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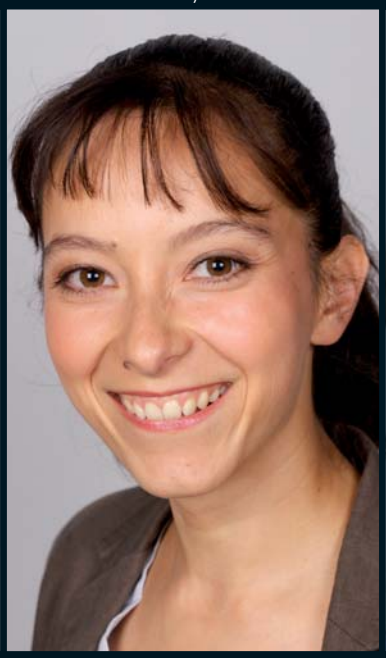
Dr Anna Git
Cancer Research UK
Cambridge Research Institute

Dr Araxi Odabachian
Cardiff University



Dr Theresa Burt de Perera
University of Oxford

Dr Seirian Sumner
Zoological Society of London

On 5th July 2007, the For Women In Science programme distinguished four promising young women with fellowships to encourage the advancement of their research.
www.forwomeninscience.com

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SCIENCE IN PARLIAMENT

The Journal of the Parliamentary and Scientific Committee.

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

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

The Parliamentary and Scientific Committee

Sales of 'organic food' have passed the £1 billion mark for the first time. Market gardening/farming was part of my life until I escaped to university in 1958. We produced 'organic food'. It was difficult to keep the aphids off the lettuce and I have dug many 'failed' crops under as a result of infestation. Our only pesticide in the 1940's was nicotine, which we burned in the greenhouses. Similarly, we lost tomatoes through 'rust' (fungal growth) on the stems of the plants, and our fruit was full of grubs and our root crops similarly infested. My father and others like him were extremely pleased when chemistry came to our rescue with its 'green revolution'.

How many of the 'organic' growers in Britain today could survive if they were not surrounded by non-organic growers that are keeping the pests out of the organic growers' crops? I don't want to go back to the 'good old days', thank you.

If residual pesticide on our food was as dangerous as the Soil Association would have us believe, how come that we are living so much longer than in the 1940's, when I was born? Indeed, copper sulphate, pyrethrum and the other chemicals used by organic farmers are probably more dangerous to the environment than modern pesticides applied by modern farming practices.

Is 'organic food' an idea now hijacked by modern marketing ploys? Please write and tell us what you believe.

The debate on embryology is hotting up as we approach a revision of the Human Fertility and Embryology Act 1990 this Autumn. The House of Commons Science & Technology Select Committee has produced 'Government Proposals for the Regulation of Hybrid and Chimera Embryos' (HC 272), which gets behind research on cytoplasmic hybrid embryos as a means of producing stem cells without involving human embryos. By contrast, three groups have reported their ability to re-programme normal skin cells to their embryonic state.

The Wellcome Trust-sponsored research that has found new genetic variants for seven common diseases is another remarkable breakthrough that is worthy of our attention.

Dr Brian Iddon MP
Chairman, Editorial Board
Science in Parliament

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The Energy White Paper 2007

Review by Robert Freer

This is the fourth report by the Government on national energy policy in the last five years and has the encouraging title "Meeting the Challenge"[1]. But although it includes some positive steps towards a sound national energy policy it will still disappoint those looking for strong leadership and a necessary sense of urgency and commitment.

Previous energy reviews have been long on the need for consultation, discussion, debate and more research, but less positive about making decisions and taking action to avoid an impending energy crisis. Decisions delayed always become more expensive. Meanwhile all our major power stations are ageing, many will close and there is little incentive for generating companies to invest in new ones. Keeping the lights on will become increasingly more difficult.

Energy policy is a matter of national importance because we cannot operate or survive as a modern country without a secure and reliable supply of energy. In the introduction to the Energy Challenge in 2006, Tony Blair specifically and correctly identified security of supply as the most important of the "immense challenges" facing us. Identifying a single focus helps to concentrate resources.

But the new White Paper seeks to achieve two objectives, to reduce greenhouse gas emissions and to ensure we have a secure supply of energy. Trying to achieve two objectives simultaneously will almost inevitably lead to tensions which will make the problems that much more difficult to solve.

There are practical differences between these objectives.

Ensuring security of supply is a straightforward technical problem; we rely on power stations using coal, gas or uranium to produce power when required.

Controlling emissions is a different problem because to be effective we need to negotiate and achieve international co-operation with countries whose priorities may be different from ours. For example, liberalisation of the energy market even within Europe is proceeding more slowly than expected. Our efforts alone will not be significant; our example may be persuasive, but later rather than sooner.

It is important that we plan to use a diversity of fuels. For the first time in our history we are no longer self-sufficient in energy and we will need to buy our fuels, coal, uranium and gas, in the most reliable markets. Coal is available throughout the world and will continue to be a major fuel, provided we can find a way to burn it cleanly.

The White Paper says that "successful demonstration of CCS (carbon capture and storage) would be a major contribution by the UK to global efforts to tackle climate change" and it was therefore unfortunate that the Government could not provide sufficient incentive to enable BP to proceed with their innovative project for CCS at Peterhead power station. This could have been a model for other countries to follow. But the competition for funds for CCS has been put back to November and BP apparently decided this "was a delay too far".

We also need to replace our old nuclear power stations with new ones, and the White Paper states "it is in the public interest to give the private sector the option of investing in new nuclear power stations". The Government now proposes a 20-week period of consultation before they make a decision. This hesitation is not supported by *The Times* which said, "The Government must stop sending ambiguous signals and make absolutely clear as soon as possible that nuclear energy will have a large and growing role in provision of power for the people."

Other countries are busily planning and building new nuclear power stations and it is unfortunate that the Government recently sold Westinghouse so that we will now have to buy our expertise from abroad to restart an industry which we pioneered and of which we were formerly among the world leaders.

In discussing renewable energy the White Paper says, "renewables are the key to our strategy to tackle climate change" and the target is "to see renewables grow as a proportion

of our electricity supplies to 10% by 2010, and an aspiration to double by 2020". It is difficult to see how this can be achieved. Our present electricity demand is about 375Twh a year to which hydro contributes about 1% and wind energy also about 1%. But historically demand has been increasing at about 1% per year and therefore new build is unlikely to keep pace with new demand.

In contrast to its reluctance to support base load fuels it is surprising to learn that the Government intends to continue the long term subsidy for wind energy through the Renewables Obligation although the output is small and unpredictable. The International Energy Agency has said that the subsidy for onshore wind farms is excessively generous and even the developers agree that without this subsidy no-one would build them. Any form of electricity generation which requires to be supported by continuing subsidy cannot be good engineering or good economics.

There are better low carbon alternatives available, such as the thermal recycling of Municipal Solid Waste through an Energy from Waste plant, which could meet about half the 2010 target, and ground source heat pumps which produce 3kwh of heat for 1kwh of electrical input. But the White Paper does not appear to explore these possibilities fully.

The frequency of these energy reviews and White Papers calls into question whether this is the correct way of establishing energy policy as part of the national infrastructure, and how technical advice from industry and the professions intended to produce workable and affordable solutions can best be incorporated into Government policy. If the Government Minister responsible for Energy had a seat in the Cabinet perhaps long term planning would have a greater national priority.

This White Paper demonstrates that politicians and scientists are clearly concerned by the linear increase in carbon dioxide emissions, but they appear to be less interested in trying to address the exponential increase in the world population which is the root cause of the problem.

[1] Meeting the Energy Challenge – A White Paper on Energy, May 2007. Department of Trade and Industry CM 7124.

OPINION

Venture Capital and Science: Mind the Gap…

Brooks Newmark MP

As an industry practitioner with a number of years of experience in both venture capital and private equity I welcome the growth and achievement of the venture capital industry in the UK.

Indeed, we should be proud that the UK venture capital industry now accounts for over 50% of the whole European market.

I have more than just professional pride in the industry's success. I am also confident that the central role of venture capital in the UK economy is helping a very wide range of science based enterprises to flourish.

One VC fund alone, Amadeus Capital Partners, has backed almost 60 technology companies at different stages of business growth and development and in sectors ranging from communications and networking to medical technology.

Nevertheless, many science based enterprises continue to face a challenge in early-stage funding.

In 1998, 10% of venture funding was invested in early stage companies but that figure had fallen to just 2% by 2005 because of the perception of poor returns on early stage investments.

Some of this underperformance can be attributed to the glut of money made available at the height of the dot-com bubble.

But problems are also caused by the way that the finance cycle has developed over the last few years to make later stage investing look more attractive to venture capital funds.

There are several reasons for this. Early stage investors take the highest risk and must wait longer until any gains can be realised. Early stage enterprises are also smaller and more management intensive for fund managers.

So the challenge facing the science based enterprises is how to attract venture capital fund managers back into the smaller, earlier-stage and riskier end of the market.

And that is also the fundamental challenge facing the Government.

It has responded in several ways but there is still much more that could be done.

First, the Treasury has been engaged in a long running search for the so called 'equity gap'.

This exercise has proved to be much like looking for the Scarlet Pimpernel – it is elusive and tends to be reported in different places.

The gap is said to exist between early stage investors, or 'business angels' who are often enthusiasts, family or friends, and larger scale venture capital funding.

The Government has attempted to respond to the gap by targeting fiscal incentives to attract investment, and it has had some success in doing so.

But the difficulty in providing useful fiscal incentives is that the sheer variety of needs faced by growing enterprises means that incentives are often poorly targeted and can be open to abuse by investors.

This inevitably leads to increasing complexity and tail-chasing.

The answer is not to tinker with the incentives in order to plug a gap, but to look at other methods of assisting science based enterprises more directly.

Second, the Government should continue to look for and support best practice.

The Higher Education Innovation Fund has provided approximately £265 million to help universities establish technology transfer offices and become more commercially oriented.

The European Investment fund has given significant support to the venture capital industry in Europe and enabled firms to raise venture capital funds when they would formerly have been unable to do so.

Likewise, the UK High Technology Fund had a significant impact in supporting early stage investors in the UK but unfortunately there has been no successor to the fund.

These initiatives invest funds with specialist managers and are a very effective way of ensuring that government funds reach professional managers in the target market.

The United States provides a good example of the benefit to the wider economy of further support for early stage venture capital.

The percentage of early stage deals is the same, 34% versus 35%, but the amount of capital is much lower in the UK with approximately 14 times as much money invested in start-ups in the US than in the UK.

US initiatives like the Small Business Innovation Research Programme, which targets government Research and Development funds at small businesses, together with procurement rules designed to benefit early stage companies, would undoubtedly help science based enterprises if they were implemented in the UK.

Third, there is a need to address the specific challenges faced by science based enterprises.

Many are spin-outs from universities, and these are a growing success story. In 2004 the Library House Spin-out monitor identified 435 technology spin outs from the 36 leading research universities in the UK.

Of these, 65% were at the seed funding stage; which in itself underscores the need for more early stage investment.

An excellent example of a university spin-out is Surrey Satellite Technology, now the world's leading manufacturer of small satellites and still 85% owned by the University of Surrey.

Arguably the next logical step would be for the business to seek further venture capital involvement to help it grow – and for the university to reap a healthy return on its investment.

But one of the biggest concerns expressed by the venture capital industry, and by university spin-outs themselves, is the challenge of attracting appropriately qualified management into early-stage ventures.

In fact, a study conducted in 2002 by the Bank of England found that attracting high quality management to spin-out companies was a bigger problem than attracting finance.

So the support that the Venture Capital industry offers to science based enterprises goes deeper than finance; we must also continue to offer the management expertise in order to capitalise on this innovation.

My conclusion is optimistic. The British venture capital industry is thriving and that success will continue to have a very positive impact on science based enterprises.

But the Government can always be smarter about how it spends its money in support of early stage technology companies and how it targets its fiscal incentives.

At the same time venture capital fund managers must remain committed to investing in management expertise as well as finance.

The School Food Reform Journey - much more than just eating healthily

Prue Leith
Chair of the School Food Trust

It is over eight months since the new standards for school food were introduced in England, a period that has witnessed great innovation, commitment, dedication and occasionally frustration amongst all those responsible for food in schools. But also a period that has seen the most fundamental changes to school food for over 20 years.

The reform agenda

When the School Food Trust was created by the DfES at the end of 2005, it soon became clear that initiating what was nothing short of a revolution in the provision of school food would never be an easy task for all schools and local authorities. With varying levels of infrastructure, trained staff, interested parents, committed councillors and engaged headteachers, there was never going to be a uniform response on the ground to the introduction last September (2006) of interim standards.

For those schools that had already gone some way to reforming their school meals the introduction of the standards has been relatively painless, with little impact on their day-to-day operations or viability. For others, the process has been a real struggle and it would be foolish to pretend otherwise.

2007 has, and will continue to be, a year of further improvements. The Trust has recently issued guidance to help schools meet the new standards for food other than lunch (vending machines, breakfast clubs, tuck shops etc) which will become law in September 2007. We have also recently published a revised guide to the original standards which responds to the wide range of questions we have received from schools, local authorities and caterers. It also provides further practical advice on how to implement the standards, whilst maintaining a viable food service.

The final pieces of the reform jigsaw are the nutrient standards which will become mandatory for primary schools in 2008 and secondary schools in 2009. The Trust will be producing its definitive guide to these later in the year.

Cooking up success

Whilst implementing all the mandatory reforms is absolutely essential, the Trust is also determined to ensure that children learn about food and how to cook it. We know that if they are knowledgeable and interested they are more likely to choose a healthy diet. The Trust is seeking to create a national network of community cooking clubs which use the school as a hub for their activity. Our 'Let's Get Cooking' initiative – which at the time of writing is subject to a Big Lottery Fund application – will help to bridge the gap between the desire to cook and the skills required to make it happen. We are hopeful that this project will complement the Government's 'licence to cook' proposals which are rolled out in 2008.

State of the school food nation

In July 2007 the Trust will publish the first definitive picture of what has happened to take-up figures since September 2006. However, we already know from a variety of sources, including headteachers, that it is a mixed picture, with some schools enjoying increased demand and some suffering a fall.

The real divide appears to be between primary and secondary schools, with the latter facing the gargantuan task of pleasing increasingly savvy teenage consumers who are usually afforded the choice of leaving the school premises and seeking their physical and mental fuel elsewhere.

How we convince the Starbucks generation that they should eat in an environment which quite often feels Dickensian in contrast to their normal social arena is quite a challenge.

The answer is a mixture of reforming the school lunch hour to reduce queues, giving more time for socialising and sport; it is making the dining environment a pleasant place to be; it is ensuring those who qualify for free school meals do not feel stigmatised or alienated; and it is headteachers being brave enough to forbid forays into the High Street at lunch time, and saying no to pupils bringing in products from outside which undermine the healthy eating agenda.

The cost of school food could also have a bearing on demand. I think there is a real debate to be had about the relative cost of school meals and who and how we should pay for them. Whilst admitting that the cost of a two course school meal is relatively inexpensive for many of us – between £1.50 and £2 – it is nonetheless a hefty whack for a three-child family on a low income.

What we need is innovation and creative ways to develop loyalty amongst our children to the school food brand. A recent experiment in a school in York showed that offering free school meals for a week resulted in a sustained increase in take-up of over 17%. Our own research has also revealed that the two countries with the highest take up in Europe – Sweden (85%) and Finland (90%) – both have free school meals for all. Such findings could be an important consideration for policy makers when they determine how we really ensure children are eating healthily at lunchtime.

Conclusion – we are all in this together

Fulfilling our agenda sounds so simple when writing an article: produce and distribute some guidance here, disseminate some best practice there, and surely all the problems will be solved. Unfortunately, the reality is far different.

Delivering real and lasting change means that we all – children, parents, schools, local authorities, caterers and Government – have to work together.

This means allowing our children enough time to collect and eat their food. It means providing an environment that is interesting and enticing, not dull and depressing. It means providing training for cooks to ensure that food is delicious as well as healthy. It means getting school leadership to encourage, lead and inspire change. And it means reinforcing to parents and children that for their sakes as well as for schools' they should choose school lunches.

This final point is of huge importance if we are to create the demand that will mean an economically sustainable service alongside well-nourished children. So the Trust has decided to use its 'Eat Better Do Better' slogan to encourage parents and children to sign up for school dinners. Getting the message out there that changing your diet will benefit concentration, performance and attainment, as well as your health, could start a move in the right direction – towards eating better and doing better.

The School Food Trust is under no illusions that reforming school food will be a complex and challenging process. But we are optimists, because we know the rewards of improving our children's diet are so fundamental. We believe that together we can ensure healthier, happier and better educated children and young people. We hope that all Parliamentarians will support our activities as we continue to make changes to improve the health and potential of our children.

Yorkshire and Humber – the UK's real powerhouse?

Tom Riordan
Chief Executive, Yorkshire Forward

Too often Yorkshire and Humber's association with the coal industry has held negative connotations. The decline of the industry in recent decades, leading to extensive unemployment and a downturn in the economic fortunes in the region was one of the most challenging in our manufacturing history.

Today, however, the region is moving on, building on the legacy of energy production and the expertise that Yorkshire and Humber holds in dealing with the environmental consequences of this production. This knowledge is offering our businesses new opportunities to lead the way in addressing the global need for cleaner fuels and the development of sustainable energy.

Our fortunes are still inextricably linked with energy production, as Yorkshire and Humber sits on 22% of the UK's indigenous coal supplies, and is home to three of Europe's largest coal fired power stations, which collectively generate 27% of the UK's coal fired electricity.

But with the growing emphasis on energy efficiency and greenhouse gas reduction, it is imperative that we learn how to update our production methods by embracing cleaner coal technologies like super-critical

boilers, advanced steam turbines and bio-mass co-firing.

Even with this technology, carbon emissions may not be reduced to an acceptable level. If the region can have the same success with other technologies as it has had with bio-mass co-firing, which is proving to be a real hit with the local farmers as well as power generators, we will be in a position to continue to provide energy in bulk with minimum environmental effect.

Add to this the possibility for a carbon capture and storage network linked to power stations, and emissions from the region could be further reduced.

Recognising the need for action, our power stations are already investing heavily in technical research and there are plans for a self-sufficient business park on the site of a colliery that has recently been re-opened in South Yorkshire. On the banks of the Humber, Conoco has one of the largest combined heat and power plants in Europe. Couple these investments and others like them with technological advances, and there is huge potential for the region to export the engineering and comissioning of new technology in this sector.

The challenge for Yorkshire Forward, as the regional development agency for Yorkshire and Humber and the organisation charged with growing our region's economy, is to bring this expertise together, not only to reduce the carbon footprint of our region, but to support Yorkshire and Humber in becoming a world leader in moving to a lower carbon energy. It is estimated that the global market for environmental technologies is worth £400 billion, and we want to ensure that Yorkshire and Humber gets its fair share of this business.

At a strategic level, Yorkshire and Humber remains the only region in the UK to specify the reduction of carbon emissions in its Regional Economic Strategy and we are the only region to have set our own targets for this reduction – 20% by 2010. We are working with public and private companies across the region to get them committed to reducing their carbon footprint – already we have some of the biggest names in industry on board as well as almost two-thirds of the NHS. Amongst our allies is Drax power station, Europe's largest coal fired electricity plant, which produces 7% of England's electricity and keeps the lights on in London as well as Yorkshire and Humber.

In terms of knowledge base, the region is home to one of the highest concentrations of universities in Europe and of these, four: Bradford, Leeds, Hull and Sheffield have all developed cutting edge expertise in the field of environmental technologies.

For the past four years, Yorkshire Forward has pioneered a network of unique Centres of Industrial Collaboration, which harness the expertise of research academics from universities across the Yorkshire and Humber region and translate this knowledge into commercially focused research services which can be accessed by companies to develop new products or improve existing processes.

These Centres – CICs – recognise the critical role science and innovation plays in our region's capacity for further economic growth and prosperity. So far they have worked on over 1400 collaborations with industry and generated in excess of £50 million of research income for the region.

A number of these centres are already working in the field of environmental technologies and collaborating with companies to help them reduce their carbon footprint – the Environmental Technologies CIC based at the Universities of Hull and Leeds is home to leading expertise in environmental forensics, organics processing and water dynamics.

Over at the University of Bradford, The Polymer CIC has been working with companies involved in plastics manufacturing to improve their industrial processes, which use a great deal of energy. One such collaboration has enabled a company to demonstrate the energy efficiency of their plastics manufacturing machinery, helping them to develop their business and reduce their energy consumption in an industry that is known as a high energy user.

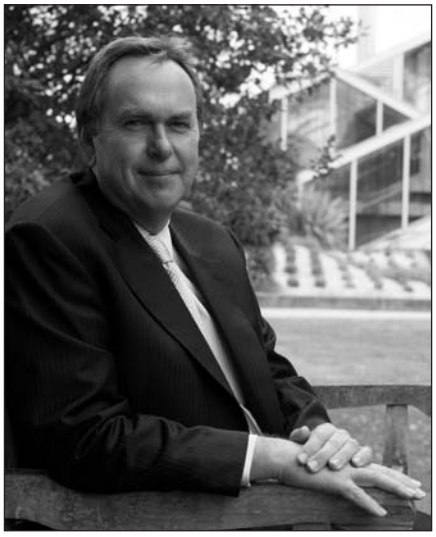
Yorkshire Forward has also recently announced an £8.7 million investment in an environmental energy technology centre (EETC) that will provide premises for new and start-up businesses specialising in low carbon technologies. Our region is already attracting innovative companies that are developing new products like fuel cells and ground source heat pumps, and we want to encourage these businesses to develop and grow.

