difficult and irrelevant, the events and activities during the year aim to be entertaining, accessible and interesting. For example, throughout 2005 groups of "physics buskers" will be turning up in public places and festivals to show off the exciting physics-based tricks in our specially created "Physics To Go" packs. And there's even an Einstein Year computer game, *Time Twins*, that's great fun to play but also communicates some of the ideas raised by special relativity.

We hope to reach as many young people as possible during Einstein Year, and that everyone who takes part will learn a little physics. But Einstein Year won't take the place of physics teaching in the classroom. Instead, it's about exposing young people to some new experiences of physics – ones they're unlikely to

get at school. The touring exhibition "Move Over Einstein", for example, details the search for the Higgs boson and the mysteries of dark matter with hands-on exhibits that capture the excitement of these research areas. The exhibits will also feature information about some of the young researchers involved in this work. Aside from science museums and science centres, the exhibit will also visit some less traditional spaces, such as city museums and even shopping centres, to reach those who might not otherwise be exposed to physics.

One of the biggest projects that will start during Einstein Year is Lab in a Lorry. Three of these custom-built mobile physics laboratories will be touring the country, each with experiments designed to inspire young people. Visitors will take part in real physics and meet real physicists and, for some, their visit could even be the push that makes them consider taking physics further.

We've started the year as we mean to go on – engaging young people by highlighting the physics involved in activities that interest them. That's why the Institute was keen to team up with Ipswich Town

Football Club to put on an Einstein birthday party – one of dozens around the country. It will include party tricks and games that are, first and foremost, great fun but which are also based on physics. These children will discover, for example, that it's harder to score a goal with a completely smooth football than one with a seam, but they'll also find out why.

Most activities next year are aimed at young people, but adults needn't feel left out. There will be plenty to engage all age groups during the year. Young people don't live in a vacuum. They're influenced by older siblings, parents and teachers, and if everyone around them says physics is boring, they're likely to believe it. Throughout 2005 we'll be demonstrating to everyone how physics plays a part in so many aspects of our lives. There will be ten themes during Einstein Year – including Physics in Music, Physics in Sport, Physics in the Future – which we hope will demonstrate just how relevant physics really is to us all.

This year is a great opportunity to try out new ways of inspiring people with physics, and that effort won't end on 31 December 2005. Once the balloons have come down and the cleaners have left, we'll be taking a close look at what worked – and what didn't – to make sure Einstein Year has a lasting impact. It's not too late to put on your own event. You, too, can be part of this effort to change attitudes, so that a whole new generation grows up believing that physics is interesting, exciting and, yes, even cool.



Tuff Teddy, the main character in a new computer game for Einstein Year called "Time Twins" and based on ideas about special relativity

Engineering and Physical Sciences for the 21st century

John O'Reilly, Chief Executive, Engineering and Physical Sciences Research Council



Medical imaging, genetic fingerprinting, flooding prediction, energy efficient building design, the lasers used in CDs and DVDs, the optical fibres which have revolutionised our communications systems and enabled broadband internet access – these are just a few of the technological developments upon which we rely in our everyday lives that have resulted from breakthroughs in engineering and the physical sciences.

While the technology of today is based on knowledge we currently possess, future technology will be based on knowledge that we have yet to acquire – through research. The Engineering and Physical Sciences Research Council (EPSRC) is the UK's main funding agency for research and training in these areas and invests over £500 million a year in UK universities and other research organisations across a broad range of subjects from mathematics to materials science,

from information technology to structural engineering. Our aim is to ensure the UK is equipped with the research knowledge and expertise to maintain the UK's technological leading edge, build a strong economy and improve people's quality of life.

EPSRC supports more than 5000 research projects across a broad remit ranging from research on "optical tweezers" to enable the manipulation of individual molecules, to sustainable processing and manufacturing to address climate change; from the atomic scale intricacies of quantum computing, to the design of living areas which are less susceptible to crime.

However, the shape of science is changing and real world problems do not respect the boundaries of established academic disciplines. We are therefore increasingly working in partnerships with other Research Councils, with Government Departments and with industry to tackle the research challenges in areas such as energy (both the development of cleaner renewable alternatives to fossil fuels as well as technologies and processes to improve energy efficiency), climate change, transport, crime prevention and detection, information technology and communications and healthcare.



The award winning David Wilson Eco-House on the campus at the University of Nottingham is a test bed for innovations in "green" living with EPSRC providing support for both research and public engagement.

Out of the labs and into society

One of the main strands of the Government's 10 year Framework for Science and Innovation is to ensure that the scientific knowledge generated by our universities is used by business to create wealth. Knowledge transfer is an integral part of our business. In the last decade more than 500 start-up companies have been formed built upon EPSRC sponsored research and more than 45% of our research grants involve partnership with industry and other external partners. We also promote industrial involvement in the training of our postgraduate students and the first employment destination of over 50% is industry, with the postgraduate students taking their newly acquired knowledge and skills out into the workforce.

For the future we believe that we can best contribute to improving the UK's innovation performance by seeking further to raise the appetite of business for research and high level skills, and acting as a catalyst for collaboration across the business/university interface.

Training the next generation of scientists and engineers

Creating a workforce equipped with high level skills in engineering and the physical sciences is essential to drive discovery and innovation and position the UK as a key knowledge hub in the global economy. EPSRC is the largest supporter of PhD training in the UK in engineering and physical sciences; we currently support over 7000 PhD students who will become the next generation of research leaders in both industry and academia.

Securing the future

The physical sciences and engineering are remarkable in their importance and pervasiveness throughout the economy. As identified in a recent report by the Science and Technology Policy Research Unit (SPRU), engineering and physical sciences related sectors account for 30% of UK GDP, 40%



Thousands of people learnt about the science of bridges, birdsong, volcanoes and many more topics at the University of Bristol's "Science Alive" event held in Bristol's Galleries shopping centre, sponsored as part of EPSRC's Public Engagement Programme.

of all investment and 75% of all industrial R&D.¹ In addition, much of the rapid and exciting research progress in biology, medicine and environmental sciences has depended on earlier breakthroughs in the engineering and physical sciences (eg x-ray crystallography and synchrotron radiation, amino-acid sequencers and bioinformatics) and this trend continues.

However, in engineering and physical sciences a decline in undergraduate numbers over recent years has resulted in a reduction in researchers and centres of research activity in our universities. As a result there are serious concerns that some areas of engineering and physical sciences research in the UK no longer have the capacity to produce the well-trained people and research leaders of tomorrow. Given the importance of engineering and the physical sciences to both the UK economy and other areas of research, urgent action is required.

As a result we have decided to take action in a new way and in partnership with the Higher

Education Funding Council for England (HEFCE) and the Scottish Higher Education Funding Council (SHEFC) we are working to secure strategically important research areas that are missing or "at risk" in the UK. We have recently introduced Science and Innovation Awards on a pilot basis and by February 2005 plan to award 3 to 5 large, five year grants to enable academic staff to be appointed to establish research groups in strategically important areas. A crucial part of the scheme is a commitment from the host university to continue to support the academic posts and activities after the end of the special EPSRC funding to grow and sustain research capacity in these key areas. However, this can only serve as the beginning and to have a real effect in halting the decline in research capacity a continuing programme of these awards is needed.

This initiative must be coupled with longer term activities to engage with young people about the benefits of science and engineering and the opportunities for pursuing careers utilising these skills. A distinct feature of Research Councils in this arena is the access that we have to a large number of active researchers who have an important role to play in promoting and discussing the outcomes of their research with the public. We are currently working with other Research Councils to ensure our researchers have the training, resources and opportunities they need to undertake public engagement activities. This includes a major programme to link young scientist role models with schools to inspire interest in science.

These are just the first of many steps that will need to be taken to reverse the situation and EPSRC is one partner amongst several that have a role to play if we are to ensure the UK has the research capability it requires to drive the next generation of technological change.

¹ "Engineering and Physical Sciences in the UK", G Crespi and P Patel, Science and Technology Policy Research Unit www.sussex.ac.uk/sprutest/documents/pateleps.doc

Further information about the Engineering and Physical Sciences Research Council and its activities is available from our website at www.epsrc.ac.uk

The Innovation Challenge: Lessons from America and the UK

Representatives from Government, industry and academia took part in the Cambridge-MIT Institute's annual Competitiveness Summit in Edinburgh on 30 November, where they discussed ways of boosting knowledge exchange between universities and industry to help promote science and engineering enterprise. Speakers included two senior innovation policy advisers, one from the US and one from the UK. These are their personal views on how to tackle the innovation challenge.

Dr Charles Wessner is Director of the Program on Technology and Innovation at the National Academy of Sciences in Washington, and speaks to the US Congress on science and innovation policy.



The UK and the US face common challenges in bringing the results of research to the market, and there is much to learn on both sides of the Atlantic. The US offers UK policymakers some interesting lessons, and some mechanisms that could potentially be adapted to Britain – like the Small Business Innovation Research program (SBIR). This has successfully funded thousands of high-technology businesses in the US, and helped many entrepreneurial academics set up their own firms. Similar programs are currently under way in Finland and Sweden, and “an SBIR-type program” was recommended by the European Advisory Board.

Now, the US is far from having all the answers for successfully encouraging science and technology innovation. The common assumption that the US has a well-oiled, well-run innovation system is a myth – not least because no one entity is really in charge. Instead of having a science ministry, or a central plan for science, we have multiple and competing sources of decision-making. This means the system is responsive to new challenges, but it can also lead to a lack of coherence that is potentially damaging to innovation. What the US does have is a business climate and a positive social attitude that support innovation.

It is also important to say that UK innovation is faring better than many people think, helped by the relatively low regulatory burden the UK places on its small firms, and the high quality of British science research. The challenge for the UK is to capitalise on its R&D investment, and to generate returns to British taxpayers in the form of new, welfare-enhancing products, and jobs and growth that new companies can offer. To the UK's advantage, the Government recognises this challenge and is seeking to address it.

Lack of finance

One barrier in both our countries to the establishment of new, high-tech firms is a financial “Valley of Death” – a lack of available finance for new ideas. In the US, the SBIR is one mechanism set up to help bridge this Valley. SBIR is a competitive program that awards funds in two phases. Just 12 per cent of applicants receive Phase I awards (of \$100,000), and less than half of these go on to win a Phase II award, of \$750,000, after demonstrating the feasibility of the technology they are developing. But the awards are highly sought-after, for good reasons. The grant does not have to be paid back, and the company keeps the IP rights. Importantly, the award also sends out signals of research quality and commercial potential that help attract funds from private investors.

The US Government, which provides awards through agencies ranging

from the Department of Defence (which funds half the program) to the National Institutes of Health, and the National Science Foundation, regards its payback as the development in the US of vital new technologies in health, defence, energy and the environment. These address the specific missions of these agencies, as well as the larger national goal of a robust and innovative economy. A recent evaluation by the National Academy of Sciences of the Program at the Department of Defence confirmed that SBIR has been successful in stimulating the creation of thousands of new start-ups, including those by academics.

A major advantage of the SBIR program, which now distributes \$2 billion a year, is its stability. Introduced in 1982, SBIR is currently funded through a set-aside of 2.5 per cent on the external R&D budgets of the participating agencies. This means the program does not require yearly approval by the US Congress, making its budget predictable and ensuring growth apace with US R&D expenditure. The former Smart scheme in the UK was in some ways similar to the SBIR program. However the changes made to it recently mean that in its current form, it no longer has the resources and outreach necessary to help promising small companies.

Tyranny of the small scale

At a time when the UK Government is making a sustained effort to put new money into science in a smart way, and paying a commendably high level of attention to this area, I would caution against the British tendency to under-fund well-conceived programmes. This leads to a tyranny of the small scale, ie too many well-conceived but under-funded initiatives operated for too short a time. This short-changes the potential of the UK's excellent science base. As the example of the SBIR program shows, Government-funded initiatives work best if they are highly competitive, well funded, and stable over time. An innovation economy requires sustained policy attention, but the rewards in growth and employment are worth it.

Alan Hughes is Professor of Enterprise Studies at the Judge Institute of Management, and Director of the Centre for Business Research at Cambridge University. He was appointed, in 2004, to membership of the Council for Science and Technology (CST). The views expressed here are his own.



Currently there is considerable UK policy interest in how to harness the excellence of university science and research so it can be used as the platform for successful innovation by businesses. Hence, a number of policy initiatives are fostering more links between universities and industry generally, and encouraging university spin-outs and licensing activity in particular.

But is this the right policy emphasis to enhance UK innovation levels? The first findings from a new research project, benchmarking innovative behaviour in the UK and US, are revealing a complex picture of the relationships UK businesses forge with universities – and indeed with other organisations – as they search for competitive advantage. It suggests that pursuing university spin-offs and licensing is not necessarily the best or only solution, as this is just one of many

ways in which universities interact with the commercial world.

The Cambridge-MIT Institute is sponsoring the “Innovation Benchmarking” research, which is being conducted by Andy Cosh and myself at Cambridge University's Centre for Business Research with Richard Lester at MIT's Industrial Performance Center. Together, we are interviewing ultimately 4,000 companies in the US and UK to measure and compare their innovative behaviour and performance

Collaborative activities

Preliminary findings for smaller firms in our study (those employing between 20 and 500 staff) show that the number of UK companies that have relationships with universities is actually greater than previously thought, and more than in the US. Here, two-thirds of companies use universities and higher education institutions as sources of knowledge, compared to one third in the US; and almost one in four UK companies (23 per cent) are involved in collaborative activities with them, compared to around one in seven (14 per cent) in the US.

The relationships are broad-ranging. Our study confirms a growing (but often neglected) body of evidence that knowledge exchange between business and universities takes place in many diverse ways, ranging from open channels (eg publication of papers, conferences and informal interactions) to more closed and formal collaborations, like joint research and development projects, and academic consultancy.

People play a key role as central carriers of knowledge in exchange relationships (as recruits, consultants, interns etc), though interestingly, we found US companies use internships far more as a method of interacting with universities than in the UK. Also when we asked companies in both the UK and the US the purpose of their collaborations with universities, “sharing in-house research”, “helping to develop specialist services or products

required by customers” and “gaining access to specialised equipment or information” all came higher up the list than developing licensing activities or supporting spin-outs.

However, UK policy-makers will be most concerned by our findings that while a smaller proportion of small American companies collaborate with US universities, those that do have a more intense relationship with them, and value their collaboration more highly than in the UK. In our study, thirty per cent of US companies that had university links rated them as a “highly important” source of knowledge, compared with just thirteen per cent in the UK.

This may be because American companies place a greater premium on education generally. Our study provides evidence for this with its findings that more American company chiefs, and more American workers, have a degree than their UK counterparts.

Private sector commitment

These emerging results from our study raise some interesting policy issues. The ten-year Science and Innovation investment framework commits the UK to raise R&D by 75%, or some £16.5 billion in real terms. The Government has outlined its commitment and contribution to this target. But it will be an enormous challenge for the private sector, whose R&D spend is twice as important as that of the public sector in quantitative terms, to reach this level. And with smaller firms in the UK expected to be a key driver in this, our study suggests that major behavioural changes are required.

The 2003 Lambert Review of Business-University Collaboration suggested that the main challenge for the UK lay in raising “the overall level of demand by business for research from all sources.” We agree with this, but we would emphasise the importance of the intensity and quality of this demand, and the need to raise the capacity of business to absorb and apply knowledge if we are to rise to the innovation challenge.

Bees on their Knees?

Pamela A Hunter

Microbiological Consultant and Medical Writer



The National Bee Unit (NBU) is part of the DEFRA-funded Central Science Laboratories. The proposal in the Haskins report is to make a 20% reduction (£250,000) and such a cut will have major repercussions on the viability of beekeeping in England.

The numbers of honeybees have reduced dramatically in the countryside, mostly from the advent in 1992 of a parasitic mite, known as varroa. Colonies were decimated and as a result, many beekeepers gave up in the early to mid 1990s. Feral colonies were also destroyed so that pollination by honey bees now relies almost exclusively on colonies of bees managed by beekeepers. The parasite has to be kept at low levels by careful manipulation and chemical treatment, all monitored by the Bee Disease Officers (part of the National Bee Unit). It has been estimated by ADAS (2001) that the contribution of pollination by honey bees to the agricultural economy was as much as £120 million, while the experts at Rothamstead suggest that the figure is nearer to £150 million.

ADAS also stated in (2001) in their report "An Economic Evaluation of DEFRA's Bee Health Programme" that the bee health service (the National Bee Unit - NBU) had a benefit-to-cost ratio of 33. In spite of this DEFRA has not issued a consultation document on these proposals; this is in contravention of the Cabinet Office Code of Practice.

One of the major roles of the NBU

is the testing for and monitoring of various bee diseases, in particular American Foul Brood and European Foul Brood. These are both notifiable diseases and have increased in frequency since the advent of varroa. The Bee Diseases Inspectors have a statutory right to inspect any bee hives or apiary premises.

Varroa is to be deregulated in 2005 on the grounds that it is now endemic and beekeepers know how to handle it. Although that may sound a reasonable proposal, unfortunately the varroa mite has recently become resistant to the only two chemicals available in the UK for treating the parasite. This will make dealing with varroa very difficult and the beekeeping community thus relies very heavily on the advice from and inspections by the Bee Disease Inspectors. As the resistant mites spread, their help will be essential if we are to manage our colonies effectively.

It has also been announced that European Foul Brood will be deregulated in 2007/8. The rationale for this is that there are now good ways of controlling this disease without recourse to the destruction or treatment with antibiotics that has been used up until now. Again, this has not been thought through since these alternative methods have not been validated, especially for use in heavy infections. There is historical evidence from before this disease was notifiable that these methods, although useful, were not adequate.

In addition, this disease is not easy

for the non-expert to recognise in the early stages. ADAS calculated that the control of European Foul Brood had a benefit-to-cost ratio as high as 70.

It seems probable that the required cost savings will be made by cutting the numbers of Bee Disease Inspectors. It is a bad time to be making such cuts as there are yet more unpleasant and potentially devastating problems waiting in the wings. One, the small hive beetle, has recently been found in the USA and in Australia. Illegal imports to the EU of bees containing this beetle have been discovered very recently and although these were detected and appropriate measures taken, it is impossible to tell if all beetles and larvae have been destroyed. This pest may already be just across the channel.

It is clear from the situation with human diseases that in the modern world of rapid travel across continents, importation of exotic foods and of course illegal activities, containing the spread of pests and diseases is extremely difficult. We have to assume therefore that these other pests and diseases will find their way here just as varroa did.

Varroa has become more of a problem because of resistant mites since the ADAS reported in 2001. The incidence of foulbroods has remained static and the likelihood of additional pests and diseases has increased. Thus we have a greater need for research and support if the bees and the agricultural economy that relies on them are not to suffer.

Towards One Institution of Engineers

A personal view by Robert Freer

The Institution of Civil Engineers was founded in 1818, just before the beginning of the Railway Era, and was the first institution for the practitioners of the new profession of engineering. In those days the term civil engineer meant simply a non-military engineer and most of the members at that time were the engineers of the roads, canals and harbours.

The story that the Institution refused to admit George Stephenson because as a mechanic he was not a “gentleman engineer” is, like many other popular stories, probably apocryphal. But the fact remains that the formation of the Institution of Mechanical Engineers, some thirty years after the Civils, with George Stephenson as their first President, started the fragmentation of the engineering profession which has continued relentlessly and has bedevilled and weakened the efforts of engineers today to establish and maintain influence with politicians and with the general public. Today there are between thirty and forty institutions accommodating the main engineering specialisations and many more representing minor interests.

Almost everything engineers do nowadays to build or to maintain the national infrastructure is sponsored or influenced in some way by the Government. The Government is deeply involved in the national infrastructure and it is in the interests of all of us that the specialist practitioners have sufficient influence with the Government to ensure that Government policies are first of all guided by sound technical advice and then carried out in a technically efficient manner. Such advice would carry more weight if it was seen to represent the views of

the whole engineering profession.

Throughout the country there are many technical specialists on every subject able to offer such advice, but with thirty or forty institutions claiming to speak for the engineering profession how does the Government know how to locate and make best use of this reservoir of information?

It would be much simpler for the Government to speak to one Institution of Engineers which could offer, on matters of both policy and its implementation, sound technical advice distilled from a wide range of opinions within its membership. Unanimity among specialists is not to be expected and is unlikely to be achieved but if different views and their consequences are clearly stated and an appropriate technical judgment clearly made it becomes much easier for politicians to adopt and pursue a sound and workable policy.

Personal individuality would not be lost because within the one Institution there would be a number of special interest groups (as there are now in the separate institutions) to provide the “intellectual home” for specialist practitioners.

The older professions have been more far-sighted. If the Government wants technical advice on, say, medical policy or legal policy they have just one organisation they can speak to.

This problem of fragmentation has been recognised by a number of engineers for many years and the Government's impatience with the present arrangements has also been apparent. Since the Finnieston enquiry more than twenty years ago (which was prompted by the



Government of the day) there have been three opportunities to bring the main engineering institutions together and three times the opportunity has been lost. Three times is a lot.

Today there is another opportunity to bring the institutions together, and it may be a last opportunity. The practical reality is that the historical distinctions between the different types of engineer are fading and are becoming less relevant in modern practice. And all the large employers and commercial organisations are now multidisciplinary.

Many of the present institutions are concerned that their membership is static or declining and in any case is ageing. It is much better for the main institutions to start negotiations now on a basis of equality than to allow this opportunity to slip by again for a number of years by which time some institutions may need to seek amalgamation for reasons of economic necessity.

Brunel was one of the first to recognise the damaging consequences of the fragmentation of the profession. He was admitted as a Member of the Institution of Civil Engineers in 1837 and later in 1841 he was invited to join the new Institution of Mechanical Engineers. He declined on the grounds that if the new Institution were to be “an Institution for England generally.. I fear it would tend to create a division in our Institution of Engineers and so far would I think be open to objection”. Brunel was born in 1806 and to bring the Institutions together would be a fitting way to commemorate the bi-centenary of his birth in 2006.

Robert Freer is an engineer but the opinions expressed are his own and not those of any institution



House of Commons Select Committee on Science and Technology

Under the Standing Orders, the Committee's terms of reference are to examine "the expenditure, policy and administration of the Office of Science and Technology and its associated public bodies". The Committee was nominated on 12 November 2001. The Chairman is Dr Ian Gibson (Lab, Norwich North). Other members of the Committee are Paul Farrelly (Lab, Newcastle-under-Lyme), Dr Evan Harris (Lib Dem, Oxford West and Abingdon), Kate Hoey (Lab, Vauxhall), Dr Brian Iddon (Lab, Bolton South East), Mr Robert Key (Salisbury), Mr Tony McWalter (Lab/Co-op, Hemel Hempstead), Dr Andrew Murrison (Con, Westbury), Geraldine Smith (Lab, Morecambe and Lunesdale), Bob Spink (Con, Castle Point), and Dr Desmond Turner (Lab, Brighton Kemptown).

Oral Evidence

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

Science Question Time

The Committee hosted a "Science Question Time" with Lord Sainsbury of Turville on Wednesday 1 December. The Committee will continue to host such sessions at regular intervals.

Science and Innovation Investment Framework 2004–2014

The Committee took evidence from the Rt Hon Paul Boateng MP, Chief Secretary to the Treasury; Dr Kim Howells MP, Minister of State, Department for Education and Skills; and the Lord Sainsbury of Turville, Parliamentary Under-Secretary of State, Department of Trade and Industry, on Monday 1 November. The session was used to discuss the Government's Science and Innovation Investment Framework 2004–2014. The evidence taken formed part of the Committee's annual scrutiny Report on the work of OST.

Current Inquiries

Human Reproductive Technologies and the Law

The Committee announced its terms of reference in March 2004. The terms of reference were informed by a public e-consultation on some of the major issues involved in the inquiry, which ran from January to March 2004 at www.tellparliament.net. The inquiry is looking into how human reproductive technologies are regulated in the UK. Terms of reference include the balance between legislation, regulation and reproductive freedom; the role of Parliament in the area of human reproductive technologies; the ethical framework for legislation on reproductive technologies; the Human Fertilisation and Embryology Act 1990; and the work of the Human Fertilisation and Embryology Authority. The Committee held its last evidence session on this inquiry in January 2005. A Report is expected in the Spring.

Forensic Science

The Committee announced its terms of reference in July 2004. The inquiry is looking into the likely impact of the Government plan to develop the Forensic Science Service as a public private partnership; the quality of forensic science education and training and the supply of skilled personnel;

levels of investment in forensic science R&D; the use of novel forensic technologies by the FSS and criminal justice system; and the use of forensic science in criminal investigations and court proceedings. The Committee began taking oral evidence in December 2004. A Report is expected at Easter.

The Future of the National Institute for Medical Research

The Committee announced, on 21 October 2004, that it would conduct an inquiry into the future of the Medical Research Council's National Institute for Medical Research. The inquiry is looking at the proposed move of the National Institute for Medical Research to a central London university hospital site, and the process by which decisions are being reached. The Committee will hold its final evidence session for this inquiry in January 2005. A Report is expected in the early Spring.

Strategic Science Provision in English Universities

The Committee announced its terms of reference in December 2004. The inquiry will look at the impact of HEFCE's research funding formulae on the financial viability of university science departments; the desirability of increasing the concentration of research in a small number of university departments; the implications for university science teaching of changes in the weightings given to science subjects in the teaching funding formula; the optimal balance between teaching and research provision in universities; the importance of maintaining a regional capacity in university science teaching and research; and the extent to which the Government should intervene to ensure continuing provision of subjects of strategic national or regional importance, and the mechanisms it should use for this purpose. The Committee began taking evidence in February 2005.

Reports

Research Assessment Exercise: a re-assessment

The Committee published its Eleventh Report of Session 2003–04, *Research Assessment Exercise: a re-assessment* (HC 586) on 23 September 2004.

The Committee concluded that the proposals for the next Research Assessment Exercise, scheduled for 2008, contained some positive elements, particularly the introduction of the quality profile to replace the 7-point rating scale. It noted that this should eliminate the financial incentive for games-playing. It also

concluded that the new panel and sub-panel structure should improve the consistency in assessments between Units of Assessment and the treatment of interdisciplinary and applied research. In other respects the Committee regarded the proposals as too timid. The Report stated that the Funding Bodies should have accepted the recommendations of Sir Gareth Roberts to abandon the “one size fits all” approach and to demand that institutions satisfy minimum standards of research competence.

Government Support for Beagle 2

The Committee published its Twelfth Report of Session 2003–04, *Government Support for Beagle 2* (HC 711) on 2 November 2004.

The Committee concluded that the failure of the Beagle 2 Mars lander could be traced to the Government’s unwillingness to commit funding early enough, and the failure of the European Space Agency (ESA) and the UK Government to monitor the project sufficiently closely. The Report stated that the lack of guaranteed funding left the Consortium behind the Beagle 2 project held together by an amateurish gentleman’s agreement that allowed a key backer to pull out without penalty, and hampered efforts to secure the necessary funding. The Committee also criticised ESA’s and the UK Government’s refusal to publish in full their own Commission of Inquiry Report into the failure of Beagle. The Report did, however, welcome the moral support given by the Government to a worthwhile but risky project.

The Use of Science in UK International Development Policy

The Committee published its Thirteenth Report of Session 2003–04, *The Use of Science in UK International Development Policy* (HC 133) on 26 October 2004.

The Committee concluded that the Department for International Development (DFID) had failed to fully value and make use of scientific research and evidence, leading to poorer quality policy making and support for developing countries. The Report stated that a scientific approach to policy making, capacity building and evaluation is the only way to achieve DFID’s objectives of making sustainable progress towards the Millennium Development Goals agreed by the international community in 2000. The Committee also expressed concern at DFID’s waning capacity to promote the role of science and technology in development and provide crucial technical advice.

Responses to the Committee’s Tenth Report, Session 2003–04, Scientific Publications: Free for all?

The Committee published its Fourteenth Report of Session 2003–04, *Responses to the Committee’s Tenth Report, Session 2003–04, Scientific Publications: Free for all?* (HC 1200) on 8 November 2004.

The Committee asked the Government to reconsider its position on scientific publications after it released an obstructive Response to the initial Committee Report. The Report concluded that the Department of Trade and Industry (DTI) had tried to neutralise the views put forward by other departments and Government-funded organisations, in particular the Joint Information Systems Committee (JISC), an expert

advisory body funded indirectly by the Department for Education and Skills. The Committee found it worrying both that an expert body had felt constrained in carrying out its advisory role, and that the Government had ignored JISC’s expert advice on the need for change in the system for publishing research findings.

The Work of the Economic and Social Research Council

The Committee published its First Report of Session 2004–05, *The Work of the Economic and Social Research Council* (HC 13) on 20 December 2004.

Government Responses

Eighth Special Report

The Committee published its Eighth Special Report of Session 2003–04, *Government Response to the Committee’s Seventh Report, Session 2003–04: Director General for Higher Education: Introductory Hearing* (HC 1015) on 17 September 2004.

Ninth Special Report

The Committee published its Ninth Special Report of Session 2003–04, *Government Response to the Committee’s Ninth Report, Session 2003–04: Director General of the Research Councils: Introductory Hearing* (HC 1059) on 27 September 2004.

Tenth Special Report

The Committee published its Tenth Special Report of Session 2003–04, *Government Response to the Committee’s Tenth Report, Session 2003–04: Director General of the Research Councils: Introductory Hearing* (HC 1199) on 3 November 2004.

First Special Report

The Committee published its First Special Report of Session 2004–05, *Research Assessment Exercise: a re-assessment: Government Response to the Committee’s Eleventh Report of Session 2003–04* (HC 34) on 30 November 2004.

Further Information

Further information about the work of the Committee or its current inquiries can be obtained from the Clerk of the Committee, Chris Shaw, the Second Clerk, Emily Commander, or from the Committee Assistant, Ana Ferreira on 020 7219 2792/0859/2794; or by writing to: The Clerk of the Committee, Science and Technology Committee, House of Commons, 7 Millbank, London SW1P 3JA. Inquiries can also be emailed to scitechcom@parliament.uk. Anyone wishing to be included on the Committee’s mailing list should contact the staff of the Committee.

Anyone wishing to submit evidence to the Committee is strongly recommended to obtain a copy of the guidance note first. Guidance on the submission of evidence can be found at <http://www.parliament.uk/commons/selcom/witguide.htm>.

The Committee has a new website address: www.parliament.uk/s&tcom. All recent publications (from May 1997 onwards), terms of reference for all inquiries and press notices are available at this address.



House of Lords Science and Technology Select Committee

The members of the Committee (appointed 1 December 2004) are Lord Broers (Chairman), Baroness Finlay of Llandaff, Lord Mitchell, Lord Patel, Lord Paul, Baroness Perry of Southwark, Baroness Platt of Writtle, Baroness Sharp of Guildford, Lord Soulsby of Swaffham Prior, Lord Sutherland of Houndwood, Lord Taverne, Lord Turnberg, Lord Winston and Lord Young of Graffham

The Reports and Calls for Evidence for the inquiries mentioned below can be found at the Committee's web site www.parliament.uk/hlscience.

Radioactive waste management

In December, the Select Committee published a short report on radioactive waste management. The inquiry concentrated on the Government's new body, the Committee on Radioactive Waste Management (CoRWM), set up in 2003, which has been tasked with finding a long-term solution for managing high and intermediate level waste. The Select Committee had heard evidence from the Chairman of CoRWM and the Defra Minister, Elliot Morley, in October. Members also attended an open meeting of CoRWM in Ipswich in September.

The report strongly condemned the Government's handling of policy in this area, in particular the remit and membership of CoRWM. The Select Committee expressed astonishment that CoRWM had been asked to start from a "blank sheet of paper" when considering management options. There was also concern at the lack of technical expertise on CoRWM itself, relating to waste management options. Members warned that without such expertise, CoRWM would be unable to evaluate critically evidence submitted to it. The inquiry found shortcomings in the process establishing CoRWM. The Minister admitted that Defra's Chief Scientific Advisor had not been directly involved in the setting up of CoRWM.

Members of the Select Committee felt that a disproportionate amount of time and money was being given over to discussing methodology for the public and stakeholder engagement process when such consultation has been undertaken by similar bodies. Furthermore, the evidence showed that the public would show real interest in the management of radioactive waste when it directly affected them, that is, selection of a suitable site. This next stage of policy was also found to be severely lacking any development.

A debate on the report was held on 12 January, at which the Minister responding, Lord Whitty, assured the House that a Government response would be published within a month or so.

Scientific aspects of ageing

Sub-Committee I, chaired by Lord Sutherland of Houndwood, has been hearing oral evidence for its inquiry into the scientific aspects of ageing since October. Members are investigating the ageing process, and how science and technology can help postpone and mitigate the effects of illnesses or disabilities associated with growing old, and assist the elderly in adapting to the challenges of, for example, restricted mobility and deteriorating senses.

The Sub-Committee has been fascinated hearing about the research that is being carried out in the UK, in areas such as the importance of nutrition in the ageing process, heart and circulatory diseases, and musculoskeletal disorders

such as arthritis. Evidence has also been heard from the Departments of Health and Transport, and the Office of Science and Technology. Oral evidence on neurodegenerative diseases, sensory impairment, and research priorities will continue to be taken until March. Ministers will appear before the Sub-Committee on 22 March.

Members enjoyed visiting a "smart home" at the University of York in November. A model apartment had been equipped with a number of technological aids, to help older people. For example, flood sensors were set up to notify a call centre of an overflowing bath or sink, and a sensor, which would be worn by an occupant, could detect a fall and again alert carers. At the time of writing, Members were about to visit the National Institute on Aging in Washington DC. It is a body that has existed since 1974 to improve the health and well being of older Americans.

Michael Collon (collonm@parliament.uk) is the Clerk of Sub-Committee I.

Energy efficiency

Baroness Perry of Southwark is chairing Sub-Committee II's investigation of the Government's targets for increased energy efficiency. In particular, the Committee is examining the Government's recently published energy efficiency "Plan for Action" which details ambitious reductions in energy use.

Evidence has so far been heard from a wide range of representatives, including from the Carbon Trust and Energy Saving Trust, the UK Energy Research Centre, architects and builders, and energy supply companies. Evidence will be heard until March, covering other sectors including consumer electronics and air conditioning. The Defra Minister, Lord Whitty, will give evidence on March 23.

In December, the Sub-Committee visited the Building Research Establishment, the UK's leading centre of expertise on buildings, construction, energy, environment, fire and risk. Further trips are planned to a renovated Georgian terrace house in Knightsbridge which has substantially reduced its energy demand, and Leicester, which has had a strong commitment to managing its energy resources since the 1970s. Members are also visiting Germany and Sweden in January, exemplars of energy efficiency in Europe.

Christopher Johnson (johnsonc@parliament.uk) is the Clerk of Sub-Committee II.

Further Information

Further information about the work of the Select Committee can be obtained from the Clerk, Christopher Johnson (johnsonc@parliament.uk). A free weekly notice of business of all House of Lords Select Committees is available from Geoff Newsome, 020 7219 6678. The Committee's email address is hlscience@parliament.uk



Parliamentary Office of Science and Technology



Recent POST publications

The future of UK gas supplies

October 2004

POSTnote 230

The UK's gas reserves are declining. Government and industry analysts estimate that by around 2006 the UK will no longer be self-sufficient in gas production and will revert to being a net gas importer from Europe and further afield. Gas is the largest proportion of the UK's primary energy supply, and gas-fired power plants are the main method of power generation. This POSTnote examines the UK's options for dealing with a diminishing domestic gas supply and for ensuring future gas security.

Organ transplants

October 2004

POSTnote 231

Those awaiting organ transplants considerably exceed the organs available. This POSTnote describes this organ (and tissue) "gap". It examines the pros and cons of various options for increasing donation rates including "opt-in" (the current UK scheme) and "opt-out" (presumed consent) and the use of these systems in other countries. Potential alternative treatments for the future, such as stem cell therapies, are not discussed in this note.

UK health impacts of climate change

November 2004

POSTnote 232

The response to climate change, both globally and in the UK, is an issue of public concern. To date, the main focus has been on the likely environmental and economic outcomes. However, there is growing recognition that there may be significant human health impacts. This POSTnote outlines these potential impacts in the UK and examines the options open to public policy makers.