The EETC building, located on the Advanced Manufacturing Park in South Yorkshire, which already provides premises for forward-thinking engineering companies and specialist engineering research centres, will itself incorporate some of the latest technology, including an iconic renewable energy mini grid to supply electricity and heat to the tenants and provide a real life 'plug and play' demonstrator for new technologies.

These developments in research and business support provide a firm foundation for the region's future work in environmental technologies. I have no doubt that by working together with universities and industry, Yorkshire and Humber will continue to be at the forefront of innovative power generation.

The Royal Botanic Gardens, Kew: for people and plants worldwide

Professor Stephen D Hopper FLS
Director, Royal Botanic Gardens Kew



In 2009, the Royal Botanic Gardens Kew celebrates 250 years as a plant science powerhouse and much-loved botanic garden of global reach and impact. This anniversary provides a significant opportunity both to celebrate the past and look to the future. Here I would like to present an update on contemporary work and planning for Kew.

A new mission

Recently, following my arrival as incoming Director succeeding Professor Sir Peter Crane, the organisation has developed a new mission: *to inspire and deliver science-based plant conservation worldwide, enhancing the quality of life*.

This mission statement has several key elements. First, Kew's primary purpose is to conserve and enhance plant and fungal life, as well as the World Heritage assets, collections and programmes in its remit – caring for and respecting significant natural and cultural heritage, and ensuring improvements are of lasting universal value.

Second, it recognises that the most effective way Kew might have global impact is to inspire others. Inspiration embodies many ideas, including leadership, discovery, teaching, partnering, and enabling.

Third, Kew delivers services and runs programmes: through excellence in the care and enhancement of collections, World Heritage buildings and landscapes; through science, horticulture, visitor services and education; through UK and overseas partnerships; and through world-class approaches to biodiversity conservation and sustainable living (eg the Millennium Seed Bank).

Fourth, the point of all of the above is to secure plant and fungal conservation worldwide. As an organisation whose existence has always revolved around plant life and people, Kew must ensure the future of the organisms that are its primary focus. And this is especially important in times of rapid climate change and global threat to wild biodiversity.

Fifth, Kew has a proud history as a centre of excellence in plant science. One-third of its 700 staff is involved in research. Science-based plant and fungal conservation, therefore, is a significant hallmark and makes Kew unique.

Last, but not least, Kew does all this to make things better for people, plants and fungi – to enhance the quality of life on earth. As a species we remain inextricably linked to other forms of life on our planet, plants especially. Plants, as major assimilators of carbon, play a vital and relatively inexpensive role in moderating impacts of climate change. We must care for them, for self-interest if nothing else. It's one of the practical things each one of us can do to make life better.

So how might Kew best make its contribution towards improving the quality of life for people and plants in today's world?

Kew's Global Conservation Partnership Programme

The recently released Stern Review on the economics of climate change and reports of the Intergovernmental Panel on Climate Change call for immediate action to mitigate and adapt to climate change. These reports conclude that climate change will affect all countries. The most vulnerable – the poorest countries and populations – will suffer earliest and most, even though they have contributed least to the causes of climate change. The worst impacts of climate change can be avoided, if we take strong action now. The costs of stabilising the climate are significant – 1 per cent of global GDP – but manageable. Delay would be dangerous and much more costly. Failure to act could create risks, for our children and grandchildren, of major disruption to economic and social activity, on a scale similar to those associated with the great wars and the economic depression of the first half of the 20th century.

Plant-based solutions are a critical part of sensible, sustainable strategies to cope with the significant environmental challenges facing us all, especially climate change. The Trustees of the Royal Botanic Gardens, Kew resolved in March that Kew will work with partners and supporters both nationally and internationally to develop Kew's Global Conservation Partnership Programme, a strategic and business plan for a greener world rich in plant and fungal life. The Programme will identify and seek the resources necessary to begin implementation by 2009 against agreed targets. Kew's Global Conservation Partnership Programme will be a key element in commemorating and celebrating RBG Kew's 250th anniversary. Our actions in response to accelerating climate change and loss of plant biodiversity

will help make the UK an international leader in this field.

While every effort is required to reduce carbon emissions, an equal focus on safeguarding and increasing carbon uptake by plants is necessary. A fifth of current carbon emissions are due to ongoing destruction and burning of wild vegetation and associated land use changes. This amounts to more than the world's transport systems combined. Increased plant productivity and conservation of wild vegetation will deliver economic long-term solutions to mitigating and adapting to climate change. In addition, these approaches will help achieve the UN's Millennium Development Goals – the set of targets, including environmental sustainability, to reduce global poverty and improve living standards by 2015.

Increased carbon uptake by plants is best achieved by four key strategies:

(i) conserving existing forests, woodlands and other wild vegetation that remain the world's major carbon sinks – a moratorium on further extensive destruction is desperately needed now;

(ii) banking seeds and accelerating the science of restoration ecology so that major repair and re-establishment of damaged wild vegetation can be fast-tracked – Kew's Millennium Seed Bank is a world leader in this vital area;

(iii) acquiring knowledge through science and practical experience to enable the necessary and urgent cultivation of locally-appropriate plant species under changing climatic regimes on agricultural, urban and suburban lands and;

(iv) informing and inspiring people world-wide about mitigation and adaptation strategies to cope with climate change, loss of plant biodiversity and other significant environmental challenges facing us all.

The Royal Botanic Gardens Kew and its global partners are well placed to make significant contributions in this urgent programme to create a greener world in the face of rapid climate change, accelerating loss of wild biodiversity and of the degrading of productive lands. The organisation is positioned and poised to adapt and expand its international scientific leadership and extend its global partnerships and capacity building in developing countries.

Kew's Global Conservation Partnership Programme embraces seven key actions:

three actions collectively help retain our major remaining carbon sinks such as rainforests and temperate woodlands using Kew's science powerhouse and collections data;

two help recover lost plant productivity and carbon sequestration through expanding the Millennium Seed Bank's programmes and increasing Kew's role in targeted restoration ecology;

one facilitates successful plant-based adaptation to climate change by growing locally appropriate plant species on agricultural, urban and suburban land;

and the last gives visitors to the Gardens and to our digital media greater understanding of individual, national and global actions needed to overcome these threats.

Together the seven key actions of Kew's Global Conservation Partnership Programme will help maintain and build the resilience of plant ecosystems that are the essential precursor for successful human adaptation to climate change and other environmental challenges.

Resourcing in times of significant environmental challenge

Since it became a Non-departmental Public Body in 1984, the Royal Botanic Gardens Kew has gone from 95% Government funding to about 50% today. It is sponsored by Defra, and raises additional funds through entry fees (while still remaining free to children), a diverse and inspiring events programme, retail and food, and with increasing support from the corporate sector and Foundation supporters. Previous Directors Professor Sir Ghillean Prance and Professor Sir Peter Crane led a series of initiatives to place Kew on its contemporary financial footing.

This transition has meant that Kew has engaged with its supporters and audiences much more than ever before, to ensure it remains relevant and valued locally, nationally and internationally. The momentous inscription on UNESCO's World Heritage register in 2003 signalled international recognition of its enduring value as an organisation and cultural site. Moreover, Kew is the only World Heritage site that has attained accreditation for sustainable practices under ISO 14001.

Kew and its partners around the world have demonstrated the power of collaborative global action for plants and people, most recently through the success in securing a billion seeds for the future in safe storage in-country and at Kew's Millennium Seed Banks in Wakehurst Place, West Sussex. This programme established an international network of thousands of people working together to enhance the quality of life through plant-based solutions to the serious environmental challenges and loss of biodiversity we all face.

Over the next ten years, Kew will work hard to realise an order of magnitude increase in its essential global programme for people and plants. Business as usual for Kew is no longer feasible, just as business as usual in other walks of life needs to change and change soon if we are to adapt to and mitigate future outcomes of climate change and loss of biodiversity. We have to apply much more substantial thinking and investment in environmental science and solutions, as the Stern Review emphasized. Kew and partners realise this and are focusing on the escalation of projects, training and science needed to really make a difference in areas of their expertise.

Significant announcements and events are planned for the 250th anniversary year in 2009. It is hoped that the UK and international community, private and Government, will respond to the demonstrable potential for plant-based solutions to climate change, and continue to support and collaborate with Kew and its partners so that they can escalate to necessary levels science-based plant conservation worldwide.

Kew's website is http://www.kew.org/

The importance of maintaining chemistry within universities

Professor David A Phoenix
Dean, Faculty of Science and Technology,
University of Central Lancashire, Preston

The high profile closure of a number of chemistry departments alongside a string of similar cuts at other institutions led the Royal Society to issue warnings that the subject was in meltdown across the university sector. The argument that chemistry needed expensive laboratories and sophisticated equipment and so, on economic grounds, was not sustainable in many UK universities was seen to gain increased credibility.

It would perhaps be logical to ask why, in this environment, has the University of Central Lancashire relaunched BSc Chemistry with plans to launch a further range of additional defined field chemistry courses? To understand the importance and logic of this decision it is necessary to understand the context in which the science strategy at the University has developed over the last three to four years and to realise the fundamental importance of this essential scientific discipline with respect to some of the key issues facing society today.

What is the future of chemistry?

Chemistry could be simply summarised as the study and manipulation of molecules. It is important in its own right as an intellectual discipline but also for its ability to produce new molecules, materials and methods on which other fields depend.

For the last 50 years, chemistry has focused on a range of problems based on synthesis, catalysis, the understanding of bonding and the development of methods but societal drivers for new technology are changing. The focus is no longer the need for fuels or the need for polymer-derived products such as paints and fabrics. Instead, they are, amongst others, environmental management, public health and new technologies for defence against terrorism.

Chemistry is changing to meet these new challenges and is now engaging with a different set of problems derived from, for example, chemical biology and materials science. The next phase of chemistry is in some ways so different from that of the last 50 years it could be considered a new field(s) of science, connected to the previous by the common themes of atoms, molecules, synthesis, and measurement, but differing in subject, scope, and objectives. It is my belief that such changes will require Universities to adopt a different approach to the subject in the future if we are to be internationally competitive.

How is this new paradigm incorporated into our university science strategy?

Issues of resource are important and the changes to the Faculty have required multi-million pound investment over recent years and changes to the staff profile but one of the biggest challenges was that of the general insular nature of academic departments. The funding systems that support research and teaching do not tend to drive interactions between academic disciplines, and these interactions are essential for the emergence of globally competitive science. Chemistry in the future will I believe remain a core science but its focus and development will be significantly different. The aim at the University of Central Lancashire was not therefore to create a department of chemistry but stimulate couplings of chemistry programmes to physics, biology, environmental science, engineering, and other disciplines to enable a focus on issues and applications within society and industry. This required the creation of multidisciplinary environments which are recognised features of the multidisciplinary research carried out in other nations but which tend to be uncommon in UK universities. These groupings were assembled around key themes but aligned with areas of research strength.

a) Medical Chemistry
Medicinal chemistry is an important discipline for its potential to support the pharmaceutical industry, but it has never been a major part of chemistry departments in the UK. With the creation of a new school of Pharmacy and Pharmaceutical Sciences within the faculty we have been able to invest significantly in research and teaching facilities focused on pharmaceutics. This investment has attracted a number of high calibre research and lecturing staff from the UK (eg Manchester and Imperial) as well as overseas. This will form the focus for a range of courses around pharmaceutics and medicinal chemistry.

The Faculty structure has also been reviewed to bring areas of biomedicine and related areas of bioscience under this same umbrella. It is recognised that the integration of chemistry and biology is important for the future yet is lagging behind in the UK. Here we hope that by bringing specialists together from biology and chemistry with focused investment in medical science we can enable significant progress in this area. Chemical genetics, the use of small molecules to probe cellular pathways, is an example of an area that combines chemical synthesis and cell biology both to reveal metabolic and signalling pathways and to discover potential targets for the early stages of drug discovery.

b) Green and Sustainable Chemistry
There is significant opportunity for chemistry to participate in all aspects of green and environmental chemistry. Low-pollution chemical processing, waste management recycling, atmospheric and environmental science all draw heavily on chemistry. At present, however, in the UK this type of research is still relatively limited. In the faculty we are bringing together expertise around the built and natural environment within one School to focus on issues of sustainability. This work builds on existing recognised research areas within the faculty, such as waste management, which already attracts multi-million pound income streams from industry and European sources.

Sustainable growth depends on the efficiency and nature of energy usage, the sources of raw materials used by industry, and the cleanliness of industrial processes. The new course in chemistry which starts this September has a number of specialist modules with a theme around sustainability – ensuring the students get to compare and contrast new and traditional types of synthesis – comparing yields and by-product formation for example in the two different cases to gain greater understanding of these key issues.

Eliminating the detrimental legacies of past practices, and halting the degradation of the environment by pollution will also require what are essentially chemical solutions. For example, our work in the area of nuclear science and technology, based at Preston and our Institute for nuclear science in West Cumbria, contribute strongly to this theme. We launched the UK's first course in nuclear decommissioning this year with support from the Nuclear Decommissioning Agency and other stakeholders and this has a core chemistry theme.

c) Forensic Chemistry
The UK is just beginning to engage the academic community in work in the area of crime and national security. The US, Israel, Germany, Sweden, Russia, and many other countries entered the area of defence against chemical and biological weapons some years ago, and have much larger and/or more advanced programmes. Organisational structures that promote this type of research and development are generally weak in the UK. The faculty currently leads a national knowledge exchange in this area and has created a School of Forensic and Investigative Sciences – the first to bring together scientists alongside police officers, crime scene officers and members of other uniformed services such as the fire service. Building on our expertise in fire and explosion, policing and analytical and material chemistry, this School has been able to launch a range of Chemistry courses such as Forensic Chemistry and defined field chemistry and looks at applications linked to crime and national security.

The vulnerability of open societies to terrorism is increasingly clear, and unquestionably a matter of national concern in the UK. Chemistry for sensors, agents for decontamination, protective gear, and materials for hardening against chemical, biological and radiological attacks are all key areas of science required to support the development of defences against weapons of mass casualties. New technologies for detection of explosives, materials diagnostic of nuclear weapons, and drugs are also needed and this will require a strong chemistry core.

d) Engineering & Materials Chemistry
Materials science has emerged as a major area of research in chemistry. It combines opportunities for invention and fundamental science with immediate applications in high technology products. While well advanced in other nations, materials chemistry is still taking form in the UK. The field of materials science is not yet as strongly integrated into academic chemistry departments as it is in the US, Japan, the Netherlands, and others.

Nanoscience is an area that requires seamless integration of electrical engineering, applied physics, chemistry, and mechanical engineering, and access to specialised facilities, and to this end these subjects have been brought together in the faculty to focus on a School of Advanced Technologies. This builds on our expertise in tribotechnology and materials (both materials physics and chemistry) coupled to investment in a high performance computing environment to enable advanced molecular modelling. A range of masters courses in nanotechnology and related areas have been developed. This School also enables consideration of all issues in the product cycle hopefully helping address a criticism that materials-related sciences in the UK have, in general, been late to couple synthesis to function.

In summary, we have relaunched our BSc courses in chemistry and will be launching more over the next few years. This has not been, though, in the context of a traditional chemistry department but by recognising chemistry as an integral part of future advances in many of society's priority areas. The research and teaching has therefore been facilitated across areas such as those shown above by creating multidisciplinary environments which aim to facilitate research opportunities at the interfaces between disciplines. It thus represents the type of multicentre, multidiscipline research at which the UK is traditionally weak. Key areas of chemistry research that offer particular scientific and industrial opportunities are therefore supported and the use of such applications as those listed provide the interest for many of the students who select these courses.

Is this a successful strategy? That remains to be seen but in the last few years the Faculty has had one of the fastest growth rates in terms of research in the UK (as measured by key indicators such as peer reviewed output and grant capture), it has attracted significant increases in student demand at undergraduate and postgraduate level, is being successful in recruiting high quality staff from the UK and overseas and is already in the process of launching a number of dedicated overseas Science Institutes based on this multi-disciplinary approach. I believe that as a fundamental science chemistry must be supported but the UK can only afford a limited number of Universities with dedicated chemistry departments large enough to cover the breadth of chemistry needed, and at sufficient level, to be successful internationally. For others, though chemistry as a fundamental science must also be supported, and if the challenges around the insularity of academic areas can be overcome, the above is one approach that may have merit.

Acknowledgements: The above contains a number of extracts from the report 'An international assessment of university research in chemistry in the UK' commissioned from the Royal Society of Chemistry by the Engineering and Physical Sciences Research Council

Shared Challenges, Shared Solutions

Dr Ramesh Mashelkar
IChemE President

The world is becoming more global. This statement may read like a tautology but it expresses a real and important trend that shows no signs of abating. The trend is evident in the spread of popular culture from one region to others; the uniformity of fashion in opposite corners of the globe; the dramatic escalation in air travel, as people – whether for work or leisure – increasingly sample other countries and lifestyles.

Most especially, we can see the relentless march of globalisation in science, technology and engineering. Certainly, every region has its local business, environmental and societal challenges, and presents local opportunities – shaped by environment, values, geography and other circumstances. But the solutions to these challenges, and the means of grasping the opportunities, are seldom unique to a particular region. Increasingly those who seek them are able to benefit from ideas, practices and experiences in other parts of the world.

A role for chemical engineers

By the same token, recognition is growing that different regions of the world can benefit by working together in the development of shared solutions to the big challenges that they have in common. As the world becomes more global, we will need more shared solutions. But shared solutions are only possible if there is genuine engagement between all stakeholders; government and NGO's, society and environmentalists, scientists and engineers. Chemical engineers have a pivotal role to play in helping to develop such shared solutions. As a profession, we specialise in working across boundaries – with people from different disciplines, different countries, different functions and different backgrounds.

We recognise that there can be more than one answer to a question or challenge. The energy challenge is a case in point. Satisfying the world's demand for energy will require a combination of many energy sources, not just one. Moreover, we see that the 'best' solution depends on both 'soft' and 'hard' parameters – societal mores as well as scientific metrics.

It is important that any shared solution must be scientifically responsible. As science and engineering grow in sophistication and complexity, this imperative presents chemical engineers with a great opportunity. We can work to ensure that the public policy debate in the UK and beyond is conducted on scientifically robust ground.

Serving the public interest

Another key contribution by chemical engineers lies in our role in bringing the fruits of research and innovation into play in large-scale, commercially viable, sustainable process operations that meet the needs of society at large.

2007 marks the fiftieth Anniversary of the granting of IChemE's Royal Charter. The terms of the Charter leave no doubt as to the requirement upon professional chemical engineers to serve the public interest:

"All Corporate Members shall at all times so order their conduct as to uphold the dignity and reputation of the profession and safeguard the public interest in matters of health, safety and otherwise…"

Fifty years on from the granting of the charter, IChemE remains committed to supporting its international membership in pursuit of this noble goal and today's chemical engineers are continuing the tradition of providing solutions to meet real needs. We develop and apply science and technologies that deliver economic, social and environmental benefits. We pioneer new materials and manufacturing techniques. We design and manage the large-scale manufacturing processes that characterise industrialised economies and we continue to pursue shared solutions to many pressing global challenges including energy, food and water.

Global consultation

To coincide with its jubilee year, IChemE engaged in a major global consultation with its 27,000 members in more than 100 countries. At the heart of the consultation lay a tough question: "What does society need; what are the desirable outcomes and how can chemical engineers work in partnership with others to make it happen?"

The findings of the consultation were published in May in the form of a "Roadmap for 21st Century Chemical Engineering". This document will underpin IChemE's work in the years ahead but a more digestible summary aimed at policy makers and opinion formers is presented in a Jubilee Report, "Shared Challenges, Shared Solutions" and the key points are summarised below.

Where do chemical engineers stand:

On Sustainable Technology?

"IChemE supports the more rapid pursuit of a global energy policy based on using non-fossil primary energy sources."

"IChemE supports the continuing introduction of appropriate legislation, taxes and other fiscal measures to drive the 'reduce, reuse, recycle' mentality deeper into industry and the consumers of its products."

"IChemE believes that the necessary change in business strategy to speed the introduction of innovative and sustainable technologies should be boardroom led."

On Health, Safety and Environmental Risk?

"IChemE will exert greater influence on the process sector, regulators and academia to develop and utilise new ways for cost effective and sustainable risk reduction."

"IChemE will engage with corporate leaders, regulators and other professional bodies to create cultures that deliver real improvements in health, safety and environmental performance."

"IChemE will influence industry groups and regulators to take a more proactive approach to passing on lessons learnt from industrial incidents."

On Energy?

"IChemE believes that nuclear power will continue to fulfil a significant part of global energy demand in the short and medium term."

"IChemE supports the view that, because the world is locked into fossil fuels usage for some time to come, the technological means of reducing CO_2 emission from their use must be implemented globally as an environmental and political priority."

"IChemE supports increased R&D on the development and deployment of renewable technologies and power storage systems, and the development of second generation bio fuels."

"IChemE believes that the widespread application of clean generation technology, coupled with carbon capture and storage and more efficient electricity generation and use, is essential to achieve major reductions in CO_2 emissions."

On Food and Drink?

"IChemE supports the development of technologies to maximise the use of viable waste streams from the food supply chain."

"IChemE believes that chemical engineers must play a prominent role in the development of precision agriculture technology and rendering farming methods sustainable."

"IChemE will continue to press government to take a science based approach in the development of policies for agriculture."

"IChemE supports appropriate regulation to enforce clearer and standardised labelling of food products coupled with consumer education to influence choice and market driven demand."

"IChemE believes that the delivery of safe, healthy and nutritious food will require the input of chemical engineers to explore new avenues in science and technology."

On Water?

"IChemE will work with other stakeholders to impress upon governments and international bodies the importance of developing and implementing sustainable regional water management strategies, especially through realistic charging."

"IChemE is committed to the search for technologies which contribute to sustainable water supplies. The Institution will continue to press governments and companies to fund research programmes which support this objective."