Digital television

December 2004

POSTnote 233

Digital technology is changing the way television is broadcast and watched, with more channels, interactive services and easier recording. The Government is committed to turning the analogue terrestrial television signal off, starting within the next four years, so eventually all television broadcasting will be digital. Over 55% of UK households already receive digital television, but there are many issues that need to be addressed before the switch-over to digital is completed. This POSTnote looks at the implications of and progress towards digital switchover.

Marine nature conservation

December 2004

POSTnote 234

Nearly half of the UK's species are found in its seas but protection of the marine environment has lagged behind that of the land. The Government has recently completed a review of marine nature conservation and has announced its intention to publish a marine bill to better

conserve the marine environment. This POSTnote examines the current state of knowledge about UK marine wildlife, available conservation methods and their effectiveness.

Current work

Biological Sciences and Health

POSTnotes in preparation on Drugs for neglected diseases, The role of Research Ethics Committees, Availability of prescription drugs, Alcohol and public health, and Gene therapy.

Environment and Energy

POSTnotes in preparation on Plutonium: waste or resource?, Materials in housing construction, The bushmeat trade, Recycling household waste, and Carbon sequestration.

Physical Sciences and IT

POSTnotes in preparation on Nanotechnology - risk and opportunity, e-Science and the Grid, Mobile phones, Open source software, and The Militarisation of Space.

Science policy

POSTnote in preparation on Undergraduate science education

Seminars

POST jointly hosted a seminar on Dyslexia and Dyscalculia with the British Psychological Society on November 1st 2004, which is reported on page 37.

POST will host a seminar with OFCOM on March 1st 2005 on New Communication Technologies (4.00-5.30, Macmillan Room, Portcullis House).

Fellows and Interns at POST

Since autumn 2004 POST has been pleased to welcome David Berry (ESRC), Tasmin Mather (NERC), Rosie Smith (NERC), Noelle Kumpel (ESRC), Shefaly Yogendra, Sarah Cant (MRC), Alice Farrands (ESRC) and Loredana Santoro (BPS).

International Activities

Dr Phyllis Starkey MP, Chair of POST's Board, the Director and Dr Jofey Craig represented POST at the annual Council and Conference of the European Parliamentary Technology Assessment network (EPTA), in Paris in October. It was hosted by OPECST, POST's equivalent at the French Parliament, which in 2004 celebrated its 20th anniversary, making it the senior national parliamentary TA office in Europe. The theme of the conference was the European Research Area.

The Director and Board member, Lord Oxburgh, represented POST at the first international "Science and Technology in Society Forum" held in Kyoto in November.

In December the Director was a keynote speaker as guest of the Cairo UNESCO office at the first "Arab Forum on Science, Technology and Innovation Policy, a Parliamentarian's Perspective", where he spoke on the work of EPTA and POST. The Forum agreed to create a permanent Arab Parliamentary Forum and to seek closer ties with EPTA. It was the first in a series of global regional workshops that UNESCO will hold over the next year.

The Director was included in the UK official delegates to attend the UN World Conference on Disaster Reduction in Kobe, January 2005. This was in connection with the start of a POST project, scheduled for the past nine months, on warning systems for natural disasters. Planning for this study, as well as the Conference itself, has of course been overtaken by the Asian Tsunami event of 26th December 2004.

Additional information can be obtained from POST, House of Commons, 7 Millbank, London SW1P 3JA (020 7219 2840).

Also available on the internet at <http://www.parliament.uk/post/home/htm>

Members of either House can obtain free copies of all published material. Others may purchase copies from the Parliamentary Bookshop (020 7219 3890). There is also a subscription service: details from POST



House of Commons Library Science and Environment Section Research Papers

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

Information and copies of papers can be obtained from Susan M Brown at the House of Commons Library on 0207 219 4856 or through www.parliament.uk/parliamentary_publications_and_archives/research_papers.cfm

The Mental Capacity Bill

Research Paper 04/73

This paper discusses the provisions of the Mental Capacity Bill which received its Second Reading in the House of Commons on 11 October 2004. The purpose of the Bill is to provide a statutory framework to protect those lacking capacity, and also carers and professionals.

The Mental Capacity Bill represents the culmination of a long process of policy development and consultation proposing reform of the law governing decision making on behalf of persons who lack capacity. A draft Mental Incapacity Bill was published in June 2003 which was scrutinised by the Joint Committee on the Draft Mental Incapacity Bill. .

LETTERS TO THE EDITOR

Sir,

I was pleased to represent The Royal Academy of Engineering at the recent meeting of the Parliamentary and Scientific Committee. There were excellent presentations and a stimulating discussion. It was appropriate that a major focus of attention was the influences that come to bear on the wider public's perception of risk and how this relates to the more measured assessments made by professionals.

In a recent report of the Academy we identified ten characteristics that influence whether or not people find a risk or hazard acceptable.

-Acts of God or Nature are much more acceptable than acts of Man.

Earthquakes vs chemical plant explosions despite higher fatalities

-Hazards, accidents and failures of public or community enterprises are much more acceptable than those of private, profit making enterprises.

BR vs RailTrack despite the latter's superior safety record

-We will accept risks much more readily if we are in control or have participated in the decisions leading to the risk

Car driver vs passenger

-Risks are unacceptable if we cannot see the concomitant benefits either for some "deserving" group or ourselves.

NIMBY

-Familiarity makes a hazard much more acceptable.

Death in a road accident is more acceptable than potential death caused by radiation. We all fear the unknown.

-A large number of incidents spread over time and space is much more acceptable than if the same number occurred at one time in one place.

Consider the impact on smoking habits if all of the annual deaths from lung cancer took place at one location on one day.

-We feel protective towards the innocent or vulnerable (children and the old).

-Previous track record has an enormous influence on the acceptability of an incident.

Reactions to food scares became hysterical due to earlier mishandling

-Even a modest systems failure in a mysterious, poorly understood operation like a chemical plant raises anxiety about what else is lurking within and is much less acceptable than a major incident in a better understood environment like a ship.

-Response to an incident affects its acceptability. Retreating into defensive denial can often be even less acceptable than the incident.

Exxon Valdez or BSE

There was an excellent presentation on GM Crops at the meeting. It is interesting to test the above list against this issue. It immediately becomes clear why there is so much resistance. But I think that the real value of this list is to help us as technologists to appreciate what we need to think about if we are to get new and potentially contentious technologies accepted by the community. Unless we address the real deeply felt human values and emotions represented by the list, we will be seen as remote, somewhat mad scientists happy to release Frankenstein-like monstrosities on the world.

Revisiting the GM Crops issue armed with this list we readily see why we are in trouble and researchers in the field are abandoning the UK for more friendly climes.

Act of God or Man?

GM is seen very much as man made. Conventional agriculture is seen as "natural". The Prince of Wales skilfully speaks of "playing at God". Much more is needed to explain that agriculture has been a fight against "nature" since the earliest days. The English countryside is no more "natural" than Westminster.

Public enterprise or Private Profit?

We have been persuaded that the real driver is the profit hungry Monsanto.

Level of Control?

The public feels it has no control. Perversely, the extreme acts of Greenpeace et al just add to this feeling. We feel that we have no choice.

Who benefits?

Them, not us.

Familiarity?

All novel technologies face this dilemma. If they are hyped up to be the answer to all problems and truly revolutionary, then we get scared. In reality most sensible developments are based on a foundation of well-proven familiar steps and do not appear out of the blue. GM has been presented as a "gee whiz" breakthrough!

Concentrated or Diffuse?

The nightmare is widespread illness or environmental damage.

Are the elderly or children affected?

Yes!

Previous Track Record

The authorities' record on food scares has not been good. Hopefully the establishment of the Food Standards Agency is helping to fix that, eg recent salmon scare.

Understanding?

There is little or no understanding of GM outside of the experts. There is a lot to be done if acceptance is to be obtained.

Defensive Denial?

There has been lots of this. The previous track record does

not help. Too often the pressure groups seem to have grabbed the initiative and the advocates of research have been driven to address the wrong issues.

I hope that the lessons from this meeting can be carried forward. There is much talk of "trust" these days and its loss, whether from the political system or the management of technology, has very serious and damaging consequences. I hope that the committee will continue to regard this as important and contribute to an improvement in the way that technological developments are presented to the wider public.

John Turnbull
The Royal Academy of Engineering

Sir,

Pesticide Exposures for People in Agricultural Areas.

In the early 1980s, my parents purchased a piece of land in the countryside on which they designed and built their "dream home". They believed this would be a healthy environment to bring up their family and certainly could never have predicted the nightmare it would become.

About a year after we moved in, a local farmer switched use of the surrounding fields to intensive agriculture. We were never warned about the dangers of the chemicals being used and in fact from the age of 11, I would regularly be in the garden when crop-spraying was taking place, with the tractor passing only a few feet away from me.

Throughout the years, I suffered from many debilitating and recurrent illnesses.

By 1991 my health had deteriorated to such a degree that I ended up in hospital with severe muscle wastage, muscle weakness and other chronic symptoms. It was only then that I started to look at what was in our surrounding environment.

I was astonished to discover that the tractor was actually spraying "cocktails" of hazardous chemicals into the air where we live and breathe and even more astonished to find out that a farmer is legally permitted to do so under existing government policy.

Following extensive investigations and research into the history of crop-spraying, I started presenting a case to the Government in 2001 regarding pesticide exposures for people in agricultural areas and the inadequacy and serious fundamental flaws throughout the existing regulations and monitoring system for pesticides.

The current method of assessing the dangers and risks to public health from agricultural spraying, is based on the predictive model of a "bystander" which assumes that there will only be occasional short-term exposure from the spray cloud at the time of the application only. It also assumes exposure will only be to one individual pesticide at any time.

This model is clearly inadequate to address the real-life long-term exposure of a resident living in an agricultural area, repeatedly and frequently exposed to mixtures of pesticides and other hazardous chemicals, throughout every year and in many cases for decades.

The current system does not address long-term exposure to pesticides in the air, chemical fumes, volatilisation, transportation or wider dispersion after application and yet once dispersed, pesticide particles and droplets cannot be controlled, they are airborne contaminants and can travel considerable distances. Studies have shown pesticides

located miles away from where they were originally applied.

Therefore even though crop-spraying has been a predominant feature of agriculture for over 50 years, there has never been an appropriate or realistic assessment of the risks to health for people who actually live in agricultural areas and yet pesticides are not supposed to be approved for use until risk assessments have been undertaken to provide evidence that there will not be a health risk.

I have been contacted by people from all over the country reporting acute and chronic long-term illnesses and diseases in rural communities. I also receive reports from people all over the world, as this is an international problem and is not just confined to the UK and the EU.

The most common illnesses reported include various cancers, leukaemia, non-Hodgkins lymphoma and neurological problems, along with many other medical conditions. Reports of this nature have gone on for decades and yet in relation to the UK there does not appear to have been any monitoring for chronic effects and acute effects are commonly dismissed by Government agencies/advisors as being unrelated to pesticide exposure.

On April 23rd 2004, a comprehensive pesticide literature review by the Ontario College of Family Physicians found consistent evidence linking pesticide exposure to brain, kidney, prostate and pancreatic cancer as well as leukaemia, non-Hodgkins lymphoma, neurological damage, Parkinson's disease and other serious illnesses and diseases. The review found that children are particularly vulnerable to the effects of pesticide exposure.

The authors concluded that the literature does not support the concept that some pesticides are safer than others and recommended that people avoid exposure to all pesticides whenever and wherever possible.

On June 16th 2004 Alun Michael, Defra Minister for Rural Affairs, announced that he had requested a special study to be undertaken by the Royal Commission on Environmental Pollution to assess the risk to people from crop-spraying. This study is due to be published in June 2005.

The principal aim of pesticide regulation is supposed to be the protection of public health, therefore this has to be the

overriding priority and must take absolute precedence over any financial, economic or other considerations.

Residents and others in the countryside deserve to be protected from avoidable and unnecessary exposures and risks to their health. Substantive evidence already exists to demonstrate a serious public health problem and therefore the significance of these consequences requires the adoption of a preventative approach.

The only responsible course of action for the EU and UK Government to take is an immediate ban on crop-spraying and the use of pesticides near homes, schools, workplaces and any other places of human habitation and direct access for the public to all the necessary chemical information. The overall solution is through the widespread adoption of sustainable non-chemical and natural methods to protect not only public health, but also the wider environment for now and for future generations.

Georgina Downs – UK Pesticides Campaigner.
For further information please see
www.pesticidescampaign.co.uk

Sir,

British Metrication

A hundred years after their Revolution which introduced the Metric System and sixty years after it was officially enforced in 1840 the French were still reluctant to use it. In his Presidential Address to the members of the Institution of Electrical Engineers on 12 November 1903, Mr Robert Gray told his audience that:

“In France today, precious stones are bought and sold in carats; firewood in cordes; milk in pintes; gravel in toises; grain, potatoes and charcoal in boisseaux; wine in barriques, feuilletes, demi-setiers and chopines; wood for construction in pieds, pouces and lignes; beer in canettes and pots; sugar and coffee, among the poor people, in livres, demi-livres etc. Cattle dealing is in pistoles and ecus, and not in francs. Finally, the French Government has just issued a twenty-five centime piece, doubtless because it represents a quarter of a franc.”

Robert Freer

REPORTS ON MEETINGS

The Sixth Annual FRAME Lecture

“Animals and Alternatives: Societal Expectations and Scientific Need” was the title of the Sixth Annual FRAME Lecture delivered at The Kennel Club on Wednesday 6 October by Professor Alan M Goldberg, Director, Johns Hopkins Center for Alternatives to Animal Testing (CAAT), Johns Hopkins University, Baltimore, USA. Lord Soulsby, Patron of FRAME, welcomed the assembled company on behalf of the Fund for the Replacement of Animals in Medical Experiments (FRAME).

FRAME considers that the current scale of animal experimentation is unacceptable. However, it is recognised that immediate abolition of all animal experiments is not possible. Vital medical research must continue to find treatments for diseases which lessen the quality of human and animal life. New consumer products, medicines, and industrial and agricultural chemicals must be adequately tested in order to identify potential hazards to human and animal health, and to the environment.

FRAME advocates the Three Rs approach to this dilemma, proposed by Russell and Burch, where Replacement of animals in scientific procedures, Reduction of animal use and Refinement of procedures and housing to reduce suffering, are the three principles accepted world-wide which form the basis of all attempts to find alternatives to animal use in experimentation. Their long-term goal is the total elimination of laboratory animal use through the development, validation and acceptance of replacement alternative methods. Until this goal is reached, they also support efforts to reduce the numbers of animals used through better science and better experimental design, and to refine procedures so that the suffering of any animals necessarily used is minimised. FRAME seeks to promote a moderate, but nonetheless determined, approach by encouraging a realistic consideration of the ethical and scientific issues involved and the widest possible adoption of the Three Rs. In his talk Professor Goldberg briefly described the work of CAAT, which was founded in 1981, and is the US national centre for all work pertaining to introduction of the 3Rs. Currently 200 people around the world take the course on Humane Science which is available free on line at <http://caat.jhsph.edu>.

The complete 6th Annual FRAME lecture by Professor Goldberg is also available on the Johns Hopkins website as a PDF file, at <http://caat.jhsph.edu/pubs/articles/FRAME2004.pdf>

Dyslexia and Dyscalculia

On Monday 1 November The British Psychological Society (BPS) hosted a Seminar in Committee Room 16, Palace of Westminster from 6.30 to 7.30 to publicise a POSTnote prepared by Polly Dalton on secondment to the Parliamentary Office of Science and Technology (POST), and funded by BPS. This was followed by a reception in the Astor Suite, 1 Parliament Street.

The speakers on this occasion were Professor Margaret Snowling, Department of Psychology, University of York, speaking on "Dyslexia: Risk and Protective factors"; Professor Brian Butterworth FBA, Institute of Cognitive Neuroscience, University College, London, on "Dyscalculia: the unrecognised handicap"; and Miss Jean Gross, Senior Director, Achievement and Inclusion, Primary National Strategy on "Educational approaches to dyslexia and dyscalculia". In the chair was Dr Pam Maras, Chair of the Publications & Communications Board, The British Psychological Society.

Dyslexia is a learning difficulty involving problems in acquired literacy skills. Dyscalculia involves specific difficulties in acquiring arithmetical skills. Dyslexic and dyscalculic learners may have educational needs that differ from those of other learners. Strategies to improve literacy and numeracy might therefore benefit from taking these groups into account. This POSTnote presents recent research on dyslexia and dyscalculia and outlines current educational policies relating to both. It also examines issues such as early identification and ongoing support for dyslexic and dyscalculic students throughout their education.

Domestic Tradable Quotas – Tackling Climate Change with your Personal Allowance of Carbon.

On 8th July 2004 Colin Challen MP introduced a Private Members Bill in the House of Commons entitled The Domestic Tradable Quotas (Carbon Emissions) Bill, and at a subsequent meeting in Portcullis House on 24 November 2004 Dr Richard Starkey from the Tyndall Centre for Climate Change presented a Briefing Note on Domestic Tradable Quotas which he had prepared together with Dr Kevin Anderson. The meeting was hosted by Colin Challen MP and the initial speakers were Michael Meacher MP and Matt Thomas of Npower.

The Government recognises that dealing with the problem of Climate Change has become a matter of priority and the promoters of this Bill recommend a system of Domestic Tradable Quotas (DTQs) as a means of solving the problem. The principle of DTQs is to develop a national system of controlling carbon emissions by placing an annual limit on the total amount of carbon dioxide which we in this country should release into the atmosphere each year, and then dividing it equally among everyone in the country. The system would give everyone a personal allocation of carbon units which they would use every time they buy fuel in any form including gas, electricity and petrol. Those who use less than their allocation of carbon units could sell the surplus to those who use more.

Each year the national carbon emissions allocation would be reduced so that eventually we would meet our target of a 60% reduction in greenhouse gases by the year 2050, which the Government considers would be a safe level to

minimise the effects of global warming. A successful introduction of DTQs in this country could be extended world wide as an international system for reducing carbon emissions.

In opening the meeting Mr Challen said that although the effects of Climate Change were important for all of us the politicians cannot run ahead of the electorate, for instance an adviser to the Russian Government was reported to be welcoming climate change because it might make more of Siberia habitable. In Europe a move towards a carbon tax is probably not possible at present and a potential danger with the Emissions Trading Scheme is that carbon quotas will be dumped on the developing world and the developed world will continue with business as usual. Mr Challen explained that the idea for a personal carbon allowance had been around since the mid 1990s but it is only recently with the advent of industrial and European wide Emissions Trading Schemes (ETS) that the possibility has caught on that the principle of the ETS could be extended to private individuals. Thirty years ago we lost our national lead in wind power and today we risk losing our lead in wave and tidal power. In the future we have the opportunity to export ideas and techniques rather than equipment and products.

Mr Meacher, in supporting the idea of DTQs, emphasised the importance of Climate Change on the 24 million households in this country and the need to achieve the Government's targets for a reduction in greenhouse gas emissions. Collapse of the ice caps, rising sea levels, retreating forests and increased insurance premiums are going to affect us all. Mr Blair's presidency of the EU and the G8 is an opportunity to make the public more aware of this problem.

Mr Thomas focused on the challenges and opportunities for energy suppliers such as Npower. As a nation we need to use less energy and to use energy from clean sources. Between 2002 and 2005 Npower had invested £20 million in energy efficiency and is planning to invest £60 million between 2005 and 2008. Npower together with Greenpeace has set up a company called Juice to supply energy from renewable sources. In 3 years they have acquired 40,000 customers and intend to increase this to 200,000 customers by 2010. Npower is also conducting a trial of solar pv panels with 200 customers to try to integrate the output into the Grid and to pay the customers, but there is more work to be done to accommodate micro-generation within the supply system.

Dr Richard Starkey presented a summary of the research work the Tyndall Centre has been doing on DTQs since 1997 following the initial work of David Fleming who established the idea. DTQs are intended to achieve three objectives, the three Es; Equity, Effectiveness and Efficiency. Equity is achieved by ensuring everyone shares equally in the national emission rights and allowance of carbon, and the carbon rights are allocated directly to the individual. Some people will need more carbon units according to their circumstances including those affected by the three Cs; Countryside, Children and Climate. It is not intended that children should receive carbon units directly but those with children will need extra units. The administrative procedures of using the carbon units might require the Government to keep a record of everyone's allocation and subsequent transactions to avoid fraud, but the technology is believed to be within the present capacity of the industry. Although Dr Starkey recognised that in the words of the Home Affairs Committee the Government's record on the procurement of large IT systems is "not encouraging".



Debates and Selected Parliamentary Questions & Answers



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

A full digest of all Debates, Questions and Answers on topics of scientific interest from 11th October to 21st December 2004 from both Houses of Parliament appears on pages 43 to 50.

Health

MRSA (Hospitals)

Debate in Westminster Hall on Wednesday 13 October

Mr John Lyons (Strathkelvin and Bearsden) stated that the National Audit Office reported that about 5,000 people a year are killed in hospitals, at a cost to the NHS, according to the NAO, of £1 billion a year, a fact that is obviously of major concern to politicians, staff and, of course, patients. It is creating a situation in which constituents throughout the country are now worried about even going into hospital; something must be taken on board and changed. This can only be done by improving the problem of MRSA in all acute trusts in the United Kingdom. The only political point to be made is that when sisters, matrons and nursing staff are asked what they feel about MRSA, they say they are unhappy about not having control of cleaning staff. Cleaning is a central and crucial issue in the fight against MRSA and the response must address four issues: hand hygiene, antibiotic prescriptions, hospital cleaning and rapid testing for MRSA in hospitals.

Mr Archie Norman (Tunbridge Wells) reported that BUPA hospitals have a negligible incidence of MRSA, a disease that results from the way in which hospitals are managed, which in the early and pre-NHS days were obsessive about discipline. Cleanliness must be a total culture. However, in 2003 no NHS hospital had a poor cleanliness record (basically visual measures), with 78.7 per cent of hospitals described as having "good" cleanliness records, yet there is a continuously rising and internationally high level of MRSA. Hence this essentially visual inspection method is missing the point and must be changed with more investment in measuring MRSA incidence and its prevalence in the wards.

The Parliamentary Under-Secretary of State for Health (Miss Melanie Johnson) replied that MRSA has become a greater problem in the UK because the strains responsible for most of the infections here are better adapted to spreading between patients than in other countries. Hand hygiene is important. In September the first ever national hand hygiene campaign was launched. Handrubs will be required at all staff-patient contact points. It is important that matrons and ward sisters are in control of cleaning staff, who form part of the ward team, and to make sure that they are able to maintain and have oversight of the wards. The problem is cultural but hospitals have incentives and resources to tackle the problem in a fundamental way.

Medicinal Cannabis

Debate in the House of Commons on Thursday 14 October

Peter Bradley (The Wrekin) elaborated an exceptional case for medicinal cannabis based on experience in the campaign to legalise medicinal cannabis for those such as Kate Bradley (no relative) a drug squad officer with West Midlands police until medical retirement due to multiple sclerosis. The one medicine that works for her is cannabis and she is now forced to procure what she regards as her medicine in her wheelchair on the streets from the kind of people whom she was locking up a few years ago. The problem is that she cannot obtain a suitable supply of her medicine, thereby suffering physical torment and bitter humiliation in the process.

The Parliamentary Under-Secretary of State for the Home Department (Caroline Flint) replied that the Government are committed to take the necessary procedures to ensure that if a suitable product derived from cannabis can be licensed, it can be provided as a product for people suffering from illnesses that mean that they would benefit from such a drug. Cannabis was reclassified to class C because it is relatively less harmful than drugs in classes A and B. It is not a harmless drug. The Medicines and Healthcare products Regulatory Agency (MHRA), an executive agency of the Department of Health, has been assessing an application made by GW Pharmaceuticals for its cannabis-based product, Sativex. We hope there is a speedy conclusion to the agency's investigation into Sativex as a possible solution to many people's pain. The importance of this issue to many people is recognised which should be resolved as soon as possible and a meeting will be convened with Lord Warner, the Under-Secretary of State for Health to see what can be done to bring the issue to a conclusion more quickly.

Diabetes

Debate in the House of Commons on Tuesday 16 November

Mr David Amess (Southend, West) stated that it was his good fortune to be able to debate diabetes with the Minister on the day that the Government introduced the White Paper on public health, since obesity is very closely linked to the increase in diabetes. According to Diabetes UK, since 1996 the number of people diagnosed with diabetes has increased from 1.4 million to 1.8 million and it is estimated that almost 3 million people will be suffering from diabetes by the end of the decade. There has been a huge increase and almost 1 million people are

undiagnosed. There are two types of diabetes. Type 1 is insulin-dependent with an early onset in childhood. It is not associated with obesity. Type 2 diabetes is non-insulin dependent and has a later onset. Patients still produce some insulin, but that is inadequate. Blood sugar levels are controlled through diet, exercise, medication or different combinations of these and is very much associated with obesity. Around two-thirds of the population of England are overweight or obese. Obesity has grown by almost 400 per cent in the last 25 years and on present trends will soon pass smoking as the greatest cause of premature death. It will entail levels of sickness that will put enormous strains on the health service. On some predictions today's generation of children will be the first for more than a century for whom life expectancy falls. The economic costs of obesity are between £3.3 billion and £3.7 billion a year. Most of the 1.8 million diabetics in the UK are diagnosed with type 2 diabetes. That is absolutely shocking testimony to the way things are.

The Parliamentary Under-Secretary of State for Health (Dr Stephen Ladyman) in his response congratulated Diabetes UK on its work in the community raising awareness and supporting those who have the condition. Research is ongoing into the best means of screening for type 2 diabetes. The Medical Research Council is the body that would provide Government funding for general research. Type 2 diabetes tends to run in families and is more common in Asian and African-Caribbean communities. When researching for the speech, the most horrifying statistic uncovered was that diabetes is estimated to account for 5 per cent. of total NHS spending – a huge amount of money spent on a single condition. The population comprises a complex cultural mix that is becoming more overweight, obese and inactive and more prone to diabetes, hence the national service framework (NSF) for diabetes was published in December 2001. Good progress is already being made by the Diabetes NSF. For example 86 per cent of Primary Care Trusts are part of a whole system diabetes network. In July 2004 a new joint public service agreement target was set for the Department of Health, the Department for Culture, Media and Sport and the Department for Education and Skills, aiming to halt the year on year rise in obesity among children under 11 by 2010 in the broader strategy to tackle obesity in the population as a whole.

AIDS/TB/Malaria (Global Fund)

Debate in Westminster Hall on Tuesday 16 November

Dr Gavin Strang (Edinburgh, East and Musselburgh) drew attention to the Global Fund to Fight AIDS, Tuberculosis and Malaria. The millennium declaration stated in September 2000 that goal number six is to combat HIV/AIDS, malaria and other diseases. About 190 countries have signed up to the millennium goals and the Department for International Development has made them the main focus of its work. The associated targets and indicators commit the international community to halt and begin to reverse the spread of HIV/AIDS, malaria and tuberculosis by 2015. In April 2001 Kofi Annan announced his proposal for a global fund supported in

June 2001 by the United Nations General Assembly, followed in July 2001 by the launch of a new Global Fund to Fight AIDS, Tuberculosis and Malaria at the G8 summit. In June 2002 the Global Fund board approved the first round of grants to 36 countries. It has approved \$3 billion of grants to more than 300 programmes in more than 120 countries. The Global Fund is not the only weapon against AIDS, TB and Malaria. The £150 million promised by the UK to the Global Fund is only a part of the £1.5 billion that the UK will spend on the international fight against HIV/AIDS over the next three years. The Global Fund has got off to a reasonable start and substantial sums have been raised, awarded and disbursed to combat these three diseases which cause more than 6 million preventable deaths every year.

The Parliamentary Under-Secretary of State for International Development (Mr Gareth Thomas) in his response pointed out that there are 60 million people with AIDS hence the UK recently published its strategy on HIV/AIDS for the next three years in support of the global effort scale-up on the epidemic in the developing world. TB is the fourth most common cause of death from communicable disease, and multi-drug resistant TB is an increasing problem. About 100 countries have malaria. The three epidemics feed off each other.

The UK works with and funds the work of other equally crucial international bodies, including UNAIDS, the World Health Organisation and UNICEF and organisations such as the Gates Foundation, the Clinton Foundation and major pharmaceutical companies, especially to increase access to and reduce the cost of drugs. Support is also given to key non-governmental organisations. The work of Christian Aid and the International HIV/AIDS Alliance is greatly appreciated.

Hospital-acquired Infections

Debate in the House of Lords on Wednesday 1 December

Baroness Gardner of Parkes rose to call attention to Government health policies, with particular reference to initiatives designed to reduce hospital-acquired infections. This debate could well be called a debate on hospitalism, the name applied in the mid-19th century to the often fatal post-operative infection. "The operation was a success, but the patient died," was the famous saying. Now we have hospital-acquired infection. In the 1950s, strains of staphylococcus aureus became resistant to penicillin and by the 1960s strains were developing resistance to a stronger antibiotic, methicillin. This resistant strain, methicillin resistant staphylococcus aureus is now commonly known as MRSA. The only treatment now is with an even more powerful antibiotic, vancomycin, which has unfortunate renal side effects. Resistance to that, vancomycin resistant staphylococcus aureus, VRSA, is now being reported. The National Audit Office says that the best estimate for the cost of hospital-acquired infection or "hospitalism" is around £1 billion a year.

Lord Soulsby of Swaffham Prior pointed out that the European Antimicrobial Resistance Surveillance System in 2002 identified the United Kingdom as having the highest

level of resistant MRSA bloodstream infections as a proportion of all staphylococcus aureus bloodstream infections in Europe – that is, 43.9 per cent. Nearly 50 per cent of all bloodstream aureus infections were resistant. That is compared with the system in Sweden where the figure is 0.7 per cent and in Denmark where it is 0.9 per cent. Those two countries have both taken very strong measures to control antibiotic resistance in general, including the abolition of the use of antibiotics as growth promoters in livestock. This may seem a long way from resistance in hospitals but there most likely is a connection because there is an increasing and massive environmental contamination of the genes of resistant organisms generally spread throughout the environment, derived from massive use of antibiotics in medical, veterinary and horticultural circumstances. This can be called genetic zoonosis, whereby the genes of the resistant organisms are very widespread. It should be remembered that there is a far greater population of bacteria – the commensals – that are also exposed. They become resistant and transmit resistance to other commensals and other pathogens. That is an increasing problem that Defra is now taking up to study in greater detail. One consequence is the reluctance

of major pharmaceutical companies to invest in new antibiotics in view of the cost and the short clinical life due to antibiotic resistance. The Infectious Diseases Society of America has stated that as antibiotic discovery stagnates, a public health crisis brews.

Lord Warner stated that tackling healthcare-acquired infections is a key priority for the Government. MRSA infections are not spread equally across the NHS. One fifth of trusts account for almost half of all MRSA bloodstream infections and around 80 per cent of all MRSA cases are concentrated in around 50 per cent of hospital trusts. The cleanliness figures from 2003 show that 78 per cent of trusts were assessed as “good” on cleanliness and 22 per cent as “acceptable” showing a significant improvement on previous periods. A cleaning manual has been issued to the NHS setting out the best ways to clean hospitals. The Government is determined to reduce healthcare-associated infections by creating extra capacity in the NHS and implementing an evidence-based programme to identify the actions which will make a difference and drive these forward by setting clear targets and offering support to trusts which need help.

Energy

Renewable Energy

Debate in Westminster Hall on Tuesday 16th November

Ian Lucas (Wrexham) stated that the renewables obligation seeks to ensure that 10 per cent of our electricity is produced from renewable sources by 2010. According to the DTI's digest of UK energy statistics, during the year to 31 March 2004, 3.3 per cent of UK energy was attributable to renewable sources. Progress in the UK is overwhelmingly in the sphere of wind power; however the Campaign for the Protection of Rural Wales has a particularly negative attitude to onshore wind power. Even offshore wind power is causing a great deal of controversy. Wind is becoming an increasingly controversial renewable energy source and the renewables obligation needs to be refined to allow other forms of renewable energy to prosper.

Mr Andy Reed (Loughborough) asked whether in addition to producing renewables through wind turbines, was it not also important that British industry succeeds in providing these turbines? DeWind in his constituency has now ceased operating in the wind turbine market as it was unable to secure contracts in the UK and abroad. The big players are squeezing out some of the new companies. Fiscal measures are needed to assist British firms on making use of the growth in renewables and benefiting local economies.

Ian Lucas (Wrexham) was delighted that the Sharp Manufacturing Company of Japan had recently opened its European manufacturing base for photovoltaic cells in Wrexham, although the prime market for these cells is not the UK, but Germany, as most of the PV cells produced in Wrexham are exported due to the

phenomenal success of the 100,000 roofs programme there. Capacity in photovoltaic electricity increased from 40 MW in 1997 to 400 MW by 2003, with a 50% market growth in 2003. The German government, in contrast with the UK, concentrated on revenue rather than capital support. They specified a fixed long term price for electricity produced from PV cells that brought certainty to the market for PV manufacturers, whereas in the UK it takes 70 years to recover installation costs, compared with only 17 years in Germany. He concluded that he looked forward to PV cells being as commonplace as double glazing and he was sure that a way could be found to encourage a more diverse renewables base in the UK.

The Economic Secretary to the Treasury (John Healey) pointed out that the policies under review arose from the energy White Paper of February 2003 and the four goals therein: to cut carbon dioxide emissions by 60 per cent by 2050, maintain reliability of energy supply, promote competitive markets in the UK and beyond and ensure every home is adequately and affordably heated. Early indications are that the renewables obligation is working well, with investor confidence growing. In 2003, 2.2 per cent of electricity was supplied by sources that are eligible under the renewables obligation and it is expected that by 2010 wind will provide 7 to 8 per cent and, of this, half will be from onshore sources with the rest coming from large-scale hydro and landfill gases. A review of the renewables obligation will begin soon in 2005-6 and take account of carbon prices under the new EU emissions trading scheme. The DTI (not the Treasury) is leading the review for completion by December 2005. A central consideration will be delivery of the 2010 target.

Hydrogen Technology

Debate in House of Commons on Monday 20 December

Mr Alistair Carmichael (Orkney and Shetland) stated that the Promoting Unst Renewable Energy – PURE – project in Shetland uses renewable energy to produce hydrogen by electrolysis to provide a direct fossil fuel substitute. It has shown that it is technically possible to produce the island's energy needs without any carbon emissions and for the local community to own the means of production and thereby empower some of the most economically fragile and peripheral communities. The project demonstrates the production of hydrogen from wind power, the storage of wind power in the form of hydrogen, the conversion of stored hydrogen back to electricity available on demand and the use of automotive fuel for a car converted to run on hydrogen by a Shetland graduate. However, in comparison with the United States, Canada, Germany and Japan the UK Government's commitment has so far been lukewarm and public investment minimal leaving the UK behind other countries in developing a hydrogen economy.

The Minister for Energy and E-Commerce (Mr Mike O'Brien) in his response indicated that commercialisation of exclusively cell-driven vehicles is unlikely before 2020. The Department of Trade and Industry recently commissioned a study to develop a strategic framework for hydrogen energy. The Department is also working very closely with the US Government who have embarked on a significant programme to create an international strategy in order to drive forward broad-based scientific knowledge. The potential for the future long-term development could be quite significant. Hydrogen is of particular relevance to remote areas of the UK with strong renewable energy resources. The UK Sustainable Hydrogen Energy Consortium established under the Supergen programme is undertaking research on solid state hydrogen storage and techno-socio-economic analysis on the hydrogen economy. The Department of Trade and Industry is the champion department for the hydrogen highway in which the UK hopes to take a leading role in taking forward the development of hydrogen energy.

Information Technology

Critical National Infrastructure

Debate in the House of Lords on Thursday 9 December

Lord Harris of Haringey rose to ask Her Majesty's Government whether they are satisfied with the ability of the critical national infrastructure (CNI) to withstand cyber-attack. On 4 May 2000 the "Love Bug" virus caused the parliamentary network to be shut down. In 2003 the "Slammer" worm infected more than 300,000 servers in less than 15 minutes, the "Blaster" worm infected more than half a million PCs, the "Sobig" worm turned tens of thousands of PCs into a network sending out spam, and the "Welchia" and "Nachi" worms disabled corporate networks for several days.