"IChemE supports the introduction of appropriate regulation that encourages more sustainable water supply and wastewater disposal, eg by water reuse in homes and buildings, and beneficial use of sewage sludge rather than landfill."

On biosystems?

"IChemE seeks to expand the recruitment of school leavers to biochemical and chemical engineering courses. Hailed as the third industrial revolution, bio process engineering must feature strongly in the degree course offer."

"IChemE supports reducing the environmental impact of industrial activity and will encourage members to promote new pollution abatement strategies and the design of sustainable processes. We will work with companies to highlight this approach and environmental success stories to the public."

The Jubilee Report

The publication of the Jubilee Report marks a milestone in IChemE's history and the contribution made by chemical engineers to meeting the world's needs. But more importantly, I believe, it presents a perspective on how the profession aims to develop and enhance its contribution in the years ahead.

Making that happen depends on many factors: on attracting a steady flow of young people into the chemical engineering profession; on clear and consistent communication of our capabilities to those who can benefit from working with us; and on society, policy makers and other stakeholders being prepared to engage more deeply with us to find the shared solutions the world needs.

It therefore gives me great pleasure to offer a brief taster of the IChemE's Jubilee Report and its findings via the pages of Science in Parliament. It is not merely a report of past successes. It is much more a "call to arms", especially for those outside the chemical engineering profession, to work together with us on further shared solutions for the opportunities and challenges facing us all.

FURTHER INFORMATION

A copy of 'Shared Challenges, Shared Solutions', the IChemE's Jubilee Report can be downloaded at www.icheme.org/jubileereport

For further information contact:

Andy Furlong, Director of Policy & Communication, IChemE, Davis Building, Rugby, CV21 3HQ Tel: 01788 534484 Email afurlong@icheme.org

Why Science needs Women

With L'Oréal this month announcing the winners of the first For Women In Science UK Fellowships, we look at reasons why women are failing to build successful careers in science.

As Gordon Brown made clear in his last budget, improving and developing the science and research capabilities of the UK is vital to assure future economic growth. If the UK is to compete in a global knowledge economy, it is important to attract more of the best talent into research, in addition to building a broader spectrum of skills and expertise.

Women scientists are crucial to achieving these aims, but are currently significantly under-represented in the sector, making up only 19% of the UK's total science, engineering and technology (SET) workforce.[1] And the dearth of women making it to the top in science isn't simply a problem for the individual women concerned; it represents a serious hurdle to Britain's economic competitiveness in the future.

For many reasons, women are failing to build long-term, successful careers in science. It was in response to this issue, and stemming from a fundamental belief that 'the world needs science, and science needs women', that L'Oréal and UNESCO came together in 1998 to launch the global For Women In Science Programme.

The award programme was designed to promote and highlight the critical importance of ensuring greater participation of women in science, by awarding promising female scientists with fellowships to help them further their research.

Since the programme's launch in 1998, national award schemes have been rolled out in 22 countries. This month the first winners of the L'Oréal UK Fellowships For Women In Science, which were launched in January, are announced.

The UK awards, run in partnership with the UK National Commission for UNESCO and the Royal Institution of Great Britain, will offer three fellowships of £10,000 to assist outstanding young female scientists to further their research. L'Oréal UK is offering a further fellowship of £10,000, in association with the UK Resource Centre for Women in Science, Engineering and Technology (SET), to a woman scientist returning to scientific research following a career break.

Despite the UK's growing reputation as a centre of excellence for science and research, the problem of nurturing and retaining female talent is as acute here as elsewhere internationally. Women make up 37% of those entering science, engineering and research professions after first degree and post-graduate courses.[2] However, they form only 25% of the science workforce qualified at these levels.[3]

Even in those disciplines where women dominate at under-graduate and post-graduate levels, the number of women in more senior positions is low. In the biosciences, where women make up 63% of under-graduates, they constitute only 12% of university professors. Worryingly, across all SET disciplines women hold a measly 6% of professorships.[4]

So what is causing this black hole, in which bright young women scientists enter research careers, only to disappear within ten years?

Annette Williams is Director of the UK Resource Centre for Women in SET, which was established in 2004 to deliver a substantial part of the Government's Strategy for Women in SET. The UKRC works with the Research Councils UK to promote women's access to mainstream research funding and improve career management for researchers across the board.

She explains some of the pitfalls for female scientists:

"The career structure for researchers is problematic. Moving from post-doctoral positions to an established academic or research post is where many women get stuck and end up on a succession of fixed term contracts, unable to access independent grant funding. Taking a career break in your late twenties and early thirties can result in loss of momentum, reduced publication output, and leave women without a research post to return to."

This was certainly the case for Myfanwy Lloyd, an astrophysicist and university lecturer, who was a winner of a L'Oreal/ UKRC bursary, a programme of financial support for female scientists that preceded the UK For Women In Science scheme.

She was close to giving up her career following the birth of her children, finding the difficulty of maintaining a work life balance too stressful.

Myfanwy had returned to work at Manchester University, initially part time, then full time, after her first child. But returning part time after the birth of her second child, she found the burden of lecturing in physics and astronomy, while devoting time to her research into planetary nebulae, and still trying having time for her family, too much.

Close to giving up completely, she took an 18 month career break on the advice of the University and, with the help of the L'Oréal UK/UKRC bursary, was able to buy out half her teaching load this year, effectively buying time and freedom to spend on her research.

"As a woman in this field you feel under pressure to be the best. You can't just be ordinary. Working part time, you can feel under valued."

Another barrier faced by women is the 'boys-club' mentality of some research departments, where being in the minority, female scientists can be excluded and their contributions devalued.

Dr Nancy Lane, a Senior Research Associate at the Zoology Department of Cambridge University and a member of the L'Oréal UK For Women In Science Fellowships jury panel elaborates:

"Women are just as capable of creativity and innovation as men, but it is not expected of them and only

infrequently have they had a chance to shine. Groups in labs tend to publish as a collective, and it is difficult to establish which person is the creative genius behind the research. It is generally assumed to be the PI (principal investigator), who also brings in the grant money, and that person is rarely a woman. A change of culture is needed in order to provide equality of opportunity."

Finally, there is a real need to provide strong role models for women working in science, and also for girls thinking about career options at school.

One such role model is Baroness Susan Greenfield, the first female Director of the Royal Institution of Great Britain and the president of the For Women In Science jury panel.

She feels that from the youngest age possible, children should be introduced to the excitement of science, and its impact on every aspect of modern life.

"At the moment, the demands of the National Curriculum and the teaching of various exam syllabuses might divert young people from pursuing their genuine curiosity and fun of the subject."

According to Susan, we should also be focusing on the positive side of a career in science. "We need to communicate the advantages. A career in science can offer a very cosmopolitan lifestyle and many opportunities to travel. The most important thing to stress is the stimulation and enjoyment of doing work that is creative, often ground-breaking and completely unique to you."

Since the L'Oréal UNESCO For Women In Science programme was launched, over 350 women across the world have been recognised for their careers and received funding to further their research.

In its augural year in the UK, the programme is already proving just how necessary schemes like this are. Sophie Gasperment, L'Oréal's UK MD explains:

"We've seen a fantastic reception to the awards this year. We received an overwhelming number of applications and the calibre was exceptionally high. I'm delighted that, in conjunction with our partners, we are able to help further the careers of some exceptional young female scientists and help raise awareness of this critical issue."

Professor Alec Boksenberg, Chair of the UK National Commission for UNESCO adds: "The UK jury has had the privilege of considering a really very talented pool of highly qualified female researchers in the early stages of their careers spanning a broad range of scientific fields. This year's first UK winners will become part of an impressive For Women In Science community which stretches across every continent."

Phil Willis MP, the Chair of the Commons Science and technology Select Committee, who also sits on the jury panel continues:

"The barriers placed in the way of women are seriously denying UK Science access to some of its most talented researchers. This is an issue UK Science and its traditional institutions cannot ignore.

It's great that L'Oréal and its partners are doing something in response. Let's hope that the young women who receive fellowships this year go on to act as mentors, encouraging the next generation of female scientists in the UK."

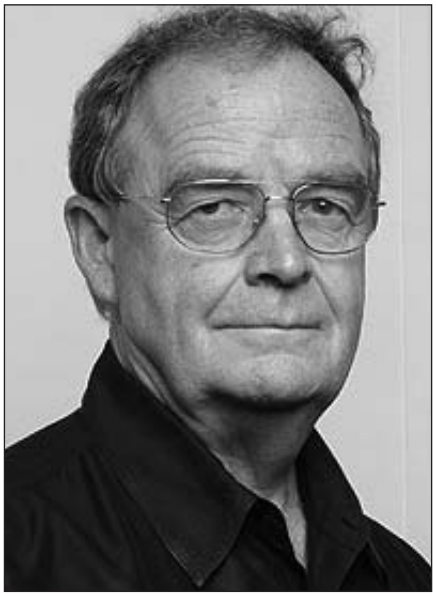
REFERENCES

[1] http://www.setwomenresource.org.uk/
[2] First Destinations 2004-5 data from HESA, 2006
[3] Labour Force Survey, Four quarters for 2006
[4] HESA, 2007

L'Oréal UK For Women In Science Fellowship winners Dr Araxi Urrutia Odabachian, Cardiff University (left); Dr Theresa Burt de Perera, University of Oxford (second from left); Dr Anna Git, Cancer Research UK Cambridge Research Institute (second from right); and Dr Seirian Sumner, Zoological Society of London (right), pictured with Baroness Susan Greenfield, President of the For Women In Science Jury Panel (centre).

Rocks of ages

Tim Radford ponders what lies beneath the grass roots*



You could make a world of claims for geology, including, of course, the ground upon which we stand. Geology may be a downward-looking science, but it secures our wealth, our bricks and mortar, our energy and indirectly our health as well. It helped explain how we got here, how long we might stay, and why our leasehold looks a bit doubtful right now. The great human adventure began with geology: the first cutting-edge technology was hammered from flint or obsidian at least two million years ago; civilisation grew from the systematic cultivation of the weathered sedimentary deposits 10,000 years ago; geometry – the clue is in the word itself – was fashioned almost 4,000 years ago as a way of measuring terrain.

Paradoxically, geological science is relatively new and first emerged from the shadow of theology. A text dating from 1690 was called "Geologia: or a Discourse concerning the Earth before the Deluge" but according to the Oxford English Dictionary it was not until 1795, two years before his death, that the great James Hutton used the words "geology" and "geological" in the modern sense of systematic investigation of the Earth's crust. Hutton was the man who looked at the epic story told in the rocks and reported that he saw "no vestige of a beginning, no prospect of an end."

Since then, geologists have tried to read the Earth like a book, with some difficulty. The storyline is patchy, the plot contorted, the authorship in permanent dispute. Pages have been torn from the text, the rest are foxed or watermarked. Whole chapters are lost for ever. Characters appear from nowhere, and disappear as mysteriously. The script is disputed, and there are still arguments about the lexicon or the grammar. But somewhere in the lapidary prose of the Earth's crust is the story of the making of a planet, with its rocks, its oceans and its atmosphere and its almost imperceptible alteration over billions of years by the life that colonised it.

Much of this great detective story is told in the papers of the Geological Society of London, now online in the form of the Lyell Collection, and the papers of Charles Lyell, the great Victorian geologist who served as mentor and friend to Charles Darwin, are a reminder of the complexity of the challenge and the thoroughness with which scientists tried to meet it, everywhere in the world.

In 1845, for instance, Charles Lyell reports on the Miocene strata of a 400 mile tract of American landscape running from Maryland to South Carolina, extending from Delaware Bay to the Cape Fear River, and what he sees reminds him of beds of rock in Suffolk, and in the Touraine of France. "On the right bank of the James River, at City Point, Virginia, about twenty miles below Richmond, in a cliff about thirty feet high, I observed the yellow and white Miocene sands resting on dark green earth and marl of the Eocene formation, just as the yellow sands of the crag rest on the blue London clay in some parts of the coast of Suffolk and Essex," Lyell writes. In Wilmington, North Carolina, he examines the beds of shells and notes similarities with formations on the other side of the Atlantic, and in other parts of the US, but adds with a note of caution "As, however, it would be very rash to assume that all the Miocene deposits of the United States, especially in countries as far apart as Maryland and South Carolina, were of strictly contemporaneous origin, the fossil faunas of each region should be carefully distinguished, and considered separately."

There you have geological science: simultaneously sweeping and non-committal; spanning continents and fretting about the occurrence of univalves; making connections but trying not to make too much of them. The surprising thing, surprising because when Lyell wrote, the science was in its infancy and the Earth still a profound puzzle, is how much of the

language of geological science was already confidently in place; and how eagerly the first geologists were using it to describe the four corners of the globe. In 1859, my homeland of New Zealand had been a British colony for just 19 years, and my home city of Auckland was just a tiny settlement, but I'd recognise it immediately from Charles Heaphy's description in the Proceedings of the Geological Society: "The isthmus may be considered as a basin of Tertiary rock. Through it have burst up, dotting its surface, as many as sixty-two separate volcanos (sic); showing in nearly every instance a well-defined point of eruption – generally a cup-like crater, on a hill about 300 feet high above the plain." Actually, according to a recent issue of Geophysical Research Letters the latest count is 49 basaltic volcanoes, and the Auckland sediments are Quaternary-Miocene, but today's geologists have more time, better techniques and equipment beyond the wildest dreams of Lyell's contemporaries.

The Geological Society of London is 200 years old this year, and its two centuries of existence describe a trajectory of understanding in the Earth sciences as a whole. What began as a detailed attempt to understand the relationship between the passage of time and the visible rocks, became an attempt to tell the whole story of the Earth, from its hellish beginnings 4.5 billion years ago to its present extraordinary condition as the only known home for life in the vastness of the universe. Lyell's inheritors still sample, examine and make guesses about the origins of rocks on Earth, but they have also stood on the Moon, and with help from sophisticated automata explored the terrain of Mars and even Saturn's moon Titan. Geology has spawned, stimulated or triggered a cascade of now-separate sciences: palaeontology, archaeology, oceanography, atmospheric science, climatology, volcanology, seismology and geophysics all begin from geology, and feed back into it.

In less than one human lifetime, Lyell's inheritors devised, tested and confirmed a revolutionary theory of plate tectonics that now explains why mountains grow, why continents move, why precious minerals concentrate in certain formations, and why volcanoes and earthquakes are not just inevitable, but helpful in the long run, in renewing and reshaping life's only home. Its members were among the giants, but it would be wrong to suggest that the Geological Society of London was always at the cutting edge of the great scientific revolutions of the last two centuries. The presidential addresses of 1859 and 1860 are remarkable for what they do not say about Darwin's theory of evolution, even though Charles Darwin was an honoured member. Gordon L Herries Davies, in "Whatever Is under the Earth", the official history of the Geological Society of London, recalls a leading figure saying "I've been reflecting on what the Society did in the 1960s for the establishment of Plate Tectonic Theory. The answer seems to be almost nothing."

But learned societies have a way of learning from their own mistakes: that's why they survive. The Society, which began from a casual meeting of 13 men in a London alehouse in 1807, will stage a bicentenary conference at the QEII conference centre in London September 10-12, to emphasise just how much the modern Earth sciences can contribute to the modern world. On the final day, the President of the Royal Society, Lord Rees of Ludlow, Richard Fortey, President of the Geological Society, and others will confront the challenges of climate change, dwindling mineral and carbon resources, natural hazards and the struggle to find water for increasingly thirsty continents. There will, of course, be pure science as well: at least one speaker will address the recent discoveries of more than 150 extra-solar planets: that is, planets that orbit distant suns. No-one has ever seen one of these objects: their existence has been inferred from subtle observation of their parent stars, but astronomers and planetary geologists are preparing experiments that could one day directly detect their reflected light and read the chemistry of their atmospheres. The research is worth doing for its own sake, but of course everyone knows what the real prize would be: the discovery of another blue planet 25 or 50 light years away, a distant world with liquid water on its surface, and oxygen and methane in its atmosphere.

This chemical mix would be evidence not just of a habitable planet, but of an already inhabited planet, a home to extraterrestrial life. That's some pay-off for a science that began by looking at the ground beneath our feet, to discover neighbours far beyond the nearest stars.

http://www.geolsoc.org.uk/lyellcentre

*Tim Radford writes for *The Guardian* of which he is a former Science Editor and Literary Editor.

MEETING OF THE PARLIAMENTARY AND SCIENTIFIC COMMITTEE ON MONDAY 23RD APRIL

Faith vs Fact – Evolution in the Classroom

Dr Ian Gibson MP

The debate over the way in which evolution is taught in schools is often seen as a microcosm for the 'battle' between religion and science. Arguments about the origin of man are viewed as being represented by the Darwinian school of thought on one side, boasting modernity and enlightenment, and some form of creationism on the other side, holding on to tradition and belief. Framing the debate in this way can however over simplify it and lead to a position where both sides are reduced to name calling. The focus must remain on how science is to be taught and what the best way is to produce students that are inquisitive and intellectually strong. In my experience the only way science can be taught to accomplish this aim is to use research and observation to come to a result that is verifiable and evidence based. Faith should not play a part in the scientific process. When we look at intelligent design it cannot be seen to pass the scientific test.

Ever since the publication of Darwin's masterpiece, the *Origin of Species*, many people of a religious disposition have sought to discredit evolutionary theory based not on scientific fact or research but based on their interpretation of creationism as written in the Bible. The debate about the scientific validity of evolution and alternative theories is not a new matter that has emerged with the coming of the so called 'intelligent design' theory. The bible belt of America saw one of the first major clashes over the teaching of evolution in schools. Dayton, Tennessee in 1925 saw the famous Scopes trial, which was built up as a clash between the forces of modernity and the forces of religion. Were children to be allowed to be taught science that contradicted the Bible and engaged them in new ideas, or were they to continue under a law that made the Bible "the yardstick to measure every man's intellect, to measure every man's intelligence, to measure every man's learning", as member of the defence counsel Clarence Darrow put it. Although the defendant, John Scopes, lost the trial, it was widely viewed as a victory for the Darwinian side as their arguments seemed to be the more powerful.

Despite such apparent victories for scientific endeavour as the Scopes trial, the 21st century continues to see those who wish to see the Bible as the foremost text for academic inquiry. Emmanuel College in Gateshead has been allowed to teach intelligent design in science lessons as a 'faith position' equal to that of the 'faith position' of evolution. To put these two theories on the same academic level seems somewhat absurd to most people in the scientific community. One position, namely evolution, is supported by vast amounts of evidence and research, while intelligent design is supported by none. Michael Behe, one of the most prominent exponents of intelligent design, testified in 2005 before a court in Dover, Pennsylvania, that no scientific evidence in support of the intelligent design hypothesis had been published in peer-reviewed scientific journals.

The pseudoscientific position of intelligent design, a term employed by the US National Science Teachers Association, could not be in starker contrast with Darwin's theory. Evolution, as currently taught, is based on evidence from a number of different scientific disciplines. It encompasses biology, chemistry, zoology and above all genetics, to bring together evidence and present it in a completely rational and coherent manner. Intelligent design simply does

not have the overwhelming weight of scientific evidence behind it that evolution does. On the debate between evolution and intelligent design The Royal Society has said that "intelligent design has far more in common with a religious belief in creationism than it has with science, which is based on evidence acquired through experiment and observation." Claims of supernatural intervention in the origin of life should not be taught as science as they cannot be tested by experiment and do not generate any predictions. When intelligent design, and other such supernatural based theories, are held up to the same scientific scrutiny as evolution we can see that the two should not be taught side by side.

Evolution should however, like other subjects in science, be allowed to be questioned and be made to demonstrate its validity. Even though there is overwhelming evidence to show that evolution can explain how the world around us came to be, students should be encouraged to question what the theory has to say and try and build on it. Proponents of intelligent design should not however use gaps in scientific knowledge in order to muddy the waters between positions of evidence and faith. Evolution is a difficult subject for young minds to understand and they should not be confused by misleading or inconclusive arguments against it. Sceptics of evolution point out that the process has not been observed and can therefore not be taught as a position based on fact. This is a shallow argument as evolution states that processes involving the changing of species happen over long periods of time. There is no one jump from a slug to a horse, but a long and gradual process of mutation and transformation, the climbing of 'Mount Improbable' as Richard Dawkins describes it, which results in new species, or sub-species, emerging. Mixing different areas of science together to cause confusion about evolution does not serve its detractors well. The second law of thermodynamics is said, by those who believe in design, to show that evolution by natural selection would be impossible. Such expressions have however not been backed by evidence based research. The University of Leeds, where Professor Andrew McIntosh, originator of McIntosh's Law of Thermodynamics, is based, have issued warnings against introducing faith-based arguments into science and have looked to distance themselves from such positions. The University could have been speaking for the whole academic community when it said that it "wishes to distance itself publicly from theories of creationism and so-called intelligent design which cannot be verified by evidence."

The ability of scientists never to settle for an answer that cannot be verified has seen advances in the original ideas expressed by Darwin. Due to progress in technology and the bringing together of ideas from various branches of science, we now have a remarkable amount of evidence to support his claims. Darwin's book, *The Descent of Man*, told us that man had evolved from an ape-like primate. Not until we unravelled the human genome were we able to see just how similar we are to other creatures. We now know that we share 98 per cent of our genetic make up with chimpanzees, which surely cannot be a coincidence of design. Looking at our DNA has told us things about ourselves that religion cannot seek to explain. Up to 97 per cent of our three billion DNA base pairs are non-functional. Why would an intelligent designer make such superfluous substances? Might this phenomenon be better explained as a relic of evolution?