The National Infrastructure Security Co-ordination Centre (NISCC) holds a pivotal role dealing with these issues, although it is only an advisory body with each element of the CNI responsible for its own defence. For example, the Ministry of Defence has reported 71 instances when malicious programs compromised the security of its system. One of those was the LovGate virus that affected more than 4,000 MoD computers at more than 30 sites, that took 4 weeks to eliminate. The Coastguard Service also fell victim to the "Sasser" worm through failure to implement a Microsoft patch in a timely manner.

The NISCC is an ad hoc inter-agency group with no statutory basis, with both its funding and future unsecured, with inadequate resources to conduct its mission on a 24/7 basis. The work of the NISCC is not criticised but some regulation is thought to be necessary. The Government should be able to establish minimum standards for the design and operation of the components of the CNI and there should be a system of certification of each operator's arrangements with facilities for validation and security testing.

Lord Bassam of Brighton thanked all contributors to the short but very valuable debate. The CNI consists of 10 sectors – communications, energy, finance, government and public services, water and sewerage, health, emergency services, transport, hazards and public safety, and food. The remit of NISCC is to minimise the risk of electronic attack against the CNI. Both Government and private sector inputs are combined to advise Government on the ability of the CNI to resist electronic attack on a 24/7 basis. The UK is a leader in this important field that others wish to emulate. These include information sharing. The NISCC hosted the first European conference on supervisory, control and data acquisition (SCADA) issues. Another information sharing concept on warning, advice and reporting points (WARPS) – encourages formation of self-help groups outside the CNI. NISCC started the Aviation Security Information Exchange and works with London Underground, Network Rail, Transport for London and Eurotunnel.

The NISCC is interdepartmental with about 90 civil servants engaged full time who work with additional private sector staff. In addition, the High Tech Crime Unit, a partner agency with the NISCC, was established within the National Crime Squad which together with the recently established Serious Organised Crime Agency will also help in future. A department of homeland security is therefore not required. Ministerial accountability is distributed, with the Home Secretary leading at Cabinet Level, supported by Nick Raynsford as Minister for civil resilience, Hazel Blears as Minister for counter-terrorism and Ruth Kelly as Minister responsible for the Civil Contingencies Secretariat. The Cabinet Office co-ordinates activity across Government under the Security and Intelligence Co-ordinator, Sir David Omand, thus providing a clearly understood and definable structure.

Environment

Marine Environment

Debate in the House of Lords on Monday 13 December

Baroness Miller of Chilthorne Domer rose to ask Her Majesty's Government what is the current state of the marine environment and what progress has been made in establishing a marine landscape classification. Successive Governments have given the marine environment pathetically little attention and the attention given by the media to the report of the Royal Commission on Environmental Pollution (RCEP), *Turning the Tide*, is warmly welcomed. The report addresses the impact of fisheries on the marine environment. Its conclusions make stark reading although it is not the first to raise the alarm about the appalling state of the marine environment and the very pressing need for Government action. The UK Government must act urgently and do everything within its power, while negotiating the reform of the common fisheries policy, to make some of the changes that they have the power to make in UK waters because fish stocks are certainly in crisis. There has been a crash in fish stocks so serious that we face the death of an ecosystem. That will affect not only marine life but all life that depends on the sea, such as sea birds and the fishing communities themselves. Work in Lyme Bay to regenerate the whole of the bay for the benefit of local fishing communities and in the Irish sea on mapping the underwater environment to protect fish spawning grounds have both been successful. Sustainable solutions such as these are needed which can be managed with local involvement by local fisheries committees.

Baroness Farrington of Ribbleton thanked all those who had taken part in the debate. The Government's vision for the marine environment is a simple one – clean, healthy, safe, productive and biologically diverse oceans and seas, as set out in the first Marine Stewardship Report in 2002, together with a package of reviews and initiatives seeking to turn this vision into reality.

On the other hand, current common fisheries policy regulation leads to discards of fish, that must be addressed. Many commercially exploited fish stocks are in a seriously depleted state due to overfishing. Bottom trawling damages fragile marine habitats resulting in high mortality rates among cetaceans such as dolphins and porpoises in the by-catch. The Prime Minister's Strategy Unit report on a sustainable fishing industry for the UK, *Net Benefits* published last March makes wide-ranging recommendations on fisheries policy. The report of the Review of Marine Fisheries and Environmental Enforcement was published in July. Concerning enforcement against foreign fishing vessels, sea fisheries committees only operate within the zero to six-mile zone where foreign vessels are not allowed to fish. Beyond the six-mile limit enforcement is carried out by the Sea Fisheries Inspectorate where all vessels are treated similarly. The RCEP report will be given careful consideration. Withdrawal from the common fisheries policy will not solve any of the current problems.

Education

Exeter University

Written Answer given on 14th December to questions to the Secretary of State for Trade and Industry from Dr Ian Gibson (Norwich N) and Dr Brian Iddon MP (Bolton SE)

Ms Hewitt: Officials in the Department were informed of the proposed closure of Exeter's undergraduate chemistry provision in early November by officials at the Department for Education and Skills (DfES). DfES was advised informally by the Vice-Chancellor of the proposed closure in early November, prior to the formal announcement on 22 November.

My noble Friend, the Parliamentary Under-Secretary of State for Science and Innovation, has discussed this issue with both the Higher Education Minister at the Department for Education and Skills and the Chief Executive of the Higher Education Funding Council for England.

Both my noble Friend and I have received representations from the Royal Society of Chemistry. Lord Sainsbury met with the Royal Society of Chemistry on 8 December. A small number of letters from other HE institutions, students, staff, and individuals have also been received. There have been no representations from either business or the South West Regional Development Agency.

Higher education institutions (HEIs) are autonomous organisations and as such are responsible for their own academic direction and strategic use of funds. The decision to close undergraduate chemistry provision is therefore a matter for Exeter university alone. I understand that Exeter

university is working very closely with students to ensure that all their individual needs are met. The Higher Education Funding Council for England (HEFCE) will continue to monitor the situation closely.

The Department has not received any reports of other university chemistry departments that may be experiencing financial difficulty.

The quality of chemistry research in English universities has increased significantly. 50 per cent of departments were rated 5 or 5* in the 2001 Research Assessment Exercise (RAE) compared with only 20 per cent in 1996. However, recognising concerns about future capacity to teach certain key disciplines, on 1 December the Secretary of State for the Department for Education and Skills wrote to HEFCE requesting advice on higher education subjects or courses of national strategic importance, including chemistry, where intervention might be appropriate to strengthen or secure them. HEFCE will be entering into a strategic dialogue with universities, colleges, employers and other partners to consider this matter.

Science and innovation is one of my Department's key priorities: we will therefore continue to work closely with DfES, the Funding Councils and others to provide a robust, world-class research base, and delivering the Government's vision for science and innovation set out in the Science and Innovation Investment Framework 2004–2014.

Our Departments and the Higher Education Funding Council for England will continue to work closely together on this issue.

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11th October – 21st December 2004

The references are to Hansard, giving first the date of publication, either HoC (House of Commons) or HoL (House of Lords), and finally the column number in Hansard.

*Denotes selected Debates and Questions and Answers of particular interest which are reproduced on pages 38 to 42.

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Mine Methane – 13.10.04 HoC 317W & 18.10.04 HoC 545W
Mining – 20.12.04 HoC 1403W
Electricity – 10.11.04 HoC 763W
Generation – 4.11.04 HoC 358W
Energy Efficient Buildings (EU Directive) – 11.11.04 HoC 844W
Policy – 26.10.04 HoC 1273 & 4.11.04 HoL 423
Projections – 2.11.04 HoC 207W
Research – 1.11.04 HoC 86W
Supplies – 30.11.04 HoC 76W
Fallow Field Initiative – 4.11.04 HoC 362W
Fuel Generation (Research and Development) – 21.10.04 HoC 877W
Gas – 4.11.04 HoC 363W
Gas (EUC Report) – debate – 5.11.04 HoL 577

Hydrogen Power – 27.10.04 HoC 1243W
 * Hydrogen Technology – adjournment debate – 20.12.04 HoC 2039
 Liquid Gas – 16.11.04 HoC 1306W
 Nuclear Energy/Industry – 4.10.04 HoC 1854W
 Nuclear Fusion Reactor (France) – 18.11.04 HoC 1934W
 Nuclear Power – 30.11.04 HoC 479
 Oil Usage – 16.11.04 HoC 1307W
 Orimulsion/Shale Oil – 17.11.04 HoC 1624W
 Power Stations – 8.12.04 HoC 595W & 16.12.04 HoL 1421
 Solar Panels – 4.11.04 HoC 355W
 Solar Power – 16.11.04 HoC 1309W
 Trans-European Energy Network – 11.11.04 HoC 835W
 Water Turbines: River Thames – 18.11.04 HoL WA213

Energy (Renewables)

Biodiesel – 15.11.04 HoC 982W
 Carbon Savings – 27.10.04 HoC 1238W
 Developing Countries – 17.11.04 HoC 1520W
 Electricity Generation (Renewables) – 7.12.04 HoC 466W & 8.12.04 HoC 590W
 Energy – 18.11.04 HoC 1915W
 Energy Crops – 21.10.04 HoC 1006
 Marine Development Fund – 11.10.04 HoC 122W
 Energy Extraction – 19.10.04 HoC 648W
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 Renewable Energy – 11.10.04 HoC 112W, 19.10.04 HoC 650W, 19.10.04 HoC 677W, 21.10.04 HoC 881W, 8.11.04
 * HoC 461W, 16.11.04 HoC 405WH, 30.11.04 HoC 81W, 2.12.04 HoC 225W, 7.12.04 HoC 473W, 9.12.04 HoC 1267 & 15.12.04 HoC 1128W
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 Tidal Lagoons – 16.12.04 HoL 1419
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 Farms – 7.12.04 HoC 476W & 8.12.04 HoC 598W
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Environment Protection

Aggregates – 14.12.04 HoC 1046W
 ASSIs – 16.11.04 HoC 1353W
 Common Land (SSSIs) – 8.11.04 HoC 445W
 Conservation Areas – 21.10.04 HoC 829W & 9.11.04 HoC 577W
 Environmental Pollution Royal Commission – 15.12.04 HoC 1101W
 Environmental Regulation – 15.12.04 HoC 1102W
 Flooding – 11.10.04 HoC 92W
 Hedges – 21.10.04 HoC 837W
 * Marine Environment – 13.12.04 HoL 1157
 Marine Planning – 4.10.04 HoC 1937W
 Offshore Wind Farms – 11.11.04 HoC 833W

Sonar 2087 – 21.10.04 HoL WA92
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Environmental Pollution

Air Pollution – 18.11.04 HoC 1995W
 Air Quality – 11.10.04 HoL WA30, 13.10.04 HoL WA60, 19.10.04 HoL WA78 & 1.12.04 HoC 119W
 Carbon Dioxide Emissions – 9.11.04 HoC 565W
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 Hazardous Waste (Substitute Fuels) – 15.11.04 HoC 1018W
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 Incineration – 15.11.04 HoC 1022W
 Nitrates – 15.12.04 HoC 1103W
 Noise (Environmental Pollution) – 8.11.04 HoC 492W
 Oil Pollution – 13.12.04 HoC 808W & 15.12.04 HoC 1104W
 Ozone – 6.12.04 HoC 357W
 Pesticide Run-Off – 20.12.04 HoC 1349W
 Small Petrol Engine Emissions – 18.10.04 HoC 432W & 25.10.04 HoC 968W

European Union Meetings

Agriculture and Fisheries Council – 10.11.04 HoC 681W & 8.12.04 HoC 509W
 Competitiveness Council – 8.12.04 HoC 586W
 Employment, Social Policy, Health and Consumer Affairs Council – 2.12.04 HoC 51WS & HoL WS34, 20.12.04 HoC 159WS & HoL WS105
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 EU Committees – 9.11.04 HoC 566W, 11.11.04 HoC 812W & 15.11.04 HoC 1004W
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 Greek Presidency (EU) – 9.11.04 HoC 642W
 Home Affairs Council – 13.12.04 HoC 841W
 Transport Council – 20.12.04 HoC 1361W
 Transport, Telecommunications and Energy Council – 8.12.04 HoC 597W

Fisheries

Bass Trawler Fishing – 16.12.04 HoC 1215W
 Bird Predation – 20.10.04 HoC 693W
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 Cormorants – 20.10.04 HoC 695W, 4.11.04 HoC 350W, 9.11.04 HoC 578W & 17.11.04 HoL WA179
 Crustacean Fishing – 4.10.04 HoC 1923W
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 Eastern Irish Sea Fishery – 21.10.04 HoC 833W, 4.11.04 HoC 351W, 16.11.04 HoC 1247W, 17.11.04 HoC 1481W & 18.11.04 HoC 2014W
 Eels – 15.11.04 HoC 1000W
 European Habitats Directive – 4.10.04 HoC 1928W

Fisheries – 4.10.04 HoC 1929W, 11.10.04 HoC 92W, 14.10.04 HoC 333W, 18.11.04 HoC 1456, 16.12.04 HoC 1218W & 20.12.04 HoC 1347W
 Action Plans – 10.11.04 HoL WA83
 Adjournment debate – 2.12.04 HoC 831
 Council – 21.10.04 HoC 1016
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Food

BSE – 15.11.04 HoC 987W
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 Diet – 15.11.04 HoC 1160W
 Folic Acid Fortification – 27.10.04 HoL WA131
 Food Additives – 30.11.04 HoC 105W & 2.12.04 HoC 235W
 And Health Action Plan – 11.10.04 HoL WA31
 Industry – 11.10.04 HoL WA43
 Labelling – 13.12.04 HoC 957W & 14.12.04 HoC 1073W
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 Healthy Eating – 28.10.04 HoC 1560
 Irradiation Treatment – 20.12.04 HoC 1479W
 Nutrition and Behaviour – 16.11.04 HoL WA152 & 18.11.04 HoL WA218
 Dietary Targets – 18.11.04 HoL WA220
 Processed Food (Salt) – 1.11.04 HoC 145W & 4.11.04 HoC 397W
 Public Bodies – 15.12.04 HoC 1056W
 Salmonella: Infected Spanish Eggs – 18.11.04 HoL WA222
 Salt – 12.10.04 HoL 115 & 7.12.04 HoC 493W
 School Meals – 6.12.04 HoC 308W & 21.12.04 HoC 1710W
 Spanish Eggs (Salmonella) – 21.10.04 HoC 915W

Health (Cancer)

Anti-cancer Drugs – 26.10.04 HoC 1190W
 Bowel Cancer – 9.11.04 HoC 654W & 18.11.04 HoC 1745W
 Breast Cancer – 4.10.04 HoC 1948W, 26.10.04 HoC 1190W & 13.12.04 HoC 866W
 Adjournment debate – 9.11.04 HoC 173WH
 Breast Radiologists – 10.11.04 HoC 777W
 Cancer – 4.10.04 HoC 1949W, 15.11.04 HoC 1153W & 18.11.04 HoC 1950W
 Cervical Cancer – 18.11.04 HoC 1951W
 Chemotherapy – 16.11.04 HoC 1354W
 Colorectal Cancer – 12.10.04 HoC 246W
 Leukaemia – 8.11.04 HoC 537W, 11.11.04 HoC 845W & 868W & 1.12.04 HoC 129W
 Prostate Cancer – 4.10.04 HoC 1995W & 14.10.04 HoC 356W

Health (General)

Abortion: Under-16s – 18.11.04 HoL WA221
 Acupuncture and Herbal Medicine – 11.10.04 HoL WA30
 Adrenaline – 6.12.04 HoC 295W
 Age-related Macular Degeneration – 25.10.04 HoC 1042W
 Alzheimer's – 18.11.04 HoC 1949W
 Anaemia – 18.11.04 HoC 1949W
 Attention Deficit Hyperactivity Disorder – 21.10.04 HoC 863W
 Cellulose Fibres – 20.12.04 HoC 1431W
 Childhood Anaemia – 13.12.04 HoC 950W
 Clinical Trials – 7.12.04 HoC 1034
 Colitis/Crohn's Disease – 3.11.04 HoC 251W & 21.12.04 HoC 1667W
 Departmental Research – 18.11.04 HoC 1958W
 Diabetes – 16.11.04 HoL WA155 & 18.11.04 HoC 1961W
 * Adjournment debate – 16.11.04 HoC 1327
 Dyspraxia – 18.11.04 HoC 1963W
 Dystonia – 4.10.04 HoC 1966W
 Ectopic Pregnancy – adjournment debate – 12.10.04 HoC 259
 Epidermolysis Bullosa – 3.11.04 HoC 315W
 Fertility Treatment – 18.11.04 HoC 1754W
 Foetal Alcohol Syndrome – debate – 18.10.04 HoL 603
 Gastroenteritis and Salmonella – 19.10.04 HoC 673W
 Group B Streptococcus – 14.12.04 HoC 1073W
 Health Inequalities: Spearhead Group – 25.11.04 HoL WS8
 Health White Paper – statement – 16.11.04 HoC 1161 & HoL 1304
 Heart Disease – 2.11.04 HoC 172W
 HFEA Annual Report – 25.11.04 HoC 9WS & HoL WS8
 Human Genetics Commission – 20.10.04 HoC 793W
 Inflammatory Bowel Disease – 20.12.04 HoL WA130
 Influenza – 8.11.04 HoC 505W
 Intravenous Fluid Management – 3.11.04 HoC 335W
 Lyme Disease – 15.12.04 HoC 1153W
 Meningitis – 8.12.04 HoC 617W
 Mesothelioma – 1.11.04 HoC 139W
 MRC PACE trials:CFS/ME – 18.11.04 HoL WA211
 Myalgic Encephalomyelitis – 4.10.04 HoC 1986W
 Myasthenia Gravis – 4.10.04 HoC 1987W
 National Healthy School Standard – 12.10.04 HoL 118
 Nosocomial Viruses – 2.12.04 HoC 240W
 Occupational Asthma – 11.10.04 HoC 153W
 Organ Donation – 3.11.04 HoC 322W
 Organ Transplants – 2.11.04 HoC 177W
 Ovarian Tissue Transplantation – 1.11.04 HoC 141W
 Pregnant Women – 1.12.04 HoC 130W
 Reproductive Health – 11.10.04 HoC 154W
 Scientific Committee on Tobacco and Health – 19.10.04 HoC 669W
 Sexual Health – 2.12.04 HoC 249W
 Silzone Heart Valves – 28.10.04 HoC 1341W, 2.11.04 HoC 178W & 3.11.04 HoC 323W
 Smoking: Effect on Foetal and Infant Health – 16.11.04 HoL WA153
 Stem Cell Treatment – 16.11.04 HoL WA154
 Tackling Health Inequalities – 25.11.04 HoC 10WS
 Transplantation – 19.10.04 HoC 670W
 Tuberculosis – 28.10.04 HoC 1359W
 Tuberculosis/Hepatitis – 6.12.04 HoC 360W