Religion does have an important role to play in society but clearly does not have much to say on the matter of evolution. Not all scientists are of the anti-religious disposition of Professor Dawkins. Some of our most eminent scientists, such as Einstein and Lord Winston, express a feeling for some other sense of their being. Einstein stated in 1939 that "the knowledge of truth as such is wonderful, but it is so little capable of acting as a guide that it cannot prove even the justification and the value of the aspiration toward that very knowledge of truth. Here we face, therefore, the limits of the purely rational conception of our existence." Religion can have much to say in the way we try to live our lives and offer some guidance on how to be a moral person. Science really does not have much of a voice when it comes to explaining how people ought to live in order to be a better person. The truth that science offers us may be a truly wonderful and beautiful thing, but a purely rational concept of our existence does not go any way to explaining the feelings of faith that billions of people around the world feel in moments of crisis and doubt. These feelings of faith however should not be allowed to undermine a scientific process based on research, evidence and the ability to inquire to an uncertain end.

Teaching Darwinism and Creationism in Schools: A Roman Catholic Perspective

Professor David Albert Jones
Professor of Bioethics,
St Mary's University College, Twickenham

Andrew Dickenson White in his two volume work *A History of the Warfare of Science with Theology in Christendom* (1896) saw the whole of the history of science as a continual struggle against theology. In the area of anatomy he tells us that a "yet more serious stumbling-block, hindering the beginnings of modern medicine and surgery, was a theory regarding the unlawfulness of meddling with the bodies of the dead… Hence Tertullian denounced the anatomist Herophilus as a butcher, and St Augustine spoke of anatomists generally in similar terms." The complete text of this book is easily available on the internet and you can find this quotation about Tertullian calling Herophilus a butcher quoted a number of times.

It is worth pointing out, as the late Professor White conspicuously failed to do, that what Tertullian objected to was not dissection but vivisection. Tertullian learnt from the pagan writer, Celsus, that Herophilus had practiced vivisection on criminals and slaves, women as well as men, perhaps as many as 600 of them. Herophilus remains the father of anatomy, and made many discoveries, but if anatomy declined radically after him it was not because of religious objections so much as because of his methods. Tertullian said he treated men and women cruelly in order to unlock the secrets of nature, "he hated men that he might know" (*On the Soul* 11).

I start with this story because it strikes me that the supposed warfare of science and religion is a myth (See JH Brooke (1991) *Science and religion: some historical perspectives*; W Carroll (2005) "Galileo and the Myth of Heterodoxy," in JH Brooke and I Maclean (eds) *Heterodoxy in Early Modern Science and Religion*). It is a myth in the sense that it is not a credible hypothesis in the history of science, but also in the other sense of myth, an idea that can shape someone's world view, that influences how they see the past and how they act in the present. AD White was so fixated with blaming religion for the decline of anatomy that he was prepared to gloss over the six hundred slaves who were tortured to death in the name of knowledge. He was so keen to pin the blame that he did not stop to examine the facts.

What then, as a matter of fact, has been the Catholic Church's reaction to theories of evolution within the biological sciences? It may be surprising to some, but the answer seems to be that the Catholic Church has not been overly concerned about the issue. It has neither enthusiastically embraced it nor has it challenged the science of it. Where there has been concern about evolution it has largely been concern over the ideological misuse of evolution by social and political forces – by social Darwinians, neo-colonialists, racists and eugenicists.

In general the Catholic Church is much less concerned than some Christian traditions to defend what some call the 'literal' truth of the book of Genesis. There is a problem here with what we mean by the literal meaning – that is, with how we identify the literary form of the passage so as to know what its intended meaning is (See Pius XII (1943) *Divino Afflante Spiritu* – see also Vatican II (1965) *Dei Verbum* and the Pontifical Biblical Commission (1994) *The Interpretation of the Bible in the Church*). Certainly Catholics are not bound to believe in a six-day creation. Augustine of Hippo, perhaps the most influential theologian of the Latin Church, did not believe that the world

was created in six days, and he warned that it was "reckless and incompetent expounders of Holy Scripture" who interpreted the Bible as intending to teach natural science (Augustine *The Literal Meaning of Genesis* I.19).

It is significant that there is no cause célèbre in the Roman Catholic tradition to rival the Huxley-Wilberforce debate of 1860 or Scopes 'Monkey' Trial? of 1925. The closest analogy to this is probably the temporary silencing of Pierre Teilhard de Chardin, the Jesuit Palaeontologist in 1950. Yet he was disciplined not for embracing the scientific theory of evolution, but for the way he reinterpreted religious doctrines of sin and salvation, in the light of evolution. It is also worth pointing out that the writings of Teilhard de Chardin were deeply controversial among some scientists (see for example Peter Medawar's entertaining but intemperate review of The Phenomenon of Man). Pope Pius XII, in the letter that was interpreted as an attack on Teilhard de Chardin, in fact argued that academics were free to discuss the doctrine of evolution "in as far as it inquires into the origin of the human body as coming from pre-existent and living matter" (Pius XII (1950) *Humani Generis*).

On the fiftieth anniversary *Humani Generis* Pope John Paul II went further and said, "new findings lead us toward the recognition of evolution as more than an hypothesis. In fact it is remarkable that this theory has had progressively greater influence on the spirit of researchers, following a series of discoveries in different scholarly disciplines. The convergence in the results of these independent studies – which was neither planned nor sought – constitutes in itself a significant argument in favour of the theory" (John Paul II (2000) *Message To The Pontifical Academy Of Sciences: On Evolution*). This was reported in the press at the time as a U-turn, but in fact the doctrine of evolution had not been condemned by Pius XII or by any pope. Rather, the statement of John Paul II was no more or less than an acknowledgement of the place of evolutionary theology within the biological sciences. John Paul II did not quote, but might well have been aware of, the assertion of Theodosius Dobzhansky: "nothing in biology makes sense except in the light of evolution".

From a Catholic perspective, should Darwin's theories on the mechanism of evolution be taught in schools? Clearly, yes. Darwinian evolution is in fact taught in Roman Catholic Schools in England and Wales as part of the national curriculum, and, as far as I am aware, the teaching of evolution within biology lessons has never been an issue of dispute between the government and the Catholic Church in the history of state funded Catholic schooling in the United Kingdom from the Balfour Act of 1902 until the present.

Should alternatives to Darwin's theory be taught in School? Clearly contemporary disputes within the discipline of biology should be taught in schools, and there have been important developments in evolutionary theory in the hundred years or so since Darwin, not least in the field of genetics.

Should six-day-creationism or 'Intelligent Design' be taught in school? Six-day-creationism is, to my mind, utterly incredible, both from the perspective of scriptural interpretation and from the perspective of the natural sciences. Intelligent Design is not such an absurd theory, and there are a minority of Catholics who take it seriously. However, I think that, taken on face value, as science it is nowhere near sufficiently established to warrant attention at school age. It is also striking that the theory, inasmuch as it finds any adherents among scientists, seems to be held more frequently by mathematicians and engineers than by biologists. In addition, speaking as a theologian, Intelligent Design is problematic from the perspective of theology, for it seems to make divine creation too closely analogous to a physical process of making, and hence the creator too much like another creature.

What then is to be taught in relation to Intelligent Design? None of the alternatives are attractive:

1. Don't mention it: This allows adherents to claim victory by default and leaves the weak arguments in favour of Intelligent Design to go unanswered.

2. Mention it in order to criticise it and use it as a foil to explain well established biological science. This would be my favoured approach.

3. Mention it only in religious studies lessons. This means it is discussed but in a context of relative scientific ignorance.

On this basis I would accept the discussion of Intelligent Design within biology lessons, though I should make clear that here I speak simply as an individual not for the Catholic Church as a whole. As far as I am aware, in many state schools (Catholic and secular), children are exposed to the 'creation-evolution' debate only in religious studies lessons, and hence in isolation from the teaching of science itself. This, which is the present default position, does not seem to me an entirely healthy state of affairs.

SCIENCE AND RELIGION

True Science and Origins

Andy McIntosh
Co-director of Truth in Science and Professor of Thermodynamics, University of Leeds*

The trouble with Truth

To tell the truth is dangerous. To listen to it is enraging. *(Danish Proverb)*

Andrei Sakharov (1921-1989) invented the Soviet nuclear bomb and then became a Russian peace activist until his death in 1989. He received the Nobel Peace Prize in 1975 (via his wife, as he was not allowed to leave Gorky). In his last speech before he died, he said, "I spent my whole life believing that the most powerful weapon in the world is the atomic bomb; Now I believe I was wrong. The most powerful weapon in the world is the truth." *(Quoted in Ravi Zacharias 'Recapture the Wonder', Nelson, 2003).*

The Royal Society has the motto *'Nullius in verba'* – on the words of no-one. There is a great danger that we infringe the spirit of free enquiry and even freedom of speech, if we insist that in the sciences that only one philosophical view of the evidence is allowed – Evolution. This raises the question just what is science and how should it be practised?

Truth and Science

What is science and how should we do our science? Experimental science and science based on naturalistic philosophy can be, and often are today, two different things. We have the same evidence to look at – same fossils, same rock, same plants, animals etc, and yet we can come to very different conclusions. The reason is because of the different starting points. We need to be aware of three issues as we approach scientific enquiry.

1 Ontological – What is reality?

Naturalistic science postulates: What ultimately exists is physical matter/energy and nothing else.

However the more enlightened scientist knows that true science is limited. It cannot deal with the whole of reality. Scientific methods deal with measurable quantities, but cannot objectively give the basis of thinking and rational thought itself. That is science cannot answer the very foundation on which science is based – reason and rationality. C S Lewis many years ago showed the absurdity of the materialist who argues that all is matter and energy (see C S Lewis *Miracles*). Will and rationality cannot be reduced to a mere dependent chain of events. If we could find for all thoughts a reason for why someone thought the way they did, then the very basis of rationality and reason would be lost. Lewis has long been forgotten, but we do well to remember that reason and logic rely on something beyond matter and energy.

2 Epistemological – How do we know what we know, and understand the Universe?

Naturalistic science (methodological naturalism) proposes: Everything that occurs in the universe can, in principle, be completely explained by reference solely to physical laws.

In this way, the naturalistic scientist is forced to conclude that there is nothing outside what the physical laws can interpret – but that of course is simply a product of his naturalistic assumptions. But the true historical basis of science is in fact from another perspective. That is, the Universe exists in such a way that it is able to be examined and understood, and furthermore that there is evidence of it being constructed by intelligence.

It is not information from mindless matter arranged in a particular order, but matter coming from information/intelligence. This resonates with a large body of scientists who, whether religious or not, do not wish that secularism acts as a religion that will allow no rival. It is this that is behind the whole issue today. Secularisation must not be a religion which stifles truth.

It is important to realise that Intelligent Design is not a new theory

*Truth in Science is an organisation set up to promote scientific enquiry, where rigorous testing of scientific views on origins is encouraged: www.truthinscience.org.uk

of origins – it was held by all the greats of the past – Boyle, Maxwell, Faraday, Newton, Einstein. It is not a presuppositional view of truth, but rather a natural, evidentialist conclusion from scientists across the religious spectrum.

The alternative, methodological naturalism, cannot deal with the underlying issues of what matter, knowledge, rationality and mind really are, because by definition *mind is not transcendent in this paradigm*.

3 Methodological – How do we do our science?

Naturalistic science states: Adequate scientific explanations of occurring events and phenomena should, in the last analysis (including origins), only refer to physical entities and laws.

The humbler approach of a scientist is surely to consider that if intelligence is needed to understand the world around him or her, then this is due to rationality and intelligence being behind the natural order.

Even if Intelligent Design is incorrect, Sakharov shows that there should always be open discussion in finding truth: "Profound insights arise only in debate, with a possibility of counterargument, only when there is a possibility of expressing not only correct ideas but also dubious ideas." (*Andrei Sakharov 'Progress, Coexistence and Intellectual Freedom', 1968*)

Freedom of paradigm is essential in understanding science, and science itself is at great risk if we impose evolution with no critical appraisal in our schools and Universities. This is already being done with disastrous results. We need to teach our young people not what to think so much as how to think – independently. *'Nullius in verba'* must be maintained.

To a growing body of scientists, the design position is scientifically, and intellectually, the most satisfying.

Intelligent Design is the best scientific paradigm to understand natural mechanisms

Examples of mechanisms abound. Both living creatures today, as well as fossilised remains even from Cambrian rocks (for instance the double calcite lenses in some trilobites of the Cambrian – Fig 1), indicate remarkable and intricate mechanisms with no evidence of simpler precursors. Other examples from flight in nature are the bird feather (Fig 2, see next page) which involves an intricate hook and ridge structure which only becomes evident under the microscope, and the avian lung whose operation is unique and completely different in operation to mammals and reptiles, the latter of which are supposed to be birds' ancestors according to evolution. Any transition is lethal and respiration in a supposed transition is impossible.

The science of information and thermodynamics

But at the fundamental level the reason evolution will not work is because of thermodynamics and information.

The laws of thermodynamics have one law in particular—the Second Law of Thermodynamics – which says that in a closed system the amount of energy that is no longer available for useful work is increasing. This is energy 'lost' to the system per unit degree of temperature, and it is called the entropy of the system. The principle of energy loss for doing useful work still applies in an open system, since unless there is a machine to use the energy added, there is no benefit. Boeing 777s cannot be made in a car factory by adding loads of sunlight or electricity unless the machinery is available to use that energy to build Boeing 777s. Similarly the human brain cannot be formed from simpler machines just by adding energy if there is no machinery

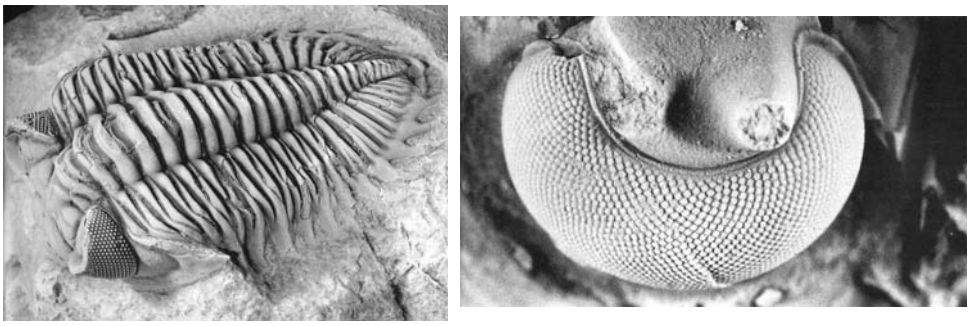
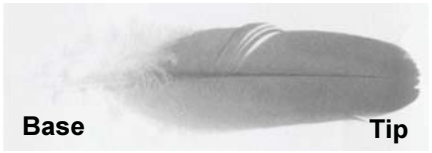
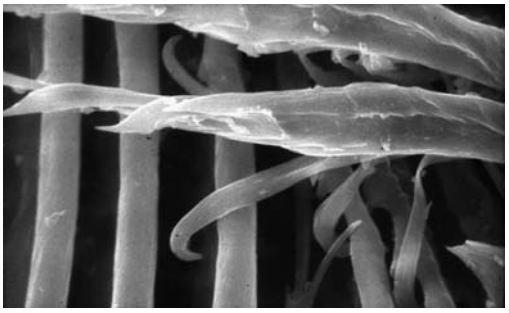


Fig. 1 Trilobites had very advanced visual systems. With compound eyes (made up of many lenses of calcium carbonate), they had special corrective features to avoid a double image. Some had corrective double lenses with the upper lens purposely 180° out of phase. These most complex lenses are in the Cambrian (conventionally dated as 450-500M years ago), and at the start of the phanerozoic era.



Pigeon Secondary



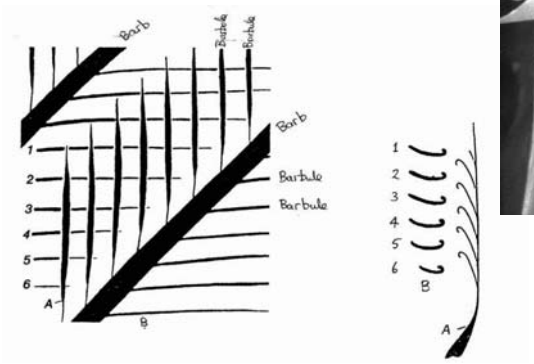


Fig. 2 Bird feather construction showing hook and barbule construction

available to do this. The spontaneous formation of such machinery will not happen.

Evolution proposes that new machinery arises of itself with no mind behind it. This idea is frankly thermodynamically absurd.

Experimentally, this has not been observed and is contrary to all the thermodynamic principles of energy transfer.

Furthermore new machines are not made by simply adding energy to existing machines. **Intelligence is always needed.**

Careful experimental science does not support 'just so' attempts to get round the clear evidence of design in nature. At the very least these matters should be critically considered in science teaching today, both in secondary and tertiary institutions.

In discussion the following points were made:

Although the Second Law of Thermodynamics had been advanced to justify the argument that evolution can only ever generate small-scale changes in plants and animals and can never be considered responsible for major changes in biota, the contrary view was expressed that it did not actually apply to evolution, which is an open biological system where mutations can occur. So it is not clear where thermodynamics fits into that model. The second law says that everything is running down. If you add energy to an open system it does not change anything unless there is machinery there which is able to capture the extra energy, requiring functional complexity which implies a designer. An open debate is therefore requested.

One suggestion that has been made is that the complexity of life is such that it could not possibly have happened by natural selection. That is not a scientific comment. It is a philosophical or religious assertion. Darwinism has been tested although Darwin never really tested it himself. He wrote the *Origin of Species* and then speculated about how complex structures in biology could have occurred. We have a responsibility to teach what is sustainable in science and Darwin is sustainable. On the other hand, Intelligent Design is a belief, and one is entitled to it, but we should not teach it in science.

The wide range of views between Biblical fundamentalists on the one hand and Richard Dawkins on the other tends to dominate the scene, whereas as a Christian one has no trouble adopting an intermediate position. Neo-Darwinists insist this has all happened through chance alone. However, a Christian may find that insufficient explanation for the world as we find it. For example, how does one explain the coming into existence of DNA?

However, this esoteric discussion is missing the point that the main concern must be that children in school are not being given a sound grounding in proven science such as Darwinism and alternative unproven theories are being advanced instead in the very limited time available for science teaching. People are perfectly at liberty to believe in and promote alternative theories, but their discussion should not form part of the core study of proven scientific facts in the school curriculum.

Science Education for the 21st Century

Professor Robin Millar
University of York

There are concerns about the quality and effectiveness of school science education in the UK, and in almost every developed industrialised country. These are of two main kinds. First, in many countries the proportion of young people who choose to continue to study science beyond the point where it is compulsory is falling, particularly in physics and chemistry. Second, public understanding of science – and trust in science – often appear to be low. So people's views on important issues, such as genetically modified (GM) organisms and global climate change, are often not well-informed – with potentially significant consequences for the public response.

School science has an important role in addressing both of these concerns: Science in schools must maintain its traditional and vital focus on preparing the most interested and talented pupils for science courses at university. At the same time, it must equip *all* students for what has been called 'scientific literacy' or 'science for citizenship'.[1]

This 'dual mandate' poses a very real challenge for school science. On the one hand, it has to provide all young people with a sufficient grasp of the scientific account of the physical universe – and of the methods of enquiry and the commitment to careful reasoning from evidence which are central to science – to allow them to take an active and informed role in making the decisions and choices that face us as individuals and as a society. It should give all students a positive experience of science, a sense of why science is valuable to them, even if they do not intend to pursue a career that requires more advanced study of science. At the same time, school science must also provide a sound foundation for further study of science for those who may want to follow this route, either out of personal interest or as a possible career direction – and it must do so in a manner that stimulates and retains the enthusiasm of students who have a particular interest in and aptitude for science.

If we only wanted to do one of these two jobs, the task of designing a science curriculum would be considerably easier. Indeed, we have in the past had science courses that were widely seen as a suitable preparation for more advanced study, when offered to the highest achieving 20% of the student cohort. But these have proved very much less satisfactory as a form of school science for the whole cohort – and the changes that have been made to broaden access have steadily diminished their suitability and effectiveness for the higher attaining group. There is much less experience, either in the UK or elsewhere, of school science courses to develop the kind of understanding of science that is of value to people who do not aspire to careers that require more advanced science. But there is very general recognition that this is crucially important in developing the social and political climate within which science and technology can thrive in an open society. We urgently need to develop expertise in designing science courses that can do this job well.

The fundamental reason why the dual mandate poses a challenge for school science is that science courses designed for each of these two purposes would be quite different in content, depth of treatment, and emphasis. A science curriculum for citizens would aim to help all students understand enough science, and enough about scientific methods of enquiry, to make better-informed choices and hold better-informed views on issues that affect them directly – like whether or not to have a child vaccinated, or to eat food produced from GM crops, or to support measures to reduce carbon emissions. It would teach some basic scientific knowledge, but would also

highlight the importance of basing claims on careful reasoning from evidence and of peer review in checking and scrutinising claims that are made. The science education of future scientists, on the other hand, is an induction into an accepted set of explanations for the behaviour of the natural world. It begins from the foundations, and proceeds in slow logical steps. It involves extensive practice in applying standard methods and in carrying out standard procedures. Students have little opportunity for independent thinking or for genuinely open enquiry until they reach an advanced stage. They learn little that they can apply practically in everyday situations. Not surprisingly, many students see little reward for the effort of trying to understand it: "A lot of the stuff is irrelevant. You're just going to go away from school and you're never going to think about it again."[2]

Studies in other developed countries report similar views.[3] Teaching 'academic' science to the whole school population results in fewer students wanting to continue to study science – and to negative views of science and science education in general. One particularly telling piece of evidence comes from the Third International Mathematics and Science Study (TIMSS). In this study, random samples of 15-year-olds in over 40 countries took a test of school science knowledge and completed a questionnaire designed to assess their attitude towards science. If we plot the average score for each country against the percentage of students in that country with a high positive attitude towards science, the graph shows a strong negative correlation between the two variables.[4] A high average score goes along with a low proportion of 15-year-old students with a positive attitude towards science. In other words, those countries which teach science in a way that results in high average scores on a rather traditional science test have the smallest proportion of students with positive attitudes towards science and school science.

The problems we, and many other countries, currently face are a consequence of thinking that one science curriculum, if suitably designed, can achieve both of the aims of the school science curriculum – the 'dual mandate'. Instead this leads to an unsatisfactory compromise – a course which does neither of the jobs of the science curriculum well. The first step towards a solution is to acknowledge the need for different kinds of science courses for different purposes, and for different students – depending on their interests and their future aspirations. We need to move away from a failed 'one size fits all' model of the science curriculum towards a more flexible set of options, each of which can be designed more effectively for purpose.

This is what I and my colleagues have been trying to do over the past 8 years in the work that has led to the *Twenty First Century Science* GCSE specification – one of four available to schools from September 2006. In developing it, we wanted to improve significantly on its predecessor, Double Award Science, in two main ways. We wanted to find a way to teach some stimulating and conceptually challenging science to students with an interest in science – something which had been gradually eroded over the previous 20 years. And we also wanted to design a course that could provide **all** students at this age with the kind of understanding of science that would help them engage more thoughtfully and critically with science as they meet it in their everyday lives – in particular, to develop their skills in looking thoughtfully and critically at the evidence that supports the kinds of claims that are made and to develop their ability and confidence to discuss and evaluate these. I emphasise 'all students' here, because this kind of understanding of science is also essential for those who wish to pursue the study of science further. So we developed a Science course to develop the 'scientific literacy' of all students – and a more formal and abstract Additional Science course for those who chose it. We quickly realised the importance of also offering an Additional Applied Science course – for students with a more practical interest in science as it is used in some real workplace situations.

If we want to address both aspects of the 'dual mandate' for the school science curriculum, we need to accept that no single course, however well-designed, will do both jobs well. We need a variety of provision, for students with different interests and aspirations. And we need a continuing effort – involving everyone with an interest in school science – to review, revise and improve the science courses we offer both to those who may go on to work with science, and those who will not.

REFERENCES

1 House of Lords Select Committee on Science and Technology, Third Report (2000)

2 This comment, by a 16-year-old school student, comes from: Osborne, J. and Collins, S. (2000). *Pupils' and Parents' Views of the School Science Curriculum*. London: King's College.

3 Lyons, T. (2006), Different countries, same science lessons. *International Journal of Science Education*, 28 (6), 591-614.

4 Ogura, Y. (2006). Unpublished graph. Tokyo: National Institute for Educational Research. Based on data from: Martin, M.O. et al. (2000). *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the eighth grade*. Chestnut Hill, MA: Boston College.

The Importance of Good Teachers

Dr Derek Bell
Chief Executive, The Association for Science Education

The Devonshire Royal Commission of 1875 claimed that 'the present state of scientific instruction in our schools is extremely unsatisfactory'[1] reminding us that this is not the first time science education has come under scrutiny. More recently, a wide range of bodies across government, business, industry and the scientific and engineering communities have also expressed their views on why students should be taught science.

There is widespread acceptance that all students should have access to the study of science throughout their years of compulsory education. The Association for Science Education (ASE) has for many years championed the cause of 'Science for All' and, since its origin in 1901, has worked to improve teaching and learning in science through its members working together to share good practice and to express views on science education. ASE argues[2] that all pupils should experience, and have access to, a broad, relevant science curriculum, which puts the understanding of science and its applications in a social context. Furthermore pupils should experience a variety of teaching and learning approaches, including practical work, in order to extend, develop and adapt their knowledge, understanding, skills and attitudes in science. Regardless of whether it is in primary or secondary school, the role of teachers, who are enthusiastic, have good subject knowledge, a clear philosophy of science education and high quality expertise in teaching, is a key element in meeting these aspirations. As Osborne and Collins[3] concluded,

"In essence, school science's most valuable resource is not its equipment or its laboratories but a cadre of *well-qualified, enthusiastic teachers* who are justly remunerated for their skills."

These teachers would be the first to acknowledge they could not do it without the support of their colleagues, technicians and teaching assistants who make up the wider science team.

The challenge for science education in the 21st Century is translating such aspirations into practice. The answers are not straight forward but it is worth reminding ourselves why most of us went into teaching in the first place. In part it is to do with our interest in our subject but for many it is because we wanted to share it with young people, getting them engaged, experiencing something different or coming to understand something that started as a 'mystery'. To do this all teachers have to juggle a wide range of demands, principally, the curriculum, the assessment requirements, the facilities and resources available and their own pedagogical skills in order to engage their students. Each of these elements obviously relates to, and impacts on, the others thus emphasising the complexity of the task and the level of expertise required by a highly accomplished teacher.

Thus if we want high quality science education in and for the 21st Century we need to ensure that teachers and other members of the science team are well prepared and have access to high quality CPD in order to keep up to date, maintain their own enthusiasm and are able to adapt to changing circumstances. This of course is easier said than done but below I have attempted to illustrate some of the implications for teachers that arise from different aspects of providing science education which is appropriate for young people. Although the main focus here is on secondary education, the issues identified also relate to primary science.

It is important to stress that there are many positive claims that can be made about science education in the UK: the performance of the UK in international comparisons, Ofsted Inspection reports showing improvements in the quality of teaching, the success of primary science and the fact that there are many pupils who do enjoy science. Such positive aspects are all too easily forgotten in the debates that take place yet these are strengths on which we can build and make progress.

Facilities and resources

In some schools the science laboratories have not changed for many years but science has moved on. The sophistication of the equipment that is available for carrying out practical work has also moved on. The potential of ICT and other

technologies provides a myriad of opportunities to improve the quality and excitement of teaching and learning. Science education in the 21st Century must embrace these developments, not just because they are new but because they provide greater insights into, and ways of investigating and learning about, the natural world.

Apart from the obvious fact that provision of new facilities and equipment needs careful planning and the funding to go with it, teachers and technicians need to be comfortable working in the new environments and with using the equipment. This in turn requires time not only in training but also to follow up the training and try things out.

Curriculum

Debates about the curriculum seem to be endless but, whatever the curriculum specification, we must have appropriately qualified teachers to teach it. Simply to argue that teachers should have a degree in a particular subject does not guarantee that they can teach what they know to young people nor that they have the breadth of knowledge from their degree course to cover that required by the curriculum. This problem is generally acknowledged and individual teachers take it on themselves to ensure that they do know what it is they have to teach. However at a system-wide level it is not so straight forward. A report in 2006[4] set out concerns that in maths and science (principally physics and chemistry) there are not enough qualified teachers to teach the curriculum required. Some steps are being taken to address this issue in the short term but ultimately it means that more individuals trained in the scientific disciplines need to be attracted into teaching and those in the profession need to engage in subject-specific CPD.

Assessment

Closely tied up with the curriculum is the issue of assessment which in turn drives what is actually taught and what students are asked to 'learn' for tests and examinations. We delude ourselves if we think it was different in the past. As teachers we have all tried to improve our students' chances of success by doing 'revision' and highlighting particular aspects of the topic that 'are likely to come up in the exam'. So what has changed? The frequency of external tests and examinations and the culture of 'league tables' have certainly contributed to creating an environment in which the assessment regime has, at the very least, restricted opportunities for exploring the subject beyond the scheme of work.

Paradoxically, assessment used in a formative manner, rather than for summative purposes, is an integral part of the learning process. The potential impact of formative assessment on the achievements of students was summed up by Black and Wiliam[5] saying,

"There is a body of firm evidence that formative assessment is an essential feature of classroom work and that development of it can raise standards."

However for teachers to maximise the benefits of formative assessment requires changes in their practice.

Engaging Students

Getting pupils engaged with the science can be done in different ways but not every approach will engage all students. Grabbing interest with a 'spectacular or intriguing demonstration' can be effective as is finding a way of making it 'relevant' to them. This will differ from student to student, for some 'relevant' means the work should be 'applied'. For others it is the need for some 'personal link', discussion of 'ethical issues', hearing about a scientific discovery or investigating something they personally find fascinating. Sparking some kind of interest is an important first step in pupils' learning.

Pedagogy

Whichever way you consider science education for 21st Century there are implications for the teachers both individually and collectively. The importance of their teaching skills, their knowledge of the subject, their understanding of children's learning, amongst other things, cannot be denied. Yet too often in the debates about curriculum, assessment and resources the implications for teachers have not been made explicit. Recent developments which have raised the profile of subject-specific CPD, have started to address the situation. I would argue that in looking ahead we need to reconsider how we manage the introduction of changes at national and school level. Teachers implementing the changes need to be well prepared but, importantly, there should be enough time, support and flexibility for teachers and schools to be able to decide how best they meet the needs of their students.

Science education has come a long way in the last 100 years and will, without doubt, move on in the 21st Century but the interactions between teachers and pupils will remain at its heart. It is through highly accomplished teachers skilfully managing the, often competing, demands that we will enthuse the next generations in science.

REFERENCES

1 Quoted in House of Commons Science and Technology Committee, 2002. *Science Education from 14-19*, Third report of session 2001-2002, Volume 1 para 1. London: The Stationery Office Limited

2 ASE Strategic Plan 2005-2010

3 Osborne, J. and Collins, S. (2000) *Pupils' and Parents' views of the school science curriculum*. London: King's College London, School of Education

4 Moor et al (2006) *Mathematics and Science in Secondary Schools: The deployment of teachers and support staff to deliver the curriculum* Research Report 708, DfES London

5 Black, P. and Wiliam, D. (1998) *Inside the Black Box: raising standards through classroom assessment*. London: King's College London, School of Education.

Science for Science's Sake

David Perks
Head of Physics, Graveney School, Tooting

When I wrote my essay *"What is science education for?"* I was asking a seemingly uncontroversial question. However, the response to the essay proved this is not a question we feel confident we can answer with any degree of certainty. In response to the introduction of the new Science GCSE last September, based on the Twenty First Century Science (TFCS) GCSE pilot, I wrote a critique of the direction educational reform was taking. In essence, I was asking for a pause to take stock before we committed ourselves to a course of action from which it will be very hard to extract ourselves in the future. The furore surrounding the publication of my essay proved there is real concern about the rush to reform school science. Famously Baroness Warnock was quoted on the front page of *The Times* calling the new Science GCSE "fit for the pub" rather than the basis for a sound science education.

On the other hand, almost everyone thinks that "something must be done" to improve science education. The decline in numbers taking science at A-level and university, especially the hard science sciences – physics and chemistry – has now reached the status of a national disaster. Despite advertising campaigns, the lure of pop stars like Myleene Klass and out-and-out bribery to attract new science teachers into the profession we still face a dire shortage of qualified physics teachers in our classrooms. The closure of university departments seems to have reached the proportions of near collapse in the physical sciences. But this is not the only driver towards the reform of science education.

The position of science in society has suffered a dramatic decline with the response to BSE, MMR and GM foods just to name a few crises that have faced the government over the last couple of decades. Scientists are now tainted by their relationship to industry and government. We just don't trust them like we once did. For government the issue of trust has become a direct target of educational reform. Robin Millar and Jonathan Osborne made it clear in *Beyond 2000* (http://www.kcl.ac.uk/education/publications/bey2000.pdf) that science education had to educate the citizen to "have sufficient knowledge and understanding to follow science and scientific debates with interest, and to engage with the issues science and technology poses – both for them individually, and for our society as a whole". That is science education should be about creating the scientifically literate citizen.

The problem is that all this asks too much of the GCSE science curriculum. The conflicting demands of creating future scientists and producing scientifically literate citizens do not sit easily at the heart of science education. They pull science education in two totally different and at times contradictory directions.

I believe neither perspective is right. Science education can only work if we believe science is worth knowing about in its own terms. Trying to claim what amounts to crude political imperatives as the rationale for science education can only serve to undermine further the value we give to science. It is our failure of nerve when it comes to explaining what we are doing in the school science laboratory which encourages us to look for other widely disparate justifications for science education. Science education will not work if we don't believe that it is worth educating young people with knowledge and understanding of science for its own sake. And by science I mean academic science, a proper foundation in the disciplines necessary to study science to a higher level. Science for science's sake is the only option if we want young people to believe that learning science has something to offer them all. The trouble is that few adults believe that this is either possible or worthwhile.

But just because something is difficult that is no reason to give up. One of the most disheartening things about the debate about science education is the assumption that traditional science education is boring. From politicians to the authors of *Beyond 2000*, there is a common assumption that science taught as an academic subject is irrelevant to young peoples' lives and so inherently dull. Even more insidious is the implication that science is just too hard for most young people. All of this is just a reflection of our lowering of expectations of what young people can achieve. It is all too easy to produce findings in attitudinal surveys that young people are turned off by their science lessons. But the banally obvious point is that if we

don't think science is interesting as politicians and educators then children have little chance of finding it important. Children have a habit of reflecting back our own concerns to us – with a pinch of disinterest just for good measure.

But even if we take the reforms on their own terms, they just don't add up. The TFCS GCSE pilot which has now become the flagship specification for the OCR examining board and the driving force behind the QCAs new programme of study for key stage 4 (14-16 year olds) is worth interrogating in its own terms. The centre piece of this new GCSE is the emphasis on scientific literacy or as the QCA calls it "how science works". This marks a dramatic shift away from academic science towards an appreciation of how science affects the consumer of science. The problems with this approach are threefold: it neither seems capable of encouraging a broader uptake of the sciences post GCSE; nor will it provide the basis for a greater trust of science for consumers of science; and lastly it just isn't science.

The clearest demonstration of the flaws of this approach is to look at how it deals with issues in science. The "science in the news" aspect of the TFCS GCSE replaces experimental coursework. This was trialled at Graveney School with year 9. The task selected asked pupils to consider "Should Britain replace it's ageing nuclear power stations?" The material provided by the exam board consisted of information in the form of press cuttings about energy production and consumption. I added my own press cuttings as this issue was very much in the news at the time. The response of pupils to this task was interesting. They asked me questions like "What is nuclear power?" "Is radioactivity dangerous?" "What is a nucleus?" etc. They wanted to know about the science and were to put it bluntly not interested in playing politics with nuclear power. Asking fourteen year olds to deal with a question posed in this way is asking them to deal with an issue the Government finds itself struggling to answer to its critics.

This approach fails on many levels. It fails to recognise how young people learn. Instead of being offered ethical choices to decide upon fourteen year olds want to be told what they should know and learn. Expecting teachers to have a clear enough perspective on such questions is asking too much of them. They will reflect wider concerns in the public arena about science, amplifying pupils' own doubts about the use of science rather than clarifying issues. Science teachers are not experts in ethics any more than they are experts in the Government's political priorities. As a result, controversial issues within the classroom very quickly become reduced to a matter of ethics based on a lack of information. This was one of the conclusions I drew from an earlier project I was involved in with the Wellcome Trust on sex selection - http://www.wellcome.ac.uk/node5962.html .

So turning science lessons into media studies classes by mimicking the worst aspects of breakfast time TV is not going to encourage pupils to trust science. Nor is it going to foster their interest in studying what amounts to a demanding choice at A-level and beyond. In fact, just these points were raised by my colleague Tony Gilland at The Institute of Ideas when he looked at the publication of research following up the pilot TFCS GCSE. Pupils following the course were if anything less likely to trust scientists and less likely to want to pursue science to a higher level ("New science GCSE: A failed experiment?" Tony Gilland, http://www.instituteofideas.com/sciedproject.html).

When pupils arrive at secondary school, science is one of the most exciting subjects on offer. Seeing their eyes light up when they first get to use a Bunsen burner never fails to enthral me. I have never found it hard to capture pupil's interest in science. They all want to know how to do science. Turning their natural enthusiasm into the hard work necessary to master the scientific disciplines is the job of the science teacher. I fail to see how replacing Bunsen burners with cuttings from the *Daily Mail* is going to help us to do this.

In discussion the following points were made:

One of the slides appeared to indicate that if you want more science, teach less of it! However social science data are always messy and possibly not reliable. An early choice is required between Science and Humanities at age 14.

The low carbon economy will require applied scientists in the future. Presently foreign nationals fill nine of every ten posts due to the lack of national graduates.

The view that science will not be required after leaving school is widely held. Hence much more effort is required at Primary Schools.

If science is boring, it is not well taught. Exciting subjects are those that are well taught. Kids are fascinated by science, but there is hard work to do as well and this needs pointing out. Science for Science Sake was endorsed and is important in its own right.

There are not enough practicals at schools. These require resources and competent teachers. Teaching can with advantage be linked to real life challenges (such as military experience, for example) with beneficial results.

Closer to home: Science and Innovation in France … and Europe

Mark Sinclair
First Secretary, Science & Innovation, Paris

Swapping the Science and Innovation role in Boston for that in Paris has certainly brought home a few differences. There's the language of course – although even here English is increasingly the language of science. But also the culture of science and innovation: from an environment where the State played a relatively minor role in the innovation engine and where strategy was emergent at best, to one where the State is firmly in the driving seat and strategy abounds. And there's not the same stream of UK science visitors keen to learn from the world's number one innovation hub. But perhaps our nearest neighbour should be better known: there is certainly plenty going on here.

France is a major force in European research, spending around 2.2% of its GDP, some €35 billion, of which 46% comes from the State. But despite the high volume there are concerns over the efficiency and effectiveness of the research output. Publications and citations are lower overall than the UK, yet the very best research here is outstanding, with a higher share than the UK of highly cited papers in the most prestigious journals. Patent numbers are higher too but exploitation of that knowledge and links between public research and industry are below international benchmarks.

The French Government has been making serious efforts to overhaul the public research sector. The Research Bill of 2006 introduced reforms aimed at increasing prioritisation and strategy, more systematic evaluation of research, encouraging co-ordination between research organisations, making scientific careers more attractive, increasing innovation and technology transfer and increasing integration into the European Research Area. In an effort to improve the innovation performance of industry, the State funded the creation of competitiveness clusters – associations of companies, research centres and educational institutions, working in partnership under a common development strategy. Sixty-six of these poles de competitivité were created, 6 of which are regarded as world-class with another 10 close behind. These are well funded with preferred access to public research calls. Many are creating real momentum regionally and developing new international links.

Last month of course saw the election of Nicolas Sarkozy as president. Research and higher education reform featured strongly in his campaign. An historic effort is needed, he said, to avoid losing the battle for intelligence. He promised to increase higher education spending by €5 billion (50%) in five years, and strengthen university governance, offering them real autonomy and placing them at the centre of research. R&D spending is to be increased by 40% (€15 billion, 4 billion of which will come out of the public purse), aimed at reaching 3% of GDP by 2012. The new Government is moving swiftly. Valérie Pécresse, appointed to a new Cabinet-level position as Minister for research and higher education, has begun consultation on a bill on university autonomy scheduled for debate in an extraordinary legislative session this July.

In the Paris Embassy, I am delighted to have taken over a team that has produced a string of solid outcomes in terms of increased bilateral co-operation. As our forthcoming annual report will show, my colleagues in the rest of the S&I European Network have an excellent story to tell too. But we are facing some strategic challenges that mean we need to look continually for ways to increase the value we add. There is the familiar competition for resources, including strong demands from our own S&I colleagues in the rapidly developing economies of the world. But the important new challenge is that of getting the best value for the UK from a hugely increased EU Framework Programme 7 (FP7), now worth €50 billion over 7 years. UK academics have tended to do well in the FPs (they were involved in 47% of all multilateral FP6 contracts) but take-up by UK industry is poor. There is a UK cross-departmental effort to turn this around. Our network has been specifically asked by GSIF (the cross-departmental committee responsible for international science and innovation issues) to focus on helping the UK achieve its goals in FP7.

To bring about these new multilateral collaborations we will need to work together across Europe, harnessing the resources we have in 11 countries (including Switzerland, Israel and Russia) and finding a way of reaching into those other countries with a significant science or innovation effort where there is currently no UK S&I resource.

Putting this new approach into practice will be a challenging task, but one that we are looking forward to tackling. The prize is worth it.

Engaging the Disengaged

Dr Nigel Eady

Science in Society Officer, the BA (British Association for the Advancement of Science)

Recent years have seen a shift in science engagement activities from rigid 'top down' approaches to methods that consciously allow participants to share power in decision-making. However, the community x-change, an innovative project run by the BA (British Association for the Advancement of Science), shows there is still a long way to go.

Power to the people

Since the House of Lords Science in Society report of 2000[1] there has been a steady stream of developments in the science communication field. Everyone is 'doing dialogue' and the processes and approaches of participation are gradually becoming embedded within institutions. The formation of Sciencewise[2], the proposed Expert Resource Centre for Public Dialogue on Science and Innovation[3] and the Beacons for Public Engagement[4] all demonstrate awareness, at a high level in public institutions, of the need for a social licence for the advance of science.

However, whilst these developments have been welcomed in many quarters, there still exists a suspicion regarding the quality and utility of these sorts of processes. Whilst new 'hardware' exists to probe public views some doubt whether culture change, the 'software' required for a meaningful response, has occurred.[5]

Over-representing the under-represented

In this context, the community x-change was designed to explore a new methodology for dialogue. This 'two-way' approach takes elements from a

number of different initiatives, including citizens' juries and common language projects, to provide time and space for citizens to discuss issues of local concern as well as those with national implications – year one of this project addressing climate change. A series of structured deliberative workshops were held where citizens, including scientists and policymakers, could share their opinions and discuss strategies for positive change.

A distinguishing element of this process is that it seeks the views of voices currently excluded from public debate. It is easy to tick the diversity box for such an engagement process whilst never getting beyond the gatekeepers within local communities. Two outreach workers were therefore employed to involve a wide range of participants in the workshops, especially targeting the marginalised in society. Over a number of months they met and worked with a wide range of local groups to encourage their involvement in the process.