Health (International Development)

- AIDS – 1.12.04 HoL 461 & 6.12.04 HoC 278W
- AIDS/TB/Malaria – 28.10.04 HoC 1314W
- * Adjournment debate – 16.11.04 HoC 343WH
- Antiretroviral Drugs – 2.11.04 HoC 202W
- Africa – adjournment debate – 2.11.04 HoC 32WH
- HIV/AIDS – 21.12.04 HoC 1601W
- Malaria – 18.11.04 HoC 1723W
- Vaccination – 15.12.04 HoC 1656

Health (Service)

- Cleanyourhands Campaign – 17.11.04 HoC 1669W
- Communicable Diseases – 28.10.04 HoC 1345W
- Consultant Radiologists – 10.11.04 HoC 778W
- Data Protection – 21.12.04 HoC 1668W
- Decontamination – 15.11.04 HoC 1157W
- Dermatology – 8.11.04 HoC 533W
- Doctor Numbers – 10.11.04 HoC 779W
- Electronic Clinical Records – 21.12.04 HoC 1674W
- EMIS System – 26.10.04 HoC 1194W
- Genito-urinary Medicine – 15.11.04 HoC 1040W
- Haemophilia: Contaminated Blood Products – 18.11.04 HoL WA217
- Hospital Acquired Infection – 4.10.04 HoC 1787W
- * Debate – 1.12.04 HoL 473
- Hospital Hygiene – 19.10.04 HoC 674W
- Hospital Infections – 14.10.04 HoC 353W, 27.10.04 HoC 1262W, 2.11.04 HoC 149 & 173W, 2.11.04 HoC 149, 4.11.04 HoC 390W, 11.11.04 HoC 867W, 17.11.04 HoC 1677W, 18.11.04 HoC 1967W, 7.12.04 HoC 505W, 13.12.04 HoC 971W, 16.12.04 HoC 1322W
- Infection Control – 4.10.04 HoC 1973W, 20.10.04 HoC 794W & 16.11.04 HoC 1379W
- In-vitro Fertilisation – 4.10.04 HoC 1977W
- IT – 25.10.04 HoC 1044W & 9.11.04 HoC 644W
- National Programme – 19.10.04 HoC 666W, 20.10.04 HoC 796W, 3.11.04 HoC 321W, 8.11.04 HoC 537W, 13.12.04 HoC 976W & 21.12.04 HoC 1680W
- Systems (GP Practices) – 16.12.04 HoC 1322W
- Medical Imaging Records – 16.12.04 HoC 1325W
- Medical Schools – 10.11.04 HoC 792W
- MRI Scanning – 10.11.04 HoC 793W
- MRI/CT Scanners – 4.11.04 HoC 395W & 18.11.04 HoC 1973W
- MRSA – 4.10.04 HoC 1984W, 14.10.04 HoC 355W, 19.10.04 HoC 676W, 26.10.04 HoC 1199W, 10.11.04 HoC 793W, 8.12.04 HoC 534W & 15.12.04 HoC 1089W
- * Hospitals – adjournment debate – 13.10.04 HoC 71WH
- National Blood Service – 15.11.04 HoC 1163W
- Clinical Director – 3.11.04 HoC 321W
- Necrotising Fasciitis – 8.12.04 HoC 619W
- NHS Research Ethics Committees – 16.11.04 HoC 77WS & HoL WS60
- NHS Software Contract – 2.12.04 HoL WA18
- NHS Staff (Pharmaceutical Company Funding) – 14.12.04 HoC 1079W
- NHS:vCJD and Hepatitis C – 21.10.04 HoL WA100
- Postgraduate Deanerics – 8.11.04 HoC 541W
- Radiographers – 1.11.04 HoC 146W & 9.11.04 HoC 651W

- Radiography – 13.12.04 HoC 927W
- Training – 18.10.04 HoC 518W
- Radiologists – 8.11.04 HoC 541W
- Radiotherapy – 2.11.04 HoC 177W
- Recruitment – 7.12.04 HoC 1035
- Vancomycin-resistant Enterococcus – 4.10.04 HoC 2002W

Health (Vaccination)

- Childhood Vaccinations – 3.11.04 HoC 313W
- Immunisations – 3.11.04 HoC 334W & 9.11.04 HoC 674W
- Influenza Vaccination – 26.10.04 HoC 1197W & 1212W, 26.10.04 HoL 1173, 17.11.04 HoC 1674W & 1681W, 18.11.04 HoC 1964W & 1969W
- MMR Vaccine – 20.10.04 HoC 796W
- Mumps – 13.12.04 HoC 975W
- Pediacel – 11.10.04 HoL WA29 & 20.10.04 HoL WA85
- Pneumonia Vaccinations – 2.11.04 HoC 168W
- Smallpox Vaccine – 11.10.04 HoL WA33, 18.11.04 HoL WA219 & 1.12.04 HoL WA8
- Vaccination Programme – debate – 8.12.04 HoL 956
- Vaccine Stocks – 16.12.04 HoC 1238W & 20.12.04 HoC 1484W

Industry

- Batteries – 30.11.04 HoC 74W
- EU Battery Directive – 30.11.04 HoC 77W
- Motor Mechanics – 18.11.04 HoC 1933W
- Motor Servicing/Vehicle Industry – 18.11.04 HoC 2142W
- Motor Sport/Performance Engineering Industries – 4.11.04 HoC 357W
- Motor Vehicle Technicians – 17.11.04 HoC 1621W

Information Technology

- Identity Cards – 16.11.04 HoC 1426W
- Information Technology Projects – 8.11.04 HoL WA61
- Oversight – 9.11.04 HoL WA70
- IT Graduates – 8.12.04 HoC 593W
- IT Skills – 11.11.04 HoC 832W

Intellectual Property

- Institute of Trade Mark Attorneys Order 2004 – 9.12.04 HoL 1029
- Intellectual Property – 11.10.04 HoC 67W
- QinetiQ – 14.12.04 HoC 1030W

Law Enforcement

- Biometrics – 17.11.04 HoC 1573W
- * Critical National Infrastructure – debate – 9.12.04 HoL 1063
- Cyber Crime – 15.11.04 HoC 1099W, 16.11.04 HoC 1415W & 17.11.04 HoC 1577W
- DNA Database – 3.11.04 HoC 297W
- Electronic Terrorism – 17.11.04 HoC 1582W
- Forensic Science Service – 11.11.04 HoC 891W & 15.11.04 HoC 1016
- Identity Cards – 17.11.04 HoC 1587W & 20.12.04 HoC 1500W

Medicines and Drugs

- Acupuncture and Herbal Medicine – 27.10.04 HoL WA132
- Acute Spinal Cord Injury – 20.12.04 HoC 1463W
- Adverse Drug Reactions – 13.10.04 HoC 284W

Aimspro – 8.11.04 HoC 529W & 21.12.04 HoC 1662W
 Alzheimer's – 15.11.04 HoC 1149W & 16.11.04 HoC 1369W
 Antibiotics – 17.11.04 HoC 1668W
 Antidepressant Drugs – 21.10.04 HoC 915W
 Anti-TNF Medications – 8.12.04 HoC 608W
 Atypical Anti-psychotic Drugs – 13.12.04 HoC 947W
 B144 Blood Testing Strips – 4.11.04 HoC 387W
 Chemotherapy – 13.12.04 HoC 916W
 Cialis (Counterfeiting) – 7.12.04 HoC 495W & 20.12.04 HoC 1468W
 Clinical Research Collaboration – 25.10.04 HoC 1063W
 Counterfeit Medicines – 20.12.04 HoC 1377W
 Dementia – 11.11.04 HoC 865W
 Diabetes – 16.12.04 HoC 1315W
 Generic Prescribing – 16.12.04 HoC 1319W
 Hormone Replacement Therapy – 7.12.04 HoC 1038
 Insulin – 13.12.04 HoC 972W
 Malaria (Malavane) – 15.10.04 HoC 400W
 * Medicinal Cannabis – adjournment debate – 14.10.04 HoC 518
 Medicines (Children and Infants) – 2.11.04 HoC 173W & 3.11.04 HoC 317W
 Medicines (Packaging) – 9.12.04 HoC 757W, 16.12.04 HoC 1279W & 20.12.04 HoC 1380W
 Medicines Act Advisory Committees – 11.11.04 HoL WS24
 Medicines and Healthcare Products Regulatory Agency – adjournment debate – 10.11.04 HoC 243WH
 MRSA – 16.11.04 HoC 1364W
 Multiple Sclerosis – 8.12.04 HoC 618W
 Aimspro – 1.12.04 HoL WA7 & 6.12.04 HoL WA29
 Packaging Regulations (Medicines) – 13.10.04 HoC 286W
 Pharmaceutical Price Regulation Scheme – 3.11.04 HoC 9WS
 Pharmaceuticals – 15.11.04 HoC 1174W
 Driving – 16.12.04 HoC 1264W
 Ritalin – 11.10.04 HoC 155W
 Safety of Medicines – 19.10.04 HoC 667W & 25.10.04 HoC 1046W
 Selective Serotonin Re-uptake Inhibitors – 6.12.04 HoL WS49 & 7.12.04 HoC 80WS
 Steri-X System – 18.11.04 HoC 1991W
 Teriparatide – 12.10.04 HoC 262W
 Yellow Card Scheme – 4.11.04 HoC 401W

Nuclear and Radioactive Substances

Depleted Uranium – 13.10.04 HoL WA60
 EU Nuclear Regulation – 4.10.04 HoC 1851W
 Intermediate Level Radioactive Waste Substitution – 13.12.04 HoC 115WS & HoL WS70
 Nuclear Accidents – 2.12.04 HoC 223W
 Clean-up – 10.11.04 HoC 764W
 Decommissioning – 8.11.04 HoC 460W, 10.11.04 HoC 765W & 17.11.04 HoC 1623W
 Authority – 9.12.04 HoC 707W
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 Energy/Nuclear Material – 20.12.04 HoC 1381W
 Industry – 16.12.04 HoC 1280W
 Installations (Safety) – 17.11.04 HoC 1623W
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Pylons – 11.11.04 HoC 870W & 17.11.04 HoC 1691W
 Radiation – 15.11.04 HoL WA126
 Risks – 15.11.04 HoC 1032W
 Radiation: CERRIE Report – 11.11.04 HoC WA98
 Radioactive Contamination – 29.11.04 HoC 30W
 Waste – 16.11.04 HoC 1256W, 15.12.04 HoC 1127W, 20.12.04 HoC 1382W & 21.12.04 HoC 1520W
 Waste and Nuclear Decommissioning: Budget – 21.12.04 HoL WA146
 Weapons Grade Plutonium (Transportation) – 21.10.04 HoC 876W

Science and Engineering Policy

Botany – 21.10.04 HoC 827W
 Centre for Environment, Fisheries and Aquaculture Science – 8.12.04 HoC 97WS
 Education, Research and Technology Transfer (NI) – 8.11.04 HoC 17WS & HoL WS15
 Engineering – 11.10.04 HoL WA8
 Policy – 9.12.04 HoC 1274
 Experimental Fusion Reactor – 28.10.04 HoC 1311W
 Faraday Partnerships – 8.12.04 HoC 592W
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 Human Fertilisation and Embryology Authority – 25.10.04 HoC 1043W
 International Thermonuclear Experimental Reactor – 2.12.04 HoC 222W
 National Institute for Medical Research – 1.11.04 HoC 90W
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 R and D Clusters – 20.10.04 HoC 768W & 21.10.04 HoC 881W
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 United States and United Kingdom Science and Technology Agreement – 9.12.04 HoC 111WS & HoL WS59
 Women Chartered Engineers – 4.11.04 HoC 448
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Space

Civil Space Technology – 2.12.04 HoC 216W
Galileo Positioning System – 12.10.04 HoL WA56
Galileo Satellite – 14.10.04 HoC 338W
Space Technology – 21.12.04 HoC 1659W

Sustainable Development

Diet (Environmental Impact) – 4.10.04 HoC 1927W
Energy Efficiency – 1.12.04 HoC 151W
Reed Bed Technology – 21.10.04 HoC 841W
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Telecommunications and Broadcasting

Acoustic Neuromas – 21.12.04 HoL WA148
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Communication Masts (Health Effect) – 13.12.04 HoC 951W
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Mobile Phone Masts – 15.10.04 HoC 420W, 4.11.04 HoC 437W, 17.11.04 HoC 1685W & 6.12.04 HoL 655
Mobile Phones – 4.10.04 HoC 1983W & 18.11.04 HoC 1947W
 Health Risk Research – 16.11.04 HoL WA152
Telecommunication Developments – 9.12.04 HoC 103WS & HoL WS60
Telecommunications Masts – 2.12.04 HoC 250W
TETRA Airwave Project – 8.12.04 HoC 648W
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Identity Cards Bill: Report Stage HoC 10.2.05

Private Members' Bills

Children's Food Bill: introduced by Ms Debra Shipley 8.2.05; provisional 2R 8.5.05

Human Tissue Act 2004 (Amendment) Bill: introduced

under the Ballot by Mr Stephen Pound; provisional 2R 22.4.05

Pharmaceutical Labelling (Warning of Cognitive Function Impairment) Bill: introduced by Mr Andrew Dismore; provisional 2R 20.5.05

Renewable Energy Bill: completed all stages HoL

School Meals and Nutrition Bill: introduced under the Ballot by Geraint Davies; provisional 2R 25.2.05

Euro-News

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

Naval Sonars

The European Parliament calls on the Member States to adopt a moratorium on the deployment of high-intensity active naval sonars until a global assessment of their cumulative environmental impact on marine mammals, fish and other marine life has been completed. It also wants the Commission to conduct a study and to provide an assessment of the impact of current practices in European waters. The resolution was tabled by the Committee on Environment, Public Health and Food Safety. It points out that there is a growing body of research which confirms that the very loud sounds produced by high-intensity active naval sonars pose a significant threat to marine mammals, fish and other ocean wildlife.

One minute interventions

Baroness Sarah Ludford (UK) recalled that Sunday 14 November had been World Diabetes Day. She asked why there was such wide variation between Member States in the lists of jobs barred to diabetics. In many cases these lists had been established many years ago and no longer made sense in the light of modern treatment options. This sort of blanket discrimination must be abolished she said.

Robert Evans (UK) reminded MEPs of the Bhopal disaster in December 1984, when a chemical leak from a Union Carbide plant led to many thousands of deaths and injuries, which were still continuing today. He condemned Dow Chemicals, the US owner of Union Carbide for what he called its pitiful compensation and negligible acceptance of responsibility.

Climatic Change

In view of the recent signing by Russia of the Kyoto Protocol, this could now enter into force early next year. The European Union (EU) is at the forefront of international efforts to combat climate change and has played a key role in the development of the two major treaties addressing the issue, the United Nations Framework Convention on Climate Change and its Kyoto Protocol. The EU is also taking serious steps to address its own greenhouse gas emissions. In March 2000 the Commission launched the European Climate Change Programme (ECCP). The ECCP led to the adoption of a range of new policies and measures, among which the EU's emissions trading scheme, which will start its operation on 1 January 2005, will play a key role. As a result of the EU's and individual Member States' actions, the latest monitoring data indicate that the European Union has delivered on its long-standing commitment to stabilise emissions of CO₂ at the level of 1990 in the year 2000. The EU-15 is committed to deliver the collective 8% cut in emissions by 2008-2012 to which it signed up under the Kyoto Protocol. Equally the New Member States are determined to meet their individual targets under the Kyoto Protocol which is only a first step to address the

serious threat of climate change. Further action must be taken after 2012, the end of the Kyoto Protocol's "first commitment period".

Climate Change Conference

The EU delegation will take part in negotiations at the COP-10 Conference in Buenos Aires on the 6-17 December. MEPs want the EU to maintain its leading role in the negotiations on climate change. Parliament believes that COP-10 constitutes a good opportunity not only to build on the decisions taken at previous Conferences on implementing the Kyoto Protocol, but also to start a wide-ranging debate on the main issues for the second commitment period, with a view to incorporating emissions from international flights and shipping into the emission reduction targets of the second commitment period from 2012. Parliament also reminds the EU delegation that according to the European Environment Agency, Europe is warming faster than the global average as a result of climate change.

Enhanced safeguards for "biometric" passports

The European Parliament agrees with the introduction of passports containing a facial image, since this biometric element will make it very difficult to falsify passports. The EP however opposes the setting up of a central database of European Union passports and travel documents containing all EU passport holders' biometric and other data. Such a database would increase the risk of abuse and function creep.

Safer Internet programme

The Safer Internet Plus programme is established for the period 2005-2008 to promote safer use of Internet and new online technologies, particularly for children. Its aim is also to fight against illegal content and content unwanted by the end user.

World AIDS Day

To stem the progress of AIDS, the world requires more money, appropriate legislation and political will from governments, according to the European Parliament. In a resolution adopted by a clear majority to mark World AIDS Day, MEPs also say that "the EU has a significant role to play for both its own citizens and those of third countries in the global fight against the disease."

Pesticide residues in food: more emphasis on consumer health

Draft regulation is intended to simplify existing legislation on maximum residue levels (MRLs) of pesticides in food or feed. It replaces four existing directives and amends another. It defines the roles of the different actors in the

process, particularly that of the European Food Safety Agency (EFSA). All MRLs are to be harmonised after a transitional “phasing in” period and will be set at European level. They will be listed in annexes, to be established by EFSA, the Commission and Member States for around 1000 pesticides and 160 crops. For the interim, temporary MRLs already in existence, or based on national MRLs will be used.

EU drug policy should be science-based

The EU needs to adopt a common strategy to tackle drug problems and wants national drug policies to be based on scientific knowledge about each type of drug, not on an “emotional response”. The European Council is set to adopt a new EU Drugs Strategy for 2005-2012 on 17 December to tackle cross-border and large-scale drug trafficking, using a scientific approach.

European Union - Digest

The references are to the Official Journal of the European Communities (OJ), Adopted Legislation from the L Series (OJL) and Proposals and Opinions from the C Series (OJC).

Agriculture

Council Regulation establishing a Community programme on genetic resources in agriculture – OJ L304(p1)30.9.04

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Commission Recommendation on dioxins and dioxin-like PCBs in feedingstuffs – OJ L321(p38)22.10.04

Climate Change

Council Directive establishing a scheme for greenhouse gas emission allowance trading within the Community – OJ L338(p18)13.11.04

Chemicals

Commission Directive on maximum residue levels of bifenthrin and famoxadone – OJ L301(p42)28.9.04

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on laws of Member States with regard to the transport of dangerous goods by rail and by road – OJ

L365(p24&25)10.12.04

on uniform procedures for checks on the transport of dangerous goods by road – OJ L367(p23)14.12.04

Education and Training

Council Directive on admission of third-country nationals for study etc – OJ L375(p12)23.12.04

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regarding mutual recognition of professional qualifications (EU Member States and Swiss Confederation) – OJ L352(p129)27.11.04

on a single Community framework for the transparency of qualifications and competences – OJ L390(p6)31.12.04

Opinion of the Committee of the Regions on transparency of qualifications and competences – OJ C121(p10)30.4.04

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on Fusion Energy – OJ C302(p27)7.12.04

Opinion of the Committee of the Regions on Proposal for a Directive on energy end-use efficiency and energy services – OJ C318(p19)22.12.04

Notice inviting applications for authorisation to prospect for hydrocarbons on the Dutch continental shelf – OJ C263(p5)26.10.04

Appointment of Members of the European Energy and Transport Forum – OJ C312(p7)17.12.04

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Council Regulation concerning the Financial Instrument for the Environment – OJ L308(p1)5.10.04

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on urban waste water treatment – OJ C284(p1)20.11.04

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- fishing off the coast of Cape Verde – OJ L332(p1)6.11.04
- fixing for 2004 fishing opportunities for certain fish stocks in Community waters and for Community vessels in waters where limitations in catch are required – OJ L332(p5)6.11.04
- fishing opportunities for deep sea species – OJ L396(p1&p4)31.12.04

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- regarding the General Fisheries Commission for the Mediterranean – OJ L357(p30)2.12.04
- on withdrawal of EC from Convention on Fishing and Conservation of the Living Resources in the Baltic Sea and Belts – OJ L375(p27)23.12.04

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- concerning fishing opportunities for capelin in Greenland waters – OJ L296(p3)21.9.04
- concerning transmission of data on fisheries in the Baltic Sea – OJ L365(p12)10.12.04
- laying down detailed rules as regards applications for fisheries licences in waters of Greenland – OJ L369(p49)16.12.04
- on fishing for northern prawn by vessels flying the flag of Sweden (OJ L344(p4)20.11.04
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 - establishing lists of approved zones and farms with regard to certain fish diseases – OJ L368(p26)15.12.04
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- ### Judgment of the Court on control of the activities of fishing vessels – OJ C262(p1)23.10.04

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- the issue of import licences for beef and veal – OJ L335(p3)11.11.04
- maximum residue limits of veterinary medicinal products in foodstuffs – OJ L379(p71)24.12.04
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Commission Decision setting up the Executive Agency for the Public Health Programme – OJ L369(p73)16.12.04

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Opinion of the Economic and Social Committee on a stronger Pharmaceutical Industry for the benefit of the Patient – OJ C241(p7)28.9.04

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Opinion of the Committee of the Regions on proposal for a Directive on batteries and accumulators – OJ C121(p35)30.4.04

Opinion of the Economic and Social Committee on packaging and packaging waste – OJ C241(p20)28.9.04

Parliamentary & Scientific Committee News

New Members

We are delighted to welcome the **International Agriculture and Technology Centre** and **Soroptimist**

International, represented respectively by Mrs Philippa David and Ms Hilary Ratcliffe, as Associate members and the **British Antarctic Survey**, represented by Professor David Walton, as a Scientific and Technical Organisation.

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British Society for Antimicrobial
Chemotherapy
Clifton Scientific Trust
University of East Anglia
Engineering and Physical Sciences
Research Council

HFEA

Institute of Biology
Institute of Physics
Institution of Chemical Engineers
Medical Research Council
NESTA
Prospect
Royal Academy of Engineering
Royal Institution
The Royal Society
Royal Society of Chemistry
RSA

Quality Management

Campden & Chorleywood Food
Research Association
LGC

Radiation Hazards

National Radiological Protection
Board

Retail

Marks and Spencer

Satellite Engineering

University of Surrey

Science Policy

ABPI
Academy of Medical Sciences
British Association for the
Advancement of Science
Clifton Scientific Trust
Economic and Social Research
Council
Engineering and Physical Sciences
Research Council
HFEA
Institute of Physics
Institution of Chemical Engineers
LGC
Medical Research Council
NESTA
Prospect
Royal Academy of Engineering
Royal Institution
The Royal Society
Royal Society of Chemistry
The Science Council
UFAW

Seed Protection

CABI Bioscience

Sensors and Transducers

AMSI
CCLRC

SSSIs

English Nature
Royal Botanic Gardens Kew

Statistics

Royal Statistical Society

Surface Science

CCLRC

Sustainability

CABI Bioscience
University of East Anglia
English Nature
Environment Agency
Institution of Chemical Engineers
Institution of Civil Engineers
London Metropolitan Polymer
Centre
SCI

Technology Transfer

CABI Bioscience
Campden & Chorleywood Food
Research Association
CCLRC
LGC
University of Leeds
London Metropolitan Polymer
Centre
NESTA
National Physical Laboratory

Tropical Medicine

Society for General Microbiology

Viruses

ABPI
Society for General Microbiology

Water

AMSI
Campden & Chorleywood Food
Research Association
University of East Anglia
Environment Agency
Freshwater Biological Association
Institution of Chemical Engineers
Institution of Civil Engineers
LGC
University of Newcastle upon Tyne
Royal Society of Chemistry
SCI
Society for General Microbiology

Wildlife

University of East Anglia
English Nature
Institute of Biology
UFAW

Association of the British Pharmaceutical Industry

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Website: www.abpi.org.uk

The Association for the British Pharmaceutical Industry members brings together companies in Britain producing prescription medicines both through manufacture and supply as well as research and development (R&D).

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;
- avoids unfair commercial returns

Association of Marine Scientific Industries

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E-mail: amsi@maritimeindustries.org
Website: www.maritimeindustries.org/about/amsi.jsp

The Association of Marine Scientific Industries (AMSI) is a constituent association of the Society of Maritime Industries (SMI). As a market orientated trade association, it services companies in the marine science and technology sector. AMSI provides a co-ordinated voice for the industry sector on national, European and international issues.

Academy of Medical Sciences

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

AIRTO

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AIRTO : Association of Independent Research & Technology Organisations
c/o CCFRA, Station Road, Chipping Campden, Gloucestershire GL55 6LD.
Tel: 01386 842247
Fax: 01386 842010
E-mail: airto@campden.co.uk
Website: www.airto.co.uk

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

Association of Medical Research Charities

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Association of Medical Research Charities
61 Gray's Inn Road, London WC1X 8TL.
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E-mail: info@amrc.org.uk
Website: www.amrc.org.uk

The Association of Medical Research Charities (AMRC) works to advance medical research in the UK and, in particular, aims to improve the effectiveness of the charitable sector in medical research. There are over 100 member charities within the Association: in 2002/2003 their combined expenditure on biomedical research in the UK was £660 million. AMRC provides information, guidance and advice to medical research charities and information and data on the activities of the charity sector in medical research to government, the media and decision-formers.

Biotechnology and Biological Sciences Research Council

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Website: www.bbsrc.ac.uk

The BBSRC is the UK's leading funding agency for academic research in the non-medical life sciences and is funded principally through the Science Budget of the Office of Science and Technology. 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.

British Association for the Advancement of Science - the BA

Contact: Sir Roland Jackson Bt, Chief Executive
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Website: www.the-BA.net

The BA is the UK's nationwide, open membership organisation dedicated to connecting people with science, so that science and its applications become accessible to all. 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 organises major initiatives across the UK, including the annual BA Festival of Science, National Science Week, programmes of regional and local events, and an extensive programme for young people in schools and colleges.

British Ecological Society

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Website: www.BritishEcologicalSociety.org

The BES is an active, successful and independent scientific society. It aims to promote the science of ecology worldwide. It supports the ecological research and education communities to ensure that they remain vibrant and productive, thus generating new knowledge, skilled people and a greater appreciation of the science of ecology in the wider community. The Society publishes internationally renowned journals, organises Europe's biggest annual meeting of ecologists, provides advice to policy-makers and opinion formers, has an active programme of educational initiatives and provides grants.

British Pharmacological Society

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British Pharmacological Society
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The British Pharmacological Society's 2,500 members are trained to study drug action from the laboratory bench to the patient's bed-side. Our members come from academia, industry, hospitals and regulatory authorities and government bodies. Our aim is to improve the quality of life by developing new medicines to treat and prevent the diseases and conditions which 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 34,000 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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E-mail: tguest@bsac.org.uk
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.

British Veterinary Association



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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 Bioscience



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Website: www.cabi-bioscience.org

CABI Bioscience is a new breed of international organisation specialising in sustainable agriculture, the conservation of biodiversity, invasive species management and industrial and environmental bioremediation. Globally the work of CABI Bioscience focuses on the farmer and his need to adapt and respond to the changes and challenges of the markets - these may be for organic produce, a route to transgenic production, or dealing with the effects of climate change or alien invasive species in a safe and sustainable way.

CABI Bioscience UK is one of a network of 6 global CABI Bioscience centres and a division of CABI International, a 42 member strong UN treaty-level organisation. Its sister enterprise is CABI Publishing, a leading international life science publisher.

Campden & Chorleywood Food Research Association



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A 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



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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: LEP, SPS & future 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.

Chartered Institute of Patent Agents



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CIPAs 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 agents to obtain international protection.

Clifton Scientific Trust



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

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

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

Clifton Scientific Trust Ltd is registered charity 1086933

Council for the Central Laboratory of the Research Councils



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The CCLRC is the UK's strategic agency for scientific research facilities. It also supports leading-edge science and technology by providing world-class, large-scale experimental facilities. These advanced technological capabilities, backed by a pool of expertise and skills across a broad range of disciplines, are exploited by more than 1100 government, academic, industrial and other research organisations around the world each year. The annual budget of the CCLRC is c. £150 million.

University of East Anglia

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Website: www.uea.ac.uk

From award-winning technology translating speech into sign language, to internationally-renowned climate research, and from the intricacies of diseases such as cancer to the large-scale hazards of earthquakes and volcanoes, UEA scientists are carrying out world-class research and teaching. A strongly interdisciplinary science cluster: Biological Sciences, Chemical Sciences and Pharmacy, Environmental Sciences, Computing Sciences and Mathematics.

Economic and Social Research Council

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<http://www.esrc.ac.uk>

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

Engineering and Physical Sciences Research Council

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EPSRC invests more than £500 million a year in research and postgraduate training in the physical sciences and engineering, to help the nation handle the next generation of technological change. The areas covered range from mathematics to materials science, and information technology to structural engineering.

We also actively promote public engagement with science and engineering, and we collaborate with a wide range of organisations in this area.

English Nature

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English Nature is the Government's wildlife agency working throughout England. With our partners and others we promote the conservation of wildlife and natural places.

We commission research and publish scientific papers which underpin the development of policies and programmes to maintain and enhance biodiversity

Environment Agency

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The Environment Agency is responsible for protecting and enhancing the environment in England and Wales. We contribute to sustainable development through the integrated management of air, land and water. We commission research to support our functions through our Science Programme that is based on a 5 year plan developed through consultation.

Freshwater Biological Association

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Website: www.fba.org.uk

The Freshwater Biological Association is an independent organisation and a registered Charity, founded in 1929. It aims to promote freshwater science through an innovative research programme, an active membership organisation and by providing sound independent opinion. It publishes a variety of specialist volumes and houses one of the finest freshwater libraries in the world.

Fund for the Replacement of Animals in Medical Experiments

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Website: www.frame.org.uk
Registered Charity No.: 259464

FRAME considers that the current scale of live animal experimentation is unacceptable, but recognises that the immediate total abolition of all animal experimentation is not possible. FRAME advocates the Three Rs approach, with the long-term aim of eliminating the need for live-animal experiments altogether, through the proper development, validation and acceptance of replacement alternative methods.

Human Fertilisation and Embryology Authority

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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 with the new millennium 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.

The Institute of Mathematics and its Applications



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The IMA is a professional and learned society for qualified and practising mathematicians. Its mission is to promote mathematics in industry, business, the public sector, education and research. Forty percent of members are employed in education (schools through to universities), and the other 60% work in commercial and governmental organisations. The Institute is incorporated by Royal Charter and has the right to award Chartered Mathematician status.

Institute of Physics



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www.einsteinyear.org

2005 is Einstein Year, part of an international celebration of physics to mark the centenary of the publication of Einstein's most famous theories. The Institute of Physics (IOP), the learned society and professional body which represents physics and physicists, is co-ordinating a range of activities designed to show the diversity and importance of modern physics today and to enthuse and inspire young people to study physics. The IOP supports physics in schools, colleges and universities and provides policy advice and opportunities for public debate.

Institute of Physics and Engineering in Medicine



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

IChem^E

IChem^E is the qualifying and professional body representing chemical and process engineers in the UK. In 2002, we published *Energy at the Crossroads* in response to the UK government consultation on energy policy; a report that seeks to improve the engineering and scientific input to policymaking. IChem^E has also published a set of sustainable development indicators for the chemical & process industries. *The Sustainability Metrics* provide a valuable tool for the measurement of progress towards sustainability.

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www.icheme.org
heart of the process

Institution of Civil Engineers



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ICE aims to be a leader in shaping the engineering profession. With over 70,000 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 and comment, on a wide range of subjects from energy generation and supply, to sustainability and the environment.

LGC



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Website: www.lgc.co.uk

*Setting standards
in analytical science*

LGC is Europe's leading independent analytical laboratory providing chemical and DNA-based analysis, diagnostic services, reference standards, R&D, method development, consultancy and training to both the public and private sectors. LGC operates in a diverse range of markets including foods, pharmaceuticals, biotechnology, environment, chemicals and petroleum.

Under arrangements for the office and function of 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 is based in Teddington, Middlesex, with other UK operations in Runcorn and Edinburgh, and facilities in France, Germany, Italy, Poland, Spain, Sweden and India.

University of Leeds



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Website: <http://www.leeds.ac.uk/rsu>

The University of Leeds is among the largest research universities in Europe. We have some 3000 researchers, including postgraduates, and an annual research income of more than £70m. Research activity extends across nine faculties representing most core disciplines and often crosses traditional subject boundaries. In the last Research Assessment Exercise, we had 35 schools rated internationally or nationally 'excellent'.

London Metropolitan Polymer Centre



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The London Metropolitan Polymer Centre provides training, consultancy and applied research to the UK polymer (plastics & rubber) industry. The training courses are delivered through a programme of industrial short courses and customised courses and these, together with distance learning and other flexible delivery methods, lead to qualifications ranging from technician to Masters level. Recent successes include a WRAP sponsored programme to develop new commercial applications for recycled PET and several technology transfer projects with companies.

Marks & Spencer Plc

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Main Business Activities

Retailer - Clothing, Food, Financial Services and Home.
544 stores in 29 countries worldwide.
Employing 66,000 people.

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

Medical Research Council



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

Merck Sharp & Dohme Research Laboratories

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Drug discovery for brain diseases.

The National Endowment for Science, Technology and the Arts



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NESTA (the National Endowment for Science, Technology and the Arts) is all about innovation. Through a range of pioneering programmes, we invest in talented people and ground-breaking ideas. On a wider scale we work to improve the climate for change in this country, acting as a catalyst for change and helping the UK to fulfil its potential.

National Physical Laboratory



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E-mail: enquiry@npl.co.uk
Website: www.npl.co.uk

The National Physical Laboratory (NPL) is the United Kingdom's national standards laboratory, 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.

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To advance by research the acquisition of knowledge about the protection of mankind from radiation hazards.

To provide advice to the government on the acceptability to the UK of standards recommended or proposed by international bodies, and on their application.

To provide information and advice to those with responsibilities in the UK in relation to the protection from radiation hazards, either of the community as a whole, or particular groups.

Working in partnership with the Health Protection Agency



From April 2005, NRPB will become part of the Health Protection Agency

Natural Environment Research Council



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

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

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

University of Newcastle upon Tyne



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The University of Newcastle is a member of the Russell Group of research-intensive Universities and is enjoying substantial growth in student numbers and research income. The University has a well balanced portfolio of research funding across all sponsor groups and has one of the highest levels of research projects funded by UK Government Departments and EU activity. It was recently identified in a national survey as one of the top Universities in the UK for technology transfer.

Particle Physics and Astronomy Research Council

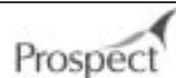


Contact: Dr Catherine Ewart,
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Particle Physics and Astronomy Research Council
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Swindon, Wiltshire SN2 1SZ
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Website: www.pparc.ac.uk

The PPARC is the UK's strategic science investment agency that directs and funds research in national and international programmes in fundamental physics.

It is this research into fundamental physics that lies behind some of the major technological advances of the 20th Century, and delivers world leading science, technologies and people for the UK.

Prospect



Contact: Sue Ferns,
Prospect Head of Research and Specialist Services, Prospect House
75 - 79 York Rd, London SE1 7AQ
Tel: 020 7902 6639 Fax: 020 7902 6637
E-mail: sue.ferns@prospect.org.uk
www.prospect.org.uk

Prospect is an independent, thriving and forward-looking trade union with 105,000 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 and, with negotiating rights with over 300 employers, we seek to secure a better life at work by putting members' pay, conditions and careers first.