Through this project we wanted to learn how to improve practices of dialogue, particularly those allowing currently excluded voices to influence policy. We wanted to learn how to improve involvement processes which address issues that communities, as well as policymakers, deem to be of concern. We also wanted to develop the capacity of our elected representatives to engage with participatory processes. With this in mind, close contact with policymakers and stakeholders was maintained throughout, in order to ensure appropriate outputs.

A safe space

The community group of about thirty participants included representatives from a broad range of groups: black and minority ethnic communities, non-English speakers, ex-offenders and young people, to name a few. A small number of scientists were also involved who were not experts on climate change but deliberately recruited as citizens.

Providing a safe space for participants to discuss local issues of concern gave depth to the process. Many of the local issues, for example public transport, could be discussed within the broad framework of the environment, allowing climate change to be introduced more naturally to the discussions. However, deep-felt personal feelings were also uncovered which impinged on the global science issue, one participant commenting, "I can't even influence my local community so how can I influence climate change." We also observed that willingness to value, and promise to act on, the views of a community quickly removes perceived barriers. Many participants greatly appreciated the opportunity to meet with other local people outside of their normal acquaintance.

The future

Participants presented their video report of the workshops at the BA

Festival of Science in September 2006 and the videos are now available to view online.[6] To extend the influence of the discussions, a series of events based on resources from the project are now running across the country throughout 2007.[6]

The project has now entered a period of reflection and evaluation. Further workshops are planned in Liverpool, European Capital of Culture 2008, to coincide with the BA Festival of Science. There has been a great deal of learning within the project team about the benefits of collaborating with local communities and we will endeavour to embed future processes more deeply in local community structures. For example, we will provide greater levels of support to the group after the workshops to enable them to engage over a longer period of time with issues discussed. The danger with all engagement being that aspirations and expectations are raised, only for the individuals to be left high and dry once the project team move on. Without doubt, a comparable challenge is presenting the views expressed in a manner that influences decision-makers both locally and nationally.

The community x-change is funded by Sciencewise, Defra and the Wellcome Trust.

REFERENCES

1 House of Lords Science and Technology Committee, Third Report, 23 February 2000 http://www.publications.parliament.uk/pa/ld199900/ldselect/ldsctech/38/3801.htm
2 Sciencewise http://www.sciencewise.org.uk/
3 Pre-budget report, 6 December 2006 http://www.hm-treasury.gov.uk/pre_budget_report/prebud_pbr06/prebud_pbr06_index.cfm
4 See http://www.hefce.ac.uk/pubs/hefce/2006/06_49/
5 The Public Value of Science, Demos, 5 September 2005 http://www.demos.co.uk/publications/publicvalueofscience, p.19
6 See http://www.the-ba.net/communityxchange

It's not just cricket – actually it's physics

Ever wanted to face a Shane Warne spin delivery or smash a Glen McGrath speed bowl? A new bowling simulator may enable you to do just that. The machine is the first of its kind to use physics, real cricket balls and novel speed and spin generating mechanisms to imitate realistic deliveries (eg spin, swing and pace) as generated by professional cricket players. Dr Andy West, the machine's inventor at Loughborough University described it at an Institute of Physics conference, *Physics and Engineering – Synergy for Success*, in October last year.

Dr West said: "By considering the physics of air flow around a ball and launch conditions we have made a robotic bowler that we can programme to mimic Warne, McGrath or the style of any other bowler. When we were designing the machine, we considered all the things that real players use, such as the orientation of the seam and the speed at which the ball is released to vary how a ball travels when it is bowled."

"Real life bowlers can get tired or injured during extensive training periods so the machine is ideal for batsmen to practise with. The team coach can programme it to bowl whatever sequences of deliveries he wants. Alternatively, exactly the same ball can be bowled again and again (referred to as shot grooving) until cricketers become expert at hitting them."

The trajectory of the ball from the bowling machine to the batsman is dependent on how the boundary air, the air next to the ball, moves around it and how it separates or moves away from the ball. There are two different types of air flow – laminar, which is smooth – and turbulent, which is rough. In laminar flow the boundary layer separates approximately halfway around the ball whereas in turbulent flow the separation is later.

The seam on a cricket ball "trips" the air flow into turbulence so there is rough air flow on one side of the ball and smooth air flow on the other. This creates an uneven air flow around the whole ball which causes a sideways drift. The size of the drift depends on the angle of the seam, the speed of the ball and the condition of the original air flow around the ball. It is essential therefore that the seam is aligned accurately to enable any machine to be able to generate this type of "swing" delivery.

Dr West continued: "Consideration of the physics of flight and the requirements of players and coaches has enabled us to make a very realistic bowling machine that will be great for professional cricketers to practise with. However our vision is that the machine is not just for the professional. The cricket emulator is part of a co-ordinated suite of sports simulation machines that have been or are currently under development at Loughborough covering sports such as golf, football, cycling, rowing and weight training."

The presentation, *The Development of a Novel Cricket Bowling System*, was made by Dr Andrew West and Laura Justham from Loughborough University at the Institute of Physics conference, Physics and Engineering – *Synergy for Success*, on 5th October 2006.

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 Innovation and its associated public bodies".

The new Committee was nominated on 19 July 2005. Members of the Committee are Adam Afriyie (Con, Windsor), Mr Robert Flello (Lab, Stoke on Trent South), Linda Gilroy (Lab Co-op, Plymouth Sutton), Dr Evan Harris (Lib Dem, Oxford West and Abingdon), Dr Brian Iddon (Lab, Bolton South East), Chris Mole (Lab, Ipswich), Mr Brooks Newmark (Con, Braintree), Dr Bob Spink (Con, Castle Point), Graham Stringer (Lab, Manchester, Blackley), Dr Desmond Turner (Lab, Brighton Kemptown), and Mr Phil Willis (Lib Dem, Harrogate and Knaresborough). Mr Phil Willis was elected Chairman of the Committee at its first meeting on 20 July 2005.

Oral Evidence

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

Introductory Hearing with Mr Edmund Wallis, Chairman of the Natural Environment Research Council
On Wednesday 25 April 2007, the Committee held an introductory hearing with Mr Edmund Wallis, Chairman of the Natural Environment Research Council.

Introductory Hearing with Sir John Chisholm, Chairman of the Medical Research Council
On Wednesday 20 June 2007, the Committee held an introductory hearing with Sir John Chisholm, Chairman of the Medical Research Council. Written evidence has been invited from interested organisations and individuals on the role and responsibilities of the Chairman.

Current Inquiries

Space Policy
On 19 July 2006, the Committee announced an inquiry into space policy in the UK. The inquiry is focusing upon the current levels of investment in the sector, the UK's relationship with the European Space Agency, the delivery of public benefits from the space-related activities of different Government departments, and the support for space-related research.

The Committee has held seven oral evidence sessions and has heard from the Minister for Science and Innovation, the BNSC, the European Space Agency, industrialists, and academics. A Report is expected to be published in the summer.

International Policies and Activities of the Research Councils
On 6 March 2007, the Committee launched a new inquiry as part of its thematic scrutiny of the Research Councils. The terms of reference include international collaboration through the EU Framework Programme, interaction between the Research Councils and Government Departments on international collaborations, and the international mobility of scientists and engineers.

The Committee has heard oral evidence from university representatives, the learned societies and the Research Councils. A Report is expected in the summer.

Investigating the Oceans
The Committee is undertaking an inquiry into marine science. It will consider the organisation and funding of marine science, the role of the UK internationally in this field, support for marine science, the use of marine sites of special scientific interest, and the state of the UK research and skills base underpinning marine science.

The inquiry was launched with a public seminar at the National Marine Aquarium in Plymouth on 17 April 2007. The Committee has subsequently held several oral evidence sessions hearing from The Inter-Agency Committee on Marine Science and Technology, the Research Councils, academics and industrialists. Oral evidence sessions will continue in the summer.

Funding of Science and Discovery Centres
On 2 May 2007, the Committee announced a new short inquiry into the funding of science and discovery centres. The inquiry will examine the role of science centres in public engagement and attracting young people to science subjects and scientific careers, the funding of such centres, and ways of supporting their long-term future. The deadline for written evidence was 11 June 2007 and oral evidence sessions will begin in the summer.

Renewable Energy-Generation Technologies
On 15 May 2007, the Committee announced a new inquiry into renewable energy technologies. It has invited written evidence on several points: the current state of UK research and development in this area; the feasibility, costs, timescales and progress in commercialising new technologies; the Government's role in funding research and development in this field, and other possible technologies for renewable energy-generation. The deadline for written evidence was 2 July 2007. Oral evidence sessions will begin in the autumn.

Debate

On Thursday 14 June 2007, there was a debate in Westminster Hall on the Committee's Fifth Report of Session 2005-06, *Drug classification: making a hash of it?* (HC 1031).

Government Responses

Human Enhancement Technologies in Sport
On 23 April 2007, the Government published the *Government Response to the Science and Technology Select Committee Report on Human Enhancement Technologies* (Cm 7088).

Further Information

Further information about the work of the Committee or its current inquires can be obtained from the Clerk of the Committee, Dr Lynn Gardner, the Second Clerk, Dr Celia Blacklock, 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 21 November 2006) are Lord Broers (Chairman), Lord Colwyn, Lord Haskel, Lord Howie of Troon, Lord May of Oxford, Lord O'Neill of Clackmannan, Lord Patel, Lord Paul, Baroness Perry of Southwark, Baroness Platt of Writtle, the Earl of Selborne, Baroness Sharp of Guildford, Lord Sutherland of Houndwood and Lord Taverne. Baroness Finlay of Llandaff was co-opted to the Committee on 12 December 2006.

Science and Heritage

The Committee's report was published in November 2006, and set out a comprehensive vision for the future of what the Committee has termed "heritage science" – the diverse range of scientific research that underpins the conservation of our cultural heritage. The Government's response was published in January 2007. While the Committee's recommendations were embraced warmly by the Research Councils, the response from DCMS was less positive. The report was then debated in Grand Committee on 12 June, with fourteen speakers taking part. Written comments on the response have also been received from a number of witnesses, and these will be published, along with the Committee's commentary, in the summer. In the meantime key players in the sector have begun to implement the Committee's recommendations independently, with English Heritage scoping a strategy for heritage science, and the Arts and Humanities Research Council appointing a Programme Director in the field.

Science Teaching in Schools

The Committee's report was published last November. Among other things, it called for dramatic action to recruit and retain more specialist physics and chemistry teachers; a wider baccalaureate-style examination system to replace A-levels; increased funding for school science laboratories; improved careers advice for students; and a proper career structure for school science technicians. The Government response was published in January 2007. The Committee's report was debated in the House on 3 May. The Committee will in due course publish a short follow-up report, including the Government's response along with written comments received from witnesses to the inquiry.

Personal Internet Security

Sub-Committee II's inquiry into personal Internet security was launched in November 2006. The inquiry, chaired by Lord Broers, has looked at a broad range of security issues affecting private individuals when using the Internet. In March the Committee visited the United States, talking to federal government and the FBI, as well as to key industry players (including Apple, Microsoft and eBay), think-tanks, and researchers. The final public meeting took place on 25 April, and the report is currently being considered by the Committee. The report will be published either in July or when the House returns in early October.

Allergy

Sub-Committee I's inquiry into Allergy, chaired by Baroness Finlay of Llandaff, was launched in October 2006. The inquiry has looked at the incidence of allergic diseases in the UK, the causes of recent trends in prevalence, and a broad range of policy issues which impact upon allergy sufferers. During the course of the inquiry, the Committee took evidence from clinicians and academics, as well as representatives from public bodies, charities and the private sector. The Committee also visited allergy clinics in the UK, Germany and Denmark, pharmaceutical companies, and the Danish National Board of Health. The Committee held its final public meeting on 18 April and is now drafting the report. It is hoped that the report will be published in July.

Radioactive Waste Management

The Select Committee's follow-up inquiry, chaired by Lord Broers, focused on the final report of the Committee on Radioactive Waste Management (CoRWM), which was published last July, and the Government's response to the report published in October 2006. The Committee took evidence from CoRWM, the Nuclear Decommissioning Authority, the Government and others. The Committee's report 'Radioactive Waste Management: an update' was published on 4 June. The report raised serious concerns over the institutional framework for the next, implementation phase of the Managing Radioactive Waste Safely Programme, and over the unseemly haste at which the programme now seems to be progressing. The Select Committee also recommended that the Government establish an independent, statutory body, free of day-to-day Government control and accountable to Parliament, with overall accountability for implementing the geological disposal programme. In its response to the CoRWM report, the Government had watered down CoRWM's recommendation for an independent body to oversee the programme and announced its plan to set up an independent advisory body instead.

New inquiry: Air Travel and Health

On 2 May, the Select Committee announced a short follow-up inquiry, chaired by Lord Broers, into air travel and health. The inquiry will focus on the Committee report published in 2000 and what progress has been made on the Committee's recommendations. The Committee will take evidence in June and July and the report is expected to be published in the Autumn.

Further information

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

Parliamentary Office of Science and Technology

Recent POST publications

Energy and Sewage
April 2007 *POSTnote 282*

Water and energy management are important and interrelated issues. Sewage treatment, that is, the physical, chemical and biological processes used to clean industrial and domestic wastewater, has improved significantly over the past 20 years, with approximately 75% of UK rivers now of good biological and chemical quality. However, the energy required to treat sewage to this standard is high; the water industry is the fourth most energy intensive sector in the UK. Further tightening of water quality standards suggests energy costs will increase. This POSTnote evaluates options for sewage treatment in terms of energy conservation and renewable energy generation.

Health Behaviour
May 2007 *POSTnote 283*

Behaviours such as stopping smoking, moderation of alcohol intake, healthy eating and physical activity can reduce the risks of developing serious illnesses such as cancer, heart disease and type 2 diabetes. However, promoting the uptake of healthier behaviour presents challenges, both at the individual and population levels. This POSTnote will describe the importance of health behaviour change and the challenges to such change.

Tackling Malaria in Developing Countries
May 2007 *POSTnote 284*

Malaria is a parasitic disease responsible for the deaths of at least a million people every year, 90% of whom live in sub-

Saharan Africa. The greatest death toll occurs in children under five. Despite effective prevention and treatment methods, the burden of malaria remains high. The UK has agreed to the UN Millennium Development Goal of halting the spread of malaria by 2015. This note examines progress towards this target and considers the remaining UK and international priorities.

Better Brains
June 2007 *POSTnote 285*

As part of the Foresight Brain Science, Addiction and Drugs project a state of science review was carried out into current knowledge in the area of cognitive enhancers. These are factors that improve functions such as memory, learning and attention. The review concluded there would be significant improvements in understanding of this area in the next twenty years, and that this would lead to an increase in the development of cognitive enhancers. It raised the possibility of otherwise healthy individuals using enhancers to boost their cognitive abilities. This POSTnote reviews existing methods of cognitive enhancement along with likely future developments, and considers the regulatory and ethical questions that they pose.

Current work

Biological Sciences and Health – Alternatives to Custodial Sentencing for Young Adult Offenders, Assisted Reproduction, Prolonging Life in Newborns, Eating Disorders.

Environment and Energy – Carbon Footprint of Biofuels, Carbon Offsetting, Urban Flooding and Drainage, Deep Sea Exploitation and Conservation, Siting of Nuclear Power Plant.

Physical Sciences and IT – Electronic Waste, E-Science and The Grid.

Science Policy – International Migration of Scientists and Engineers.

Seminars

On April 18th POST co-operated with the Natural Environment Research Council, the British Antarctic Survey, the Scott Polar Research Institute and the journal Science, to hold a parliamentary reception to mark International Polar Year in the Commons Members' Dining Room. Over 200 persons were present, making it the best-attended event in POST's history.

In May POST held seminars on Ecosystem Services, collaborating with the British Ecological Society, and on Energy from Sewage and an industry round table on Radio Spectrum Management.

Fellows and Interns at POST

In May Mary Matthews, from Imperial College London, joined POST as an Institute of Physics fellow to work on Radio Spectrum Management and Zillah Boraston, from University College London, joined as a British Psychological Society fellow to work on Eating Disorders.

In June Mhairi Aitken, from Robert Gordon University, Aberdeen, joined POST as an ESRC fellow to work on Public Perceptions of Energy Generation Options.

Lyndsey Dodds, NERC fellow from the Scottish Association for Marine Science, is extending her stay at POST to work with the UK Branch of the Commonwealth Parliamentary Association on planning a major Commonwealth seminar on climate change.

International Activities

The Director represented POST at the annual Directors' Meeting of the European Parliamentary Technology Assessment network (EPTA) held under the presidency of the Greek Parliament's Technology Assessment Permanent Committee, in Hersonissos, Crete, in April.

The Director chaired a session, and POST Royal Society of Chemistry fellow Gangani Niyadurupola presented a paper, at a UK-Dutch workshop on Cognitive Enhancers organised by the British Embassy in Den Haag, in May. The Director also visited Agriom BV, a specialist plant breeding enterprise which is promoting the development of jatropha as a biofuel oil source.

Also in May the Director participated in a workshop on Safety in Road and Rail Tunnels organised by the Science and Technology Options Assessment (STOA) unit of the European Parliament in Brussels. This project is being conducted for STOA by POST in collaboration with Heriot-Watt University in Edinburgh.

The Director made two missions to Berlin in early June. One was to chair a session and participate in a panel debate at a conference on Nuclear's Contribution to EU Energy, Environment and Security Needs, organised by the German Institute for Economics, Berlin, the Department of Energy Economics at Dresden University of Technology, the Technical University of Berlin and the Judge Business School at the University of Cambridge. The second mission was to represent POST at the first conference of Chairs of EU national parliamentary committees on education, science, research and technology assessment, called by the Bundestag's committee, under the German presidency of the EU.

POST Deputy Director Dr Peter Border attended a planning meeting in Bonn in June for a new joint project on Genetically Modified Foods being run by several of the European parliamentary science offices including POST, under the auspices of EPTA.

Parliamentary and Scientific Committee and other News

Universities Federation for Animal Welfare 3Rs Research Fellowship in honour of Professor William Russell

In honour and memory of Professor William Russell, who died on July 27th 2006, the Universities Federation for Animal Welfare (UFAW) has established a special fund to support a Research Fellowship to advance the international development and application of the Three Rs (Replacement, Reduction and Refinement) and, resources permitting, other initiatives for animal welfare in the Three Rs field.

The concept of the Three Rs was established by William Russell and his colleague Mr Rex Burch through their work at UFAW which resulted in the publication of *The Principles of Humane Experimental Technique* in 1959. The Three Rs have had, and continue to have, an immense impact on the welfare of animals used in biomedical, veterinary, and other research all over the world. The Professor William Russell Research Fellowship will support high quality research, in the UK or elsewhere, aimed at further significant international advances in knowledge or application of one or more of the Three Rs.

UFAW is planning also to publish a special edition of *The Principles of Humane Experimental Technique* later this year to mark the 50th anniversary of the UFAW meeting at Birkbeck College at which William Russell first publicly described the principles of the Three Rs. This new edition will include a foreword written by Russell himself not long before he died. In addition to printed copies, it is intended that the book will also be made available on the UFAW website. Major sponsors of the William Russell Research Fellowship will have the opportunity to be acknowledged in this special edition and also in UFAW's quarterly scientific journal *Animal Welfare*.

Science in the Service of Animal Welfare

For further information please contact UFAW at www.ufaw.org.uk.

Parliamentary and Scientific Committee

Changes on the Website

www.scienceinparliament.org.uk

As announced in the Whitsun issue of Science in Parliament, the members' discussion forum is now operational, giving members the opportunity to post further discussions on issues raised at the Committee's meetings and, on the General Discussion board, on any other matter likely to be of interest to the Committee.

Digital copies of issues of Science in Parliament published since 2004 which are more than one year old are available free to download from the website. Hard copies of these issues and those from earlier years can be obtained from the Secretariat at a much reduced cost.

The Committee will be pleased to post on its website links to the websites of member organisations on a reciprocal basis.

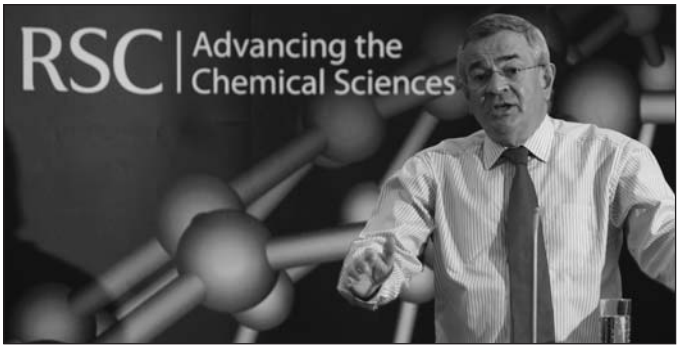
New Members

We are delighted to welcome as new industrial members **Industrial Copolymers Ltd** and **AGC Chemicals Europe Ltd**, represented by Dr Leonard J Daniels and Dr Leslie R J Hoy respectively.

Royal Society of Chemistry Voice of the Future 2007

More than 200 young scientists and engineers from all over the UK came to the House of Commons on 13th March for the annual Voice of the Future event organised by the Royal Society of Chemistry. Members of the UK Youth Parliament and some A-Level students from schools were also among the audience which packed the Attlee Suite to capacity.

They heard from Malcolm Wicks MP, Minister for Science and Innovation, whose address covered a number of important scientific issues including climate change, funding



for science, and the importance of improving healthcare. He said "This is a tremendously exciting time to be involved in scientific disciplines." He fielded questions on Government cuts to the research budget, the closure of Reading University's physics department, and on renewable energy and energy security.

In the *Science Question Time* with Members of the Select Committee on Science and Technology MPs, the panel were asked about creationism being taught in schools, clean coal technology and making the school science curriculum more exciting.

Voice of the Future also provides the opportunity for young scientists and engineers to meet their local constituency MPs.

Debates and Selected Parliamentary Questions & Answers

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

Full digests of all Debates, Questions and Answers on topics of scientific interest from 16th April to 24th May 2007 from both Houses of Parliament can be found on the website:

www.scienceinparliament.org.uk

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

Education

Science Teaching
Debate in the House of Lords on Thursday 3 May

Lord Broers rose to call attention to science teaching and the report of the Science and Technology Committee called *Science Teaching in Schools*, published last November. With respect to the practical teaching of science, the Government have fallen short. They failed to deliver the £200 million promised for school science laboratories before the 2005 election, despite the fact that the lack of motivating practical science has been a key factor in the loss of interest by students, and they failed to take adequate advice in the design of practical laboratories. The difficulties in delivering exciting and interesting practical classes were made worse by the lack of adequate career opportunities for laboratory technicians. We need to ensure the future of practical science in schools and overcome the reluctance of teachers to make practical science exciting and relevant.

The low quality of so many new and refurbished laboratories is regrettable and avoidable. The Government failed to consult acknowledged authorities such as the Consortium of Local Education Authorities for the Provision of Science Services – CLEAPSS – and the Association of Science Education which have first hand experience in laboratory design. The Government's obsession with testing was criticised as current tests focus on too narrow a range of skills and stop teachers using their own creativity to inspire students to study science. The committee recommended that schools should be encouraged to offer higher salaries to science and mathematics teachers. We further recommended that the Government provide schools with ring-fenced funding to cover the cost of CPD and any replacement teaching. Wellcome trust is in discussion with Government and industry to provide long term support for CPD.

Returning to the narrowness of the secondary education system, in many cases students are advised that to gain entry to science and engineering they should study only science and mathematics at A-level. They are being forced at age 16 to take a decision that will affect the rest of their lives. This process is completely contrary to the Bologna process which envisages a first science degree of three years covering a broad educational science and humanities base

followed by a two year MSc designed to provide the necessary focus for either a scientific career or other professional activity with a sound scientific base, followed by a three year PhD in a scientific research topic, a total of eight years, but leading to qualifications that are accepted and recognised worldwide. The current trend in the UK however is out of step, with a narrowly science based but very challenging entry specification required for science degrees. These are increasingly extended to a four year first degree as many students lack the science foundation that has to be put in place in year one. This is followed by a one year MSc in order to provide basic professional training, but with a research component added, possibly followed by an entirely research based PhD, if scarce funding is available. This process is not designed either to provide broadly educated scientists or provide science graduates at every level that relate well to or enable integration with science education elsewhere, resulting in lack of student interchange with universities in other countries.

The Parliamentary Under-Secretary of State, Department for Education and Skills (Lord Adonis): As a non-scientist I was delighted that Bill Bryson's *A Short History of Nearly Everything* was mentioned as it was by far the most instructive book that I have read in the last two years. The Government set out their objectives for schools in the Science and Innovation Investment Framework 2004-14, reinforced in last year's Next Steps document. Our goals include increasing the recruitment, retraining and retention of specialist physics, chemistry and mathematics teachers; improving the number of pupils achieving at least level 6 in the key stage 3 science tests at age 14 and good grades in at least two science GCSE's; and encouraging more students to take physics, chemistry and mathematics at A-level. To support this we have embarked upon a programme of teacher recruitment and training; an updating of the science curriculum; investment in high quality laboratories and improved careers advice to encourage greater take-up of science beyond the age of 16, leading to science-based careers. The Government are not inclined however to write off some of the student debt of new science teachers. Our target is that by 2014, 25 per cent of secondary science teachers will have a physics specialism and 31 per cent will have a chemistry specialism. As it stands, only 19 per cent are physicists and 25 per cent are chemists. A new accredited course begins from October for those teachers without a physics or chemistry specialism to gain the subject knowledge and pedagogy that they need to teach those subjects effectively. Higher level teaching assistants will help to provide cover for teachers away on CPD training.

Strong support will be given to the 21st century science syllabus. The commitment to investing in science laboratories has been incorporated into the wider investment in school buildings programme which stands at £6.4 billion a year and there is independent evaluation of how that investment proceeds.

Universities: Research Funding
Debate in the House of Lords on Monday 21 May

Baroness Sharp of Guildford rose to ask whether current methods of funding for research infrastructure are sufficient to allow all universities to engage in basic, innovative and applied research. I believe that an anomaly has crept into the current system which, while all the attention has been focused on the question of metrics in the research assessment exercise, has been overlooked. If it were to persist, it would raise questions as to whether the basic aims of the dual funding system, endorsed by successive Governments and seen by many as the key element underlying Britain's research excellence, are being met. As things stand there is an innate inconsistency in current policy on funding research, that has got lost in the debate about metrics: while preaching support for the dual-support system of funding research and defining that system as providing, through quality related (QR) funding, resources to support "a base from which to undertake research", the distribution formula used to allocate QR provides little or no QR funding for many universities.

The Parliamentary Under-Secretary of State, Department for Education and Skills (Lord Adonis): The Government's short answer to the Question is: yes we do believe that the current methods of funding for research infrastructure are sufficient, for the needs of all universities, when distributional factors are set against the substantial and sustained increases in total funding that have taken place across the sector in the past 10 years. Some of the contributions presupposed that there were cuts or threats to funding. I stress that in all the main areas of funding we have seen very substantial real terms increases in the past 10 years. The QR funding has risen in the past ten years from £769 million to £1.4 billion. The Research Council funding has risen in the past 10 years from £1.28 billion to £2.63 billion.

Energy

Energy: Biofuels (EUC Report)
Debate in the House of Lords on Thursday 19 April

Lord Sewel rose to move that this House takes note of the report of the European Union Select Committee on *The EU strategy on Biofuels:* from field to fuel presented on 20 November last. Its purpose was to assess whether the EU biofuels directive was proving effective as a means of increasing the biofuels content of road transport energy. I suppose the short answer is that it has not. Our enquiry found that the biofuels directive failed to enable the EU to

reach its 2005 target of a 2 per cent market share for biofuels and there is a necessity therefore for additional methods to meet the target of 5.75 per cent of market share by 2010. The UK's road transport fuels obligation will require fuel suppliers to ensure that by 2010, 5 per cent by volume of sales will be from renewable sources. The Commission should therefore amend the directive and member states should be allowed to select the percentage of the biofuel obligation on a country-by-country basis while retaining indicative targets for market share. The evidence we collected demonstrated that there are concerns over whether biofuel production does in fact contribute to a reduction in greenhouse gas emissions. It is now common ground that the real breakthrough is likely to take place with the second generation of biofuels. One consequence of the reduction in world poverty and the continued economic development of countries such as China and India will be an increase in the global demand for food. In those circumstances, energy crops will be in direct competition with food production. Unless there is rapid development of second-generation biofuels, it is not clear how far more traditional biofuel production can be expanded, especially in an environmentally sustainable way. It would be a cruel irony if we ended up with an industry which today is seen as something of an environmental saviour but which in time inflicted its own environmental damage.

The Earl of Selborne: The board of trustees of the Royal Botanical Gardens, Kew, which I chair, together with other botanic gardens around the world, tries to conserve rainforests, but one of the great problems that we are dealing with is the massive investment in palm oil plantations and the loss of rainforest thereby. There is a real irony when you think that this loss of biodiversity is encouraged by people trying to demonstrate their green credentials.

Lord Bassam of Brighton I put on record and make it plain that the Government are fully committed to their promotion of sustainable biofuels as they have an important and strategic role to play in helping to meet the UK and Kyoto climate change targets. Some member states, such as Germany, France and Sweden, have had domestic biofuels markets which are encouraged by measures introduced to support their Government's agricultural and fuel-supply policies. But many member states are in a similar position to the United Kingdom in seeing biofuels only very recently coming to the fore. The agreement of European targets for renewable energy of 20 per cent and for biofuels of 10 per cent by 2020 was historic and extremely ambitious. Each country will have to work out how it plans to meet its obligations, given its individual circumstances. The 10 per cent biofuels target is closer to a 13 per cent target for UK purposes. That is because, whereas Europe refers to energy content for biofuels, in the UK we use volume sales as our benchmark as it fits better with our national fuel duty arrangements. Although second-generation biofuels are not yet a commercial reality, there is considerable excitement about their development and a great deal of research. However it is still unclear how rapidly those second-generation biofuels might become core to the biofuels market.

Nuclear Industry

Debate in Westminster Hall on Thursday 19 April

Peter Luff (Mid-Worcestershire) The Trade and Industry Committee produced its fourth report of the 2005-06 Session, "New nuclear? Examining the Issues" on 10 July 2006, the day before the Government published the conclusions of their energy review consultation,"The Energy Challenge". The Trade and Industry Committee decided to look at three major aspects of the Government's review of energy policy: nuclear power; local energy; and the security of gas and coal supplies. Although nuclear power is not zero-carbon it is every bit as good as renewable energy in respect of carbon emissions and this often-heard argument against nuclear power should therefore not be used.

Michael Connarty (Linlithgow and East Falkirk) The report of the Parliamentary Office of Science and Technology on the lifetime carbon footprint of all sources of electricity generation – using uranium – is the lowest lifetime carbon footprint of all the generators.

Peter Luff Current carbon pricing arrangements such as the climate change levy and particularly the EU emissions trading scheme do not provide a sufficiently long term stable carbon price. It is essential to provide a framework of 15 to 20 years of certainty of a reasonably stable and foreseeable price for carbon if the private sector is to be encouraged to invest in nuclear power and help close the energy gap we all fear in the next decade. Phase 2 of the EU emissions trading scheme (ETS) will run until 2012 and there will be no clear progress on phase 3 until perhaps 2010. Investment decisions are needed now, and that means a UK initiative now, over and above the ETS.

New nuclear build would add only about 10 per cent to the existing volume of nuclear waste. The other 90 per cent is there already and has to be dealt with. However nothing is yet in place to dispose of the existing nuclear waste legacy, and the record of successive Governments in that respect has been abysmal. The Committee on Radioactive Waste Management (CoRWM) concluded last year that deep geological repository was the best means of providing a long term solution to the UK's waste legacy. That was no surprise. Nirex's estimate is that it could cost about £10 billion.

A review of planning and licensing is required to shorten the regulatory process which optimistically is five years and

is considered too long by developers. Reform in this area is essential if we are to fast-track new build. For example, has the Nuclear Installations Inspectorate started work yet on pre-licensing generic reactor designs? What attitude are British Energy and the Nuclear Decommissioning Authority taking to the use of the sites of their current plants for new facilities?

Most of the existing sites are coastal exposing them to risk from climate change and sea level rise. New build reactors include only two frontrunners, the Westinghouse AP1000 and Areva NP's European pressurised water reactor which is being built in Finland. Both reactors consist of largely untested technology posing risks for the pre-licensing process. Atomic Energy of Canada Ltd is also making a strong case for its advanced CANDU reactor to be licensed for use in the UK.

Mr David Drew (Stroud) Some of us are still spitting feathers over what I, for one, felt was a hurried decision to dispose of Westinghouse, the British answer to new reactor design.

Mr Ellwood (Bournemouth, East) Has consideration been given to what is happening in South Africa with pebble bed reactors which do not require seawater for cooling and can be built anywhere? They are much smaller and are designed to be built in separate modules, with a maximum of four.

The Minister for Science and Innovation (Malcolm Wicks) A majority of the conclusions in the Committee's report reflect the position and proposals advanced in the energy review which set out how the Government plan to meet the two major challenges facing us in the 21st century, namely, climate change and our energy security. The Government have made progress on the issue of nuclear waste. We are the first UK Government to take decisive steps to resolve that issue. However we are realistic and know that it will take concerted action to bring about a lasting solution.

We are currently developing plans for a consultation on geological disposal and how to take forward the CoRWM recommendations. The Government will shortly publish a planning White Paper, which will take forward proposals for the reform of major infrastructure planning, including energy. The choice of reactor type and design is broadly for the private sector, subject to licensing, to make judgements about that. It is also for private sector technology vendors to decide whether they want to have their technologies pre-licensed, and it is for the private sector generators to decide which licensing technologies to deploy, if licensing shows they are safe. There are skills gaps in the decommissioning and waste management sector but the Nuclear Decommissioning Authority, Cogent, which is the sector skills council, the industry and the National Skills Academy for nuclear are pulling together a strategy to deal with those gaps.

Nuclear Power: Research
Question and Written Answer on Thursday 17 May

Andrew Rosindell (Romford): To ask the Secretary of State for Trade and Industry what steps his Department is taking to support research into nuclear fusion.

Malcolm Wicks: The UK invests in fusion research through the Engineering and Physical Sciences Research Council (EPSRC). Almost all UK fusion research currently takes place at UKAEA Culham, which will receive grant support from EPSRC of £95 million over the four years to 2007-08. This is in addition to the EU funding for the Joint European Torus and other activities at Culham, and the EU participation in the ITER project.

Nuclear Power: Manpower
Question and Written Answer on Friday 18 May

Andrew Rosindell (Romford): To ask the Secretary of State for Trade and Industry what steps his Department is taking to ensure that the UK has an adequate supply of people with the skills needed to apply nuclear and radiological technology.

Malcolm Wicks: The Government have assisted in the establishment of a sector skills council to represent the needs of the nuclear industry. Cogent Sector Skills Council, working with employers, is taking a strategic view of the nuclear sector to ensure that the education and training base can meet the nuclear employers' current and future needs. The nuclear industry, working with Cogent, has successfully competed for a national skills academy through the Department for Education and Skills academy programme. The National Skills Academy – Nuclear is at the business planning stage which is expected to be finalised shortly. The academy, which is employer led, is designed to deliver high-quality training provision and drive up standards in the nuclear industry.

The Engineering and Physical Sciences Research Council has a portfolio of new activities in support of nuclear skills and research which include £6.1 million for a research consortium to address the challenge of "keeping open the nuclear option" and £1 million for a "Nuclear Technology Education Consortium" to provide masters-level and continuing professional development training for the nuclear industries. Both lever additional funding from industry.

Environment

Marine Environment
Debate in the House of Commons on Thursday 19 April

The Minister for Local Environment, Marine and Animal Welfare (Mr Ben Bradshaw) It is clear that tackling climate change and protecting our seas are closely linked. The draft Climate Change Bill – the first of its kind in any country, will provide a legally binding framework to address climate change and put into statute the Government's long-term goal to reduce carbon dioxide emissions by 60 per cent by 2050. Unsustainable fishing is the other major threat to our marine environment as demonstrated in my Department's report "Charting Progress", the UK's first integrated assessment of the state of our seas. Within Europe the reform of the common fisheries policy in 2002 put fishing on a more sustainable footing. Much more work is needed to secure a genuinely sustainable future for the fisheries sector by tackling discards and by-catch and thereby achieving a level playing field across the EU. Globally 52 per cent of fish stocks are fully exploited and 25 per cent are depleted. The EU is now moving to propose a new regulation against illegal fishing backed up by measures to block imports of illegal fish into EU ports and certification schemes to help control fish imported into the EU. The UN has agreed to a regulatory framework to stop destructive bottom trawling on the high seas by the end of 2008. "Protecting Whales – A global responsibility" has been published to help maintain support for the International Whaling Commission moratorium on commercial whaling. Parliamentarians on both sides of the House are urged to use their contacts to persuade like-minded countries to join the International Whaling Commission and to influence those in the caucus of Japan. Comprehensive marine legislation is about to be introduced for the first time in the country's history, designed to improve marine conservation and promote marine stewardship. The sustainable management of our marine environment is the second most important environmental challenge that the globe faces, after climate change. Because of the ocean's role in helping to regulate our climate, those two issues are intricately connected.

Bill Wiggin (Leominster) sought information on plans to introduce the Marine Bill which had been delayed by differences between Government Departments and devolved Administrations and emphasised the need to enact it before the next general election for two reasons. First, such a Bill is needed and secondly the lack of confidence in current policies designed to protect the marine environment.

Dr Desmond Turner (Brighton, Kemptown) congratulated the Minister, his predecessor and the Bill team, who were responsible for producing the White Paper on one of the clearest, most comprehensive and well-drafted White Papers he had ever seen. If the legislation that follows it reflects that clarity, we shall have one of the better Bills that Governments of either colour have produced in recent years.

Dr Brian Iddon (Bolton, South-East) drew attention to the Royal Society report published in 2005 concerning the progressive acidification of the sea, and indicated that this is essential reading for the Minister and all his team. There has been a 30 per cent increase in hydrogen ions, since the beginning of the industrial revolution. This will be trebled by the end of the century if current practices are allowed to continue. Burning fossil fuels will therefore ruin the sea within a century if we do not cease this practice.

Mr Bradshaw indicated that the proposed marine management organisation would have a DEFRA ministerial lead, but the organisation would be a non-departmental public body.

Plant Science and Climate Change
Debate in the House of Commons on Tuesday 24 April

Dr Ian Gibson (Norwich, North) There are no quick fixes when it comes to climate change, but we have to adopt and develop the policy of planting trees, whether they are in the tropics or elsewhere. This also applies to biofuels as the rush to make way for biofuel plantations is having a more severe effect on the planet than many of us imagined. It is argued that the carbon emitted by burning the trees and the peat to make way for biofuel crops far exceeds any savings that one could hope to make from burning renewable fuel instead of petrol. A further side effect is the destruction of many natural habitats and ecosystems as developing countries struggle to get into the new market, effectively throwing environmental concerns to the wind.

In the UK we should be concentrating our efforts on a second generation of bioenergy crops that use biomass. Miscanthus, switch grasses, willow and poplar trees can all be grown in the UK to contribute to the biomass initiative. Their growth requires less land than existing biofuel crops. They are renewable and carbon-neutral. They do not require the volume of chemicals and pesticides that have led to the criticism of crops such as rapeseed. We face a situation in which many countries and companies are planting vast areas of biofuels before the research has been done, which will damage the environment.

Bioscience offers us the possible solutions that we need. A description of many of the bioscience research initiatives designed to manage the impacts of climate change was then presented in detail. However lack of funding is an issue in the UK, where those involved in plant science include the

Biotechnology and Biological Sciences Research Council and only one charity, the Gatsby Charitable Foundation, which was set up by the former Minister for Science and Innovation, Lord Sainsbury of Turville. On the other hand in California, BP is setting up a $500 million biofuels research centre with help from Schwarzenegger himself, while the UK research council could only offer £20 million. It is therefore important now to establish the industry in this country. For example, the Government must start to think about plant sciences and practical solutions to climate change that they can develop to provide energy and disease resistant crops

The Parliamentary Under-Secretary of State for Environment, Food and Rural Affairs (Barry Gardiner) welcomed the opportunity to respond to Dr Gibson because of his unparalleled knowledge of science in the House, having chaired the Select Committee on Science and Technology. Agriculture contributes 7 per cent of all UK greenhouse gas emissions and 14 per cent globally. About 36 per cent of the UK's total methane emissions and 67 per cent of nitrous oxide emissions come from agriculture – for example, from artificial fertilizer, manure and livestock. Although agriculture is only directly responsible for around 1 per cent of UK carbon dioxide emissions, the sector can help to mitigate CO_2 emissions from other sources through carbon sequestration in soils, timber, and by producing energy crops to replace fossil fuels.

DEFRA's agriculture and climate change research and development programme, which is worth about £5.6 million in this financial year, helps build understanding and evidence about the threats and opportunities that climate change presents and about what farmers can do to reduce emissions. This is within the 2007-08 DEFRA budget of £70 million for sustainable farming and food science, including animal health and welfare. We need to work with farmers and land managers, and with organisations such as the Rural Climate Change Forum, to ensure that farmers have the information and advice they need to turn the results from climate change research into practical action to reduce greenhouse gas emissions, as well as to adapt to these impacts and make the most of new opportunities.

Basic plant science in the UK is funded by BBSRC rather than DEFRA, and represents a large proportion of the £30 million per annum spent at its research institutes – Rothamstead, the John Innes Centre in Norwich and the Institute of Grassland and Environmental Research and many projects funded in universities related to plant science. In addition the UK spends about £5 million annually on research and development connected with the genetic improvement of UK grown crops. A detailed listing of research initiatives on various topics concluded the response.

Dr Gibson: Among all this activity that has gone on, does my hon. Friend think that the agricultural industry knows about it, or does it go on without its knowledge, or even interest?

Barry Gardiner I have been pleasantly surprised by farmers' willingness to see themselves increasingly as land managers, landscape managers and environmental managers who are prepared to get their remuneration not from the subsidies for production but as a result of the public goods they are creating. They are increasingly ahead of those in many places in the rest of Europe in appreciating their role to that effect.

Health

Stem Cell Research

Debate in the House of Lords on Thursday 3 May

Lord Patel rose to call attention to the potential benefits of stem cell research. Stem cell research is undoubtedly the most exciting area of biomedical research. What makes it so exciting? Stem cell science has the potential to deliver cures for diseases that were hitherto untreatable, by harvesting the growth of cells and tissues in the laboratory and using them to replace diseased tissues with healthy cells. Recognising the importance of stem cell science to the economy, the Chancellor of the Exchequer, Gordon Brown, commissioned a report from Sir John Pattison, UK Stem Cell Initiative, to set out a 10-year vision on stem cell research to consolidate the UK's current position and become a global leader in stem cell therapy and technology. The Government accepted the report in full, including all the recommendations, even those related to finance; the Chancellor said so in his Budget speech.

Two areas of regulation need urgent attention. The first relates to good manufacturing practice – GMP – facilities for developing stem cell lines as there is confusion as to who is responsible for accreditation as no regulatory authority is prepared to take it on. I have yet to be convinced that the new amalgamated HFEA and Human Tissues Authority (HTA) – the Regulatory Authority for Tissues and Embryos (RATE) – will be up to such tasks, and regulations are urgently needed for stem cell work.