Queen Mary, University of London



Contact: Caroline Quest,
Innovation and Enterprise
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London E1 4NS
Tel: 020 7882 7458 Fax: 020 7882 5128
Email: c.quest@qmul.ac.uk

Queen Mary, University of London, incorporates the St Bartholomew's and Royal London School of Medicine and Dentistry. Queen Mary's outstanding research strengths cover the spectrum from Electronic Engineering to Preventive Healthcare. It is home to world-renowned specialist centres including the Centre for Commercial Law Studies, the Interdisciplinary Research Centre in Biomedical Materials and the William Harvey Research Institute.

RIO TINTO

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Rio Tinto is a leading international mining company which focuses on exploration for first class ore-bodies and the development of large, efficient long-life mines capable of sustaining competitive advantage. Principal products (aluminium, borates, coal, copper, gold, iron ore, titanium dioxide, uranium, nickel, talc, salt, diamonds and silver) provide the materials necessary for economic progress and prosperity in the developed and developing world.

The Royal Academy of Engineering



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E-mail: mclaughlant@raeng.co.uk
Website: www.raeng.co.uk

Founded in 1976, the Royal Academy of Engineering promotes the engineering and technological welfare of the country by facilitating the application of science. As a national academy, we offer independent and impartial advice to Government; work to secure the next generation of engineers; pursue excellence; and provide a voice for Britain's engineering community. Our Fellowship - comprising the UK's most eminent engineers - provides the leadership and expertise for our activities, which focus on the importance of engineering and technology to wealth creation and the quality of life.



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BOTANIC
GARDENS
KEW
WORLD HERITAGE SITE

KEW GARDENS

The mission of Kew is to enable better management of the Earth's environment by increasing knowledge and understanding of the plant and fungal kingdoms – the basis of life on Earth. Kew is fundamentally a scientific, amenity and educational organisation devoted to increasing knowledge and public understanding of plant and fungal diversity – how it came to be, what its current status is, how it can be conserved for future generations, and how it can be used in sustainable ways for human benefit.

Contact: Prof. Simon J. Owens
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Website: www.kew.org

SAVING THE WORLD'S PLANTS FOR LIFE

Royal College of Veterinary Surgeons



Royal College of Veterinary Surgeons

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+44 (0)20 7222 2001
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"Promoting and sustaining public confidence in veterinary medicine". The Royal College of Veterinary Surgeons (RCVS) is the regulatory body for veterinary surgeons in the UK and is responsible for the registration of veterinary surgeons, for monitoring standards of veterinary education and for professional conduct. The Government regularly consults the RCVS on a range of legislative issues including animal welfare, control of animal disease and veterinary certification.

The Royal Institution



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Head of Programmes
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Tel: 020 7409 2992 Fax: 020 7670 2920
E-mail: ri@ri.ac.uk Website: www.rigb.org

The Royal Institution has a reputation established over 200 years for its high calibre events that break down the barriers between science and society. It acts as a unique forum for informing people about how science affects their daily lives, and prides itself on its reputation of engaging the public in scientific debate. The Royal Institution has a range of activities all under one roof, from programmes for schools and a forum for the general public, through to a heritage programme, an arts-science initiative, a media centre and state-of-the-art chemistry labs.

The Royal Society



THE ROYAL
SOCIETY

Contact: Dr David Stewart Boak,
Director Communications
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Website: www.royalsoc.ac.uk

Founded in 1660, the Royal Society is an independent academy promoting the natural and applied sciences. It aims to:

- strengthen UK science by providing support to excellent individuals
- fund excellent research to push back the frontiers of knowledge
- attract and retain the best scientists
- ensure the UK engages with the best science around the world
- support science communication and education; and communicate and encourage dialogue with the public
- provide the best independent advice nationally and internationally
- promote scholarship and encourage research into the history of science

Royal Society for the encouragement of Arts, manufactures and commerce



Contact: Susie Harries
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Fax: 020 7839 5805
E-mail: susie.harries@rsa.org.uk
Website: www.theRSA.org

The RSAs Forum for Technology, Citizens and the Market – a group of science-based companies and their principal stakeholders – aims to promote the flow of new technologies into society by enabling companies to sharpen their understanding of public concerns around new science and engage with these concerns early on as part of their routine product development process.

The Royal Society of Chemistry



ROYAL SOCIETY OF CHEMISTRY

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Parliamentary Affairs
The Royal Society of Chemistry
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E-Mail: benms@rsc.org
Website: http://www.rsc.org
http://www.chemsoc.org

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

The Royal Statistical Society



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External Relations Officer
The Royal Statistical Society
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Fax: +44 20 7614 3905
E-mail: a.tope@rss.org.uk
Website: www.rss.org.uk

The RSS is much more than just a learned society. We lead the way as an independent source of advice on statistical issues, and through our links with government, academia and the corporate and voluntary sectors, play a crucial role in raising the profile of statistics. We have a powerful voice at Royal Commissions, Parliamentary Select Committees, and at public consultations, offering our own unique view on just about anything, from freedom of information to sustainable development.

The Science Council



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Chief Executive Officer
The Science Council
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Tel: 020 7470 4830 Fax: 020 7470 4919
E-mail: enquiries@sciencecouncil.org
Website: www.sciencecouncil.org

The Science Council has a membership of over 25 professional institutions and learned societies covering the breadth of science and mathematics. Its purpose is to provide an independent collective voice for science and scientists and to maintain standards across all scientific disciplines. We are active in science policy issues including science in education, health, society and sustainability. In 2003 the Science Council was granted its Royal Charter and in 2004 it launched the Chartered Scientist (CSci) designation as a measure of high standards in the practice, application, advancement and teaching of science.



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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 sector has 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 two million people employed in about 100,000 establishments in the core Science, Engineering and Technology sectors, currently contributes over £74 billion per annum – about ten per cent – of total UK GDP.

Society for General Microbiology

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Public Affairs Administrator
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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.

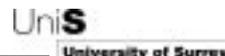
Society of Chemical Industry



Contact: Mr Richard Denyer,
General Secretary and Chief Executive
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Tel: 020 7598 1500 Fax: 020 7598 1545
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Website: www.soci.org

SCI is an interdisciplinary network for science, commerce and industry. SCI attracts forward-looking people in 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 publish journals, books and the respected magazine *Chemistry & Industry*.

University of Surrey



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Website: <http://www.surrey.ac.uk/>

The University of Surrey is one of the UK's leading professional, scientific and technological universities with a world class research profile and a reputation for excellence in teaching and learning. Ground-breaking research at the University is bringing direct benefit to all spheres of life - helping industry to maintain its competitive edge and creating improvements in the areas of health, medicine, space science, the environment, communications, ion beam and optoelectronics technology, visual multi media, defence and social policy.

Universities Federation for Animal Welfare



Contact: Dr James Kirkwood,
Scientific Director
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Wheathampstead, Herts. AL4 8AN.
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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
www.pandsctte.demon.co.uk

Monday 28 February 17.30

From the Scene of Crime to the Courthouse

Speakers: Bill Hughes, Serious Organised Crime Agency; Professor Gloria Laycock, Jill Dando Institute of Crime Science; Gary Pugh, Metropolitan Police Service

Thursday 17 March 10.15

Science Week Seminar

The UK – Best Place in the World for Innovation
Speakers to be confirmed

Monday 25 April 17.30

The Nuclear Option – Will we still need it, and if so, When

Speakers: Sir Donald Miller; Ann McCall, Nirex; Godfrey Boyle, Open University

Monday 23 May 17.30

Annual General Meeting

The Royal Institution

21 Albemarle Street, London W1S 4BS
For further information visit
www.rigb.org or call 020 7409 2992
Events held at the Royal Institution
Unless otherwise stated tickets cost £8
(£5 concessions)

Thursday 3 March 19.00

Adapt or die?

Prof Craig Sharp and Dr Greg Whyte

Tuesday 8 March 19.00

What makes us laugh?

Dr Eduardo Jáuregui and Dr Harry Witchel

Monday 14 March 19.00

Gases for the terrified!!!

Dr Neil Downie

Tuesday 15 March 19.00

Rhythms of life

Prof Russell Foster

Wednesday 16 March 19.00

Talking science

Prof Richard Gregory, Dr Adam Hart-Davis and Sir Martin Rees

Monday 21 March 19.00

The march of unreason

Dick Taverne

Tuesday 22 March 18.30

Managing climate change

Prof Mike Hulme, Dr Irene Lorenzoni and Dr Sophie Nicholson-Cole

Wednesday 23 March 19.00

Science, ethics and social responsibility

Prof Peter Atkins, Prof Tom McLeish and Prof Steven Rose

Monday 4 April 19.00

Racing hearts and sleepless nights: the story of amphetamines

Dr John Marsden

Tuesday 5 April 19.00

Building bridges: exploring extraordinary forms

Thomas Heatherwick

Wednesday 6 April 19.00

Milk, medicine and madness: a quack's progress in Hogarth's England

Lars Tharp

Thursday 7 April 19.00

From photons to fantasies: images of perception and reality

Baroness Susan Greenfield, Dr Mark Lythgoe and Prof Rafael Malach

Wednesday 13 April 19.00

How I became a boson

Prof Peter Higgs

Thursday 14 April 19.00

Swansongs: a musical anatomy of Alzheimer's

Prof Paul Robertson and Dr John Zeisel

Monday 18 April 19.00

Einstein for the terrified!!!

Prof Russell Stannard

Wednesday 20 April 19.00

Combating colon cancer

Prof Wendy Atkin and Dr Roger Leicester

Monday 25 April 19.00

Weighing the soul

Len Fisher

Tuesday 26 April 18.30

Teleporting quantum weirdness

Prof Peter Knight, Dr Almut Beige and Dr Terry Rudolph

Wednesday 27 April 19.00

Elements of murder

John Emsley

Thursday 28 April 19.00

Obsessed with truth: in conversation with Jamie Whyte

Prof Lisa Jardine and Jamie Whyte

The Royal Society

6-9 Carlton House Terrace, London SW1Y 5AG

Events held at the Royal Society unless otherwise stated

Contact Hannah Jemmett : 020 7451 2574

hannah.jemmett@royalsoc.ac.uk

<http://www.royalsoc.ac.uk/events>

Pre-registration is essential for

Discussion Meetings

Monday 14 to Tuesday 15 March (all day)

Discussion Meeting

MHD waves and oscillations in the solar plasma

Organised by Professor Robert von Fay-Siebenburgen (Erdelyi), Professor Bernard Roberts, Professor Mike Thompson and Professor Michael Ruderman

Monday 21 March 19.30

Public Lecture at the Wrexham Science Festival

Stem cells in the spotlight

By Dr Patricia Murray

Monday 4 to Tuesday 5 April (all day)

Discussion Meeting

Bioinformatics: from molecules to systems

Organised by Professor Janet Thornton CBE FRS, Professor Michael Sternberg and Professor David Jones

Wednesday 6 April 18:00

Prize Lecture

Streptomyces inside out: a new perspective on the bacteria that provide us with antibiotics

By Professor Keith Chater FRS

Tuesday 26 to Wednesday 27 April (all day)

Discussion Meeting

Food crops in a changing climate

Wednesday 4 May 18:00

Prize Lecture

Adventures in vascular biology

By Professor Salvador Moncada FRS

Monday 9 to Tuesday 10 May (all day)

Discussion Meeting

Sexual conflict: a new paradigm?

Organised by Dr Tracey Chapman, Dr Tom Tregenza and Dr Nina Wedell

British Association for the Advancement of Science

www.the-BA.net

Friday 11 - Sunday 20 March

National Science Week

A national celebration of science

Monday 23 and Tuesday 24 May

Science Communication Conference

at the Royal Society

Society of Cosmetic Scientists

Contact: ifsc.sc@btconnect.com

Tel: 01582 726661

Monday 9 and Tuesday 10 May

Spring Symposium

Technology & Trends in Skin Care Products

Tortworth Court Hotel, Wotton Under Edge, S Glos

SCI

14/15 Belgrave Square

London SW1X 8PS

Contact: conferences@soci.org or

020 7598 1562

Unless otherwise stated events are at SCI

Tuesday 1 March

Pharmaceuticals in the Environment

Tuesday 8 March

Ammonia

Thursday 17 March

Performance Enhancing Additives in Asphalt

Wednesday 23 March

Polymer Science in Coatings, Inks and Adhesives

Saturday 3 - Wednesday 6 April

Anti fungal agents

Churchill College, Cambridge

Tuesday 5 April

Rheology of Soft Matter

Rideal Lecture and Supporting Symposium

SCIENCE IN PARLIAMENT

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Monday 18 April

Environmental Risk Assessment - Implication for Public Health

Leeds

Tuesday 26 April

Young Chemist in Industry XIV

Thursday 28 April

New concepts in Synthetic Chemistry

Monday 9 & Tuesday 10 May

Protein Kinases: Signalling Success

SSLT, London

Thursday 19 May

Lea Valley Industry

Wednesday 25 & Thursday 26 May

Innovation Imperatives

Henley Management College, Henley

Royal Pharmaceutical Society

Contact: Judith Callanan

020 7572 2261

science@rpsgb.org

Monday 21 to Wednesday 23 March

Arden House European Conference 2005

Materials science in solid dosage design and development

Royal Pharmaceutical Society, London

Thursday 19 May

Clinical Trials Directive

A one-day symposium to review the impact of legislation on applications for clinical trials, manufacture and release of investigation medicinal products and the conduct of clinical trials.

Royal Pharmaceutical Society, London

Sunday 15 - Thursday 19 May

Seventh advanced level workshop on pharmacokinetic/pharmacodynamic data analysis

Madingley Hall, Cambridge



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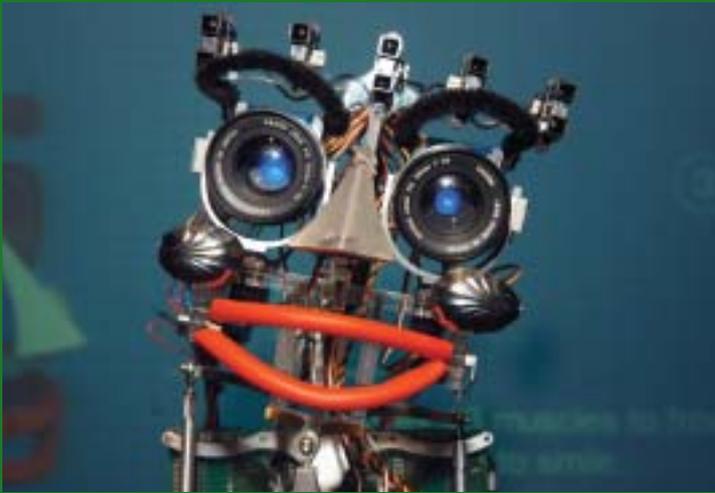
Professor Alan Malcolm

Mr Andrew Miller MP

The Lord Soulsby of Swaffham Prior

Dr Peter Warren CBE

ENGINEERING AND PHYSICAL SCIENCES RESEARCH HAS A BROAD IMPACT ON OUR EVERYDAY LIVES



The robot, eMO, developed at Sheffield University, demonstrates a range of human expressions and interacts with visitors as they enter the Thinktank Gallery at Birmingham's museum of science and discovery.

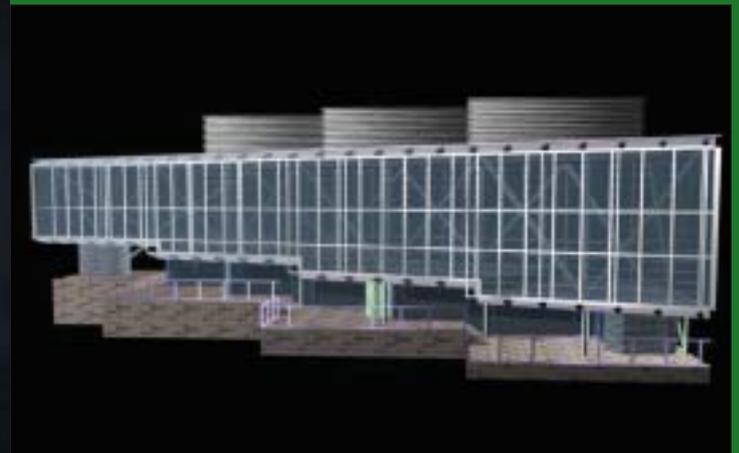


University of Bath 2002

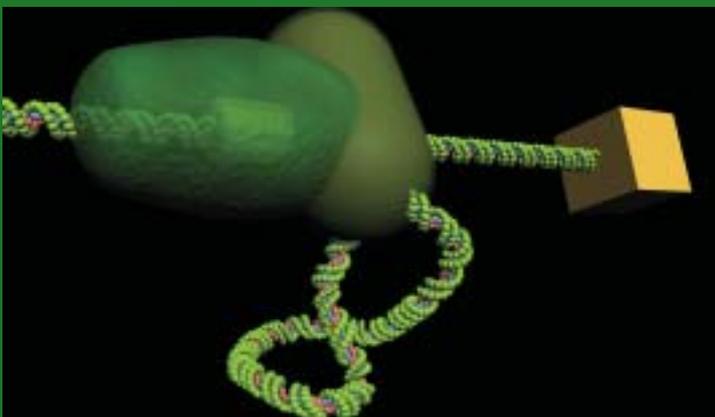
Optical fibres carrying information encoded in light are a huge part of our telecommunications network. (image: University of Bath).



Fusion has the potential to provide clean, safe, renewable energy for future generations: Shown here is a three metre diameter plasma ball inside MAST, the UK's own fusion device.



Work at Salford is taking building design beyond just three-dimensional modelling and incorporating other design 'dimensions' such as cost, sustainability, energy, accessibility, maintenance, crime and acoustics.



With its potential to produce smaller, lighter, cheaper and faster devices, which use fewer raw materials and less energy, Nanoscience and Nanotechnology offer huge potential benefits: Shown here is a molecular motor being developed by the University of Portsmouth as a nanoactuator.



Child resistant packaging developed by the Faraday Packaging Partnership: The 'Tri' concept box requires three equidistant buttons to be pressed simultaneously to unscrew the top.

EPSRC

Engineering and Physical Sciences
Research Council