There is much debate and some concern about whether *in vitro* stem cell research should be allowed on hybrid and chimera embryos. The House of Commons Science and Technology Select Committee, having taken evidence, recommended that such research should be allowed. On the other hand, in the White Paper reviewing the Human Fertilisation and Embryology Act, the Government proposed that the creation of hybrid and chimera embryos *in vitro* should not be allowed. The HFEA is engaged in

public consultation. The evidence given by research councils and charities to the Science and Technology Committee supported the need for such research.

Lord Winston: Despite what is widely thought, at least 33 countries worldwide have relatively permissive legislation along the lines of that in the UK. It is not clear how effective the regulations for that research in Britain are. Undoubtedly, the current system under the HFEA results in extremely long delays to research licences being granted. The peer review process is deeply flawed. For example, it is unthinkable that the backbone of British Science, the PhD student, will have to wait for a year or year and a half for ethical and funding approval of a project. There is a serious need to re-evaluate the legislation, not because it is wrong, but because the way in which it is implemented is deeply flawed.

Lord Soulsby of Swaffham Prior: In the 17 years between the isolation of embryo cells in mice and humans, there was a realisation about the enormous potential that stem cell technology offered in the treatment of some of the most devastating and distressing diseases of man. Stem cell technology, the regulatory framework for its use, and the ethical issues that surround it are complex and bewildering. During this period much work has been done to isolate those cells from other species such as rats, hamsters, cows, sheep and pigs. The embryonic stem (ES) cells of the rat, mouse and hamster have been used to generate transgenic animals, which serve as models for human disease and the creation of chimeras – embryos containing a mixture of cells from distinct cell lines – have proved to be an incredibly useful approach in biochemical and biomedical research to understand the effects of specific mutations and their role in human disease. An important outcome has been the production of much more specific targets for pharmaceutical research and the reduction in the number of animals required for such work.

Lord Rees of Ludlow The cytoplasmic hybrid embryo or "cybrid" issue exemplifies how the demands made on the HFEA are becoming ever more arduous as the science advances. The Royal Society have anxieties that are shared by the Academy of Medical Sciences and the Wellcome Trust about some aspects of the Government's White Paper, especially the proposal to set up RATE. A single body cannot feasibly cover its huge remit, as envisaged in the White Paper, without either diluting its expertise or delegating most key judgements to an infrastructure of expert panels. On a more positive note we should sustain our research groups so that they remain a magnet for mobile talent in the face of growing international competition for that talent. To do so is surely good for UK science. More than that, it would be good for a field that, sensitively handled, promises great hope for human welfare.

The Minister of State, Department of Health (Lord Hunt of Kings Heath) provided a brief series of summary responses to some of the items raised by the twenty-one contributors in what was described as a remarkable debate that has been extremely helpful to the Government in taking the important decisions that must be made on the way forward. The projected investment this year is around £45 million, which takes total funding since 2003 to approximately £109 million. No special future funding commitments were made or guaranteed. Enormous tribute was also paid to the work and support of the Association of Medical Research Charities and their member charities.

Medical Treatments: Testing
Question and Written Answer on Monday 14 May

Dr Gibson (Norwich N): To ask the Secretary of State for Health which academic referral centres are contracted to assess (a) drugs for the National Institute of Health and Clinical Excellence and (b) other medical technologies; and what plans she has to standardise the clinical models in different centres assessing new technologies.

Caroline Flint: The Department has contracts with seven technology assessment review teams to undertake reviews including reviews for National Institute of Health and Clinical Excellence (NICE). The teams are based at the following universities:

Aberdeen; York; Liverpool; Sheffield; Birmingham; Southampton; and Peninsula.

Each has a set of core methodological skills that mean any one team could be allocated any one topic (drugs or other medical technologies), although teams are encouraged to specialise. All teams follow the NICE methods guide in terms of methodological approach to ensure standardisation. The guide is available on the NICE website at: guidance.nice.org.uk

Drugs: Counterfeit Manufacturing
Question and Written Answer on Monday 21 May

Mr Laws (Yeovil): To ask the Secretary of State for Health how many people have (a) been admitted to hospital and (b) died as a result of taking counterfeit medicines in each of the last 10 years.

Caroline Flint: The Department holds no statistics which record hospital admissions or deaths from taking counterfeit medicines. However, the Medicines and Healthcare products Regulatory Agency, which has responsibility for investigating reports of counterfeit medicines, has found no evidence of any deaths in the United Kingdom caused by counterfeit medicines.

Euro-News

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

Happy Birthday Euratom!

While the more famous of the treaties established the European Economic Community (EEC), later to become the European Community (EC) and then the EU, a second created the European Atomic Energy Community, more commonly known then and now as Euratom. It is no wonder that the EEC treaty will be at the the forefront of the celebrations – it was the beginning of the most ambitious project ever to create a supranational community of sovereign states. Members were willing to hand over at least some of their national competencies to a set of institutions based predominantly in Brussels. But the creation of Euratom, and its 50-year existence, are also no mean feat. European research was conceived for the first time in the Euratom Treaty, and it put in place the provisions for the EC Research Programmes that were to follow later. It was very innovative at the time and we have to thank the founders of the Treaty for their vision. Though comprising the same Member States, Euratom is juridically distinct from the rest of the EC. It uses the same institutions, but the major difference is that while the European Parliament (EP) is consulted, the EU Council alone acts as the legislature. When it comes to the adoption of the Euratom research programmes, the Member States need to agree unanimously. This was not so much a problem when there were only six Member States, but it can be a different story now that there are 27.

Euratom has eight tasks, or areas of competence, as set out in the Treaty. These include establishing uniform safety standards to protect workers and members of the public, facilitating investment in and ensuring the establishment of the basic installations necessary for developing nuclear energy, ensuring that all users receive a regular and equitable supply of ores and nuclear fuels, and making sure that civil nuclear materials are not used for military purposes.

Another task is research. Euratom is charged with promoting research and ensuring the dissemination of technical information. Under the Seventh Euratom Framework Programme for nuclear research and training, which runs from 2007 until 2011, a funding envelope of €2.751 billion is available, of which €1.947 billion is for fusion research (including ITER, the International Thermonuclear Experimental Reactor), €517 million for the nuclear activities of the Joint Research Centre (JRC), which was set up under the Treaty, and €287 million for indirect actions in nuclear fission and radiation protection, for which the Commission publishes calls for proposals at regular intervals.

Unlike funding for the larger EC framework programme where funding for ITER has increased substantially, Euratom's budgetary increases in the area of nuclear fission and radiation protection have merely stayed level with inflation which will impact on our effectiveness and the ability of Europe as a whole to keep pace with the nuclear renaissance worldwide. In addition, because of the different legal bases, the Euratom programme does not have access to some of the additional funding mechanisms available under the EC Framework programmes.

The fusion community has also managed to come together more than the fission community. In fact fusion is the only area, including those in the non-nuclear field, where there is a true European research area. This is mainly because there are no national interests at stake in fusion. In fission we can have the same problems as any other area – fragmentation and duplication. Another important difference is that while Euratom provides between 30% and 40% of funding for fusion research in Europe, the figure is more like 5% for fission.

Over the last 50 years the joint execution of research into the management of radioactive waste and geological disposal programmes was cited as an achievement. The safe management and disposal of radioactive waste is a problem faced by all EU Member States, as hospitals and nuclear power stations produce it. The shared challenge has therefore made research very amenable to EU funding.

Galileo

EU transport ministers called upon the consortium of eight of Europe's leading aerospace and telecommunications companies, AENA, Alcatel-Lucent, EADS, Finmeccanica, Hispasat, Inmarsat, TeleOP and Thales SA, who are bidding to run the EU's satellite navigation programme Galileo, to resume negotiations. The ministers said they expected to see substantial progress in the negotiations, and a credible road map by the time the EU Council of Ministers meets again in June 2007. Ministers also called upon the European Commission to draw up alternative scenarios for delivering Galileo, for the June meeting.

European Union – Digest

Monthly digests of European legislation, taken from the Official Journal of the European Communities can be found on the website: www.scienceinparliament.org.uk

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

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Association of the British Pharmaceutical Industry

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

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

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

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

Association of Marine Scientific Industries

Contact: Karen Gray, Secretary
Association of Marine Scientific Industries
4th Floor, 30 Great Guildford Street
London SE1 0HS
Tel: 020 7928 9199 Fax: 020 7928 6599
E-mail: amsi@maritimeindustries.org
Website: www.maritimeindustries.org

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

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

The Academy of Medical Sciences

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

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

AIRTO

Contact: Professor Richard Brook
AIRTO Ltd: Association of Independent Research & Technology Organisations Limited
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 10,000 scientists and engineers with a turnover in the region of £1.5 billion. Work carried out by members includes research, consultancy, training and global information monitoring. AIRTO promotes their work by building closer links between members and industry, academia, UK government agencies and the European Union.

Biochemical Society

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

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

BIOSCIENCES FEDERATION

Contact: Dr Richard Dyer, Chief Executive
Biosciences Federation
PO Box 502, Cambridge, CB1 0AL
Tel: 01223 400181
Fax: 01223 246858
E-mail: rdyer.bsf@physoc.org
Website: www.bsf.ac.uk

The Biosciences Federation is a single authority representing the UK's biological expertise. The BSF directly represents 45 bioscience organisations, and contributes to the development of policy and strategy in biology-based research – including funding and the interface with other disciplines – and in school and university teaching by providing independent opinion to government.

Biotechnology and Biological Sciences Research Council

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

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

The BA (British Association for the Advancement of Science) is a charity which exists to advance the public understanding, accessibility and accountability of the sciences and engineering. The BA aims to promote openness about science in society and to engage and inspire people directly with science and technology and their implications.

Established in 1831, the BA 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

Contact: Nick Dusic, Science Policy Manager
British Ecological Society
26 Blades Court, Deodar Road, Putney, London, SW15 2NU
Tel: 020 8871 9797 Fax : 020 8871 9779
E-mail: nick@BritishEcologicalSociety.org
Website: www.BritishEcologicalSociety.org

The British Ecological Society promotes the science of ecology worldwide. The Society has 4,000 members who are active in advancing the science and application of ecology.

The BES publishes four internationally renowned scientific journals and organises the largest scientific meeting for ecologists in Europe. The BES also supports ecologists in developing countries and fieldwork in schools through its grants.

The BES informs and advises Parliament and Government on ecological issues and welcomes requests for assistance from parliamentarians.

British Nutrition Foundation

Contact: Professor Robert Pickard, Director-General
52-54 High Holborn, London WC1V 6RQ
Tel: 020 7404 6504
Fax: 020 7404 6747
Email: r.pickard@nutrition.org.uk
Website: www.nutrition.org.uk

2007 is the 40th Anniversary of the British Nutrition Foundation. This scientific and educational charity promotes the well-being of society through the impartial interpretation and effective dissemination of scientifically based knowledge and advice on the relationship between diet, physical activity and health.

British Pharmacological Society

Contact: Kevin J Kearns
British Pharmacological Society
16 Angel Gate, City Road
London EC1V 2SG
Tel: 020 7417 0113
Fax: 020 7417 0114
Email: kjk@bps.ac.uk
Website: www.bps.ac.uk

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

The British Psychological Society

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

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

British Society for Antimicrobial Chemotherapy

Contact: Tracey Guest, Executive Officer
British Society for Antimicrobial Chemotherapy
11 The Wharf, 16 Bridge Street,
Birmingham B1 2JS.
Tel: 0121 633 0410
Fax: 0121 643 9497
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

Contact:Chrissie Nicholls
7 Mansfield Street, London W1G 9NQ
Tel: 020 7636 6541
Fax: 020 7637 4769
E-mail:chrissien@bva.co.uk
www.bva.co.uk

BVA's chief interests are:

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

Contact: Dr Joan Kelley,
Executive Director Bioservices, CABI
Bakeham Lane, Egham, Surrey TW20 9TY
Tel: 01491 829306 Fax: 01491 829100
Email: t.davis@cabi.org
Website: www.cabi.org

CABI brings together and applies scientific information and expertise to improve people's lives. Founded in 1910, CABI is owned by over 40 member countries. Today CABI publishes books, journals and scientific outputs, carries out scientific research and consultancies to find sustainable solutions to agricultural and environmental issues and develops innovative ways to communicate science to many different audiences. Activities range from assisting national policy makers, informing worldwide research, to supporting farmers in the field.

Campden & Chorleywood Food Research Association

Contact: Prof Colin Dennis, Director-General
CCFRA, Chipping Campden,
Gloucestershire GL55 6LD.
Tel: 01386 842000 Fax: 01386 842100
E-mail: info@campden.co.uk
Website: www.campden.co.uk

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

Cavendish Laboratory

The Administrative Secretary, The Cavendish Laboratory,
J J Thomson Avenue, Cambridge CB3 0HE, UK.
E-mail: dhp24@phy.cam.ac.uk
http://www.phy.cam.ac.uk

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

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Cefas

Centre for Environment, Fisheries & Aquaculture Science

Contact: Anne McClarnon, Communications Manager
Pakefield Road, Lowestoft, Suffolk NR33 0HT
Tel: 01502 56 2244
Fax: 01502 51 3865
E-mail: anne.mcclarnon@cefas.co.uk
Website: www.cefas.co.uk

Cefas offers multidisciplinary scientific research and consultancy for fisheries management and aquaculture, plus environmental monitoring and assessments. Government at all levels, international institutions (EU, UN, World Bank) and clients worldwide have used Cefas services for over 100 years. Three laboratories with the latest facilities, plus Cefas' own ocean-going research vessel, underpin the delivery of high-quality science and advice to policy-makers.

Chartered Institute of Patent Attorneys

Contact: Michael Ralph -
Secretary & Registrar
The Chartered Institute of Patent Attorneys
95 Chancery Lane, London WC2A 1DT
Tel: 020 7405 9450
Fax: 020 7430 0471
E-mail: michael.ralph@cipa.org.uk
Website: www.cipa.org.uk

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

Clifton Scientific Trust

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

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- locally, nationally, internationally (currently between Britain and Japan)

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Economic and Social Research Council

Contact: Lesley Lilley, Senior Policy Manager, Knowledge Transfer,
Economic and Social Research Council,
Polaris House, North Star Avenue,
Swindon SN2 1UJ
Tel: 01793 413033 Fax 01793 413130
lesley.lilley@esrc.ac.uk
http://www.esrc.ac.uk

The ESRC is the UK's leading research and training agency addressing economic and social concerns. We pursue excellence in social science research; work to increase the impact of our research 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.

Eli Lilly and Company Limited

Answers That Matter.

Contact: Paul Johnson PhD,
Managing Director
Eli Lilly & Company, Erl Wood Manor,
Windlesham, Surrey, GU20 6PH
Tel: 01256 315000
Fax: 01276 483307
E-mail:p.johnson@lilly.com
Website:www.lilly.com or www.lilly.co.uk

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

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

Engineering and Physical Sciences Research Council

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

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.

Freshwater Biological Association

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

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

Health Protection Agency

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

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

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

Human Fertilisation and Embryology Authority

Contact: Tim Whitaker
21 Bloomsbury St
London WC1B 3HF
Tel: 020 7291 8200
Fax: 020 7291 8201
Email: tim.whitaker@hfea.gov.uk
Website: www.hfea.gov.uk

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

Institute of Biology

Contact: Prof Alan Malcolm,
Chief Executive
9 Red Lion Court, London EC4A 3EF
Tel: 020 7936 5900
Fax: 020 7936 5901
E-mail: a.malcolm@iob.org
Website: www.iob.org

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

IOP Institute of Physics

Contact: Public Relations Department
76 Portland Place, London W1B 1NT
Tel: 020 7470 4800
E-mail: public.relations@iop.org
Website: www.iop.org

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

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

Institute of Physics and Engineering in Medicine

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

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

IChemE

Institution of Chemical Engineers

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

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

Institution of Civil Engineers

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

ICE aims to be a leader in shaping the engineering profession. With over 75,000 members, ICE acts as a knowledge exchange for all aspects of civil engineering. As a Learned Society, the Institution provides expertise, in the form of reports and comment, on a wide range of subjects from energy generation and supply, to sustainability and the environment.

Institution of Engineering and Technology

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

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

LGC

Queens Road, Teddington
Middlesex, TW11 0LY
Tel: +44 (0)20 8943 7000
Fax: +44 (0)20 8943 2767
E-mail: info@lgc.co.uk
Website: www.lgc.co.uk

Setting standards in analytical science

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

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, Edinburgh, Culham, Risley and Tamworth and facilities in France, Germany, Italy, Poland, Spain, Sweden and India.

London Metropolitan Polymer Centre

Contact: Alison Green,
London Metropolitan University
166-220 Holloway Road, London N7 8DB
Tel: 020 7133 2189
Fax: 020 7133 2184
E-mail: alison@polymers.org.uk
Website: www.polymers.org.uk

The London Metropolitan Polymer Centre provides training, consultancy and applied research to the UK polymer (plastics & rubber) industry. A programme of industrial short courses and customised courses, together with distance learning and other flexible delivery methods, lead to qualifications ranging from technician to Masters level, alongside the full-time courses for Polymer Engineering and Product Design. 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

Contact:
David Gregory
Waterside House
35 North Wharf Road
London W2 1NW.

Tel: 020 8718 8247
E-mail: david.gregory@marks-and-spencer.com

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

We have around 750 stores in 33 territories worldwide, employing 65,000 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: Simon Wilde
20 Park Crescent, London W1B 1AL.

Tel: 020 7636 5422 Fax: 020 7436 2665
E-mail:
simon.wilde@headoffice.mrc.ac.uk
Website: www.mrc.ac.uk

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

MERCK SHARP & DOHME

Merck Sharp & Dohme Research Laboratories

Contact: Professor Ray Hill, FMedSci
Licensing & External Research, Europe
Hertford Road
Hoddesdon
Herts EN11 9BU
Tel: 01992 452836
Fax: 01992 441907
e-mail: ray_hill@merck.com
www.merck.com

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

The National Endowment for Science, Technology and the Arts

NESTA Making Innovation Flourish

Contact: Nicola Kane
Media and Public Affairs Assistant
1 Plough Place
London EC4A 1DE
Tel: 020 7438 2500
Fax: 020 7438 2501
Email: nicola.kane@nesta.org.uk
Website: www.nesta.org.uk

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

National Physical Laboratory

NPL National Physical Laboratory

National Physical Laboratory
Hampton Road, Teddington
Middlesex TW11 0LW
Tel: 020 8943 6880 Fax: 020 8943 6458
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.

Natural England

NATURAL ENGLAND

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

Natural England is the Government's conservation agency working throughout England; we conserve, enhance and manage the natural environment for the benefit of current and future generations. We commission research and publish papers which underpin the development of our policies and programmes.

Natural Environment Research Council

NATURAL ENVIRONMENT RESEARCH COUNCIL

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

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

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

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

Natural History Museum

NATURAL HISTORY MUSEUM

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

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

Newcastle University

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

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

The Nutrition Society

NS The Nutrition Society

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

Founded in 1941, The Nutrition Society is the premier scientific and professional body dedicated to advance the scientific study of nutrition and its application to the maintenance of human and animal health.
Highly regarded by the scientific community, the Society is the largest learned society for nutrition in Europe. Membership is worldwide and is open to those with a genuine interest in the science of human or animal nutrition.
Principal activities include:
1. Publishing internationally renowned scientific learned journals
2. Promoting the education and training of nutritionists
3. Promoting the highest standards of professional competence and practice in nutrition
4. Disseminating scientific information through its publications and programme of scientific meetings

PHARMAQ

PHARMAQ Ltd

Contact: Dr Lydia A Brown
PHARMAQ Ltd
Unit 15 Sandleheath Industrial Estate, Fordingbridge
Hants SP6 1PA.
Tel: 01425 656081
Fax: 01425 655309
E-mail: lydia.brown@pharmaq.no
Website: www.pharmaq.no

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

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 102,000 members. We represent scientists, technologists and other professions in the civil service, research councils and private sector.

Prospect's collective voice champions the interests of the engineering and scientific community to key opinion-formers and policy makers 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.

The Royal Institution

Contact: Dr Gail Cardew
Head of Programmes
The Royal Institution
21 Albemarle Street, London W1S 4BS
Tel: 020 7409 2992 Fax: 020 7670 2920
E-mail: 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. During 2007 the Ri is closed for the refurbishment of its Grade 1 listed building. The public and schools' events programme will continue throughout this time. For more details on this and our refurbishment plans, please see our website.

The Royal Statistical Society

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

The RSS is much more than just a learned society. We lead the way as an independent source of advice on statistical issues and play a crucial role in raising the profile of statistics, through our links with government, academia and the corporate and voluntary sectors. 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 Royal Academy of Engineering

Contact: Philip Greenish CBE,
Chief Executive
29 Great Peter Street,
London SW1P 3LW
Tel: 020 7227 0500 Fax: 020 7233 0054
E-mail: philip.greenish@raeng.org.uk
Website: www.raeng.org.uk

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

The Royal Society

Contact: Dr David Stewart Boak,
Director Communications
The Royal Society, 6-9 Carlton House Terrace,
London, SW1Y 5AG.
Tel: 020 7451 2510 Fax: 020 7451 2615
Email: david.boak@royalsoc.ac.uk
Website: www.royalsoc.ac.uk

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

- ·Invest in scientific excellence to create tomorrow's leaders of science
- ·Influence policymaking with the best scientific advice
- ·Invigorate science and mathematics education
- ·Inspire an interest in the joy, wonder and fulfillment of scientific discovery

The Science Council

Contact: Diana Garnham,
Chief Executive Officer
The Science Council
210 Euston Road, London NW1 2BE
Tel 020 7611 8754 Fax 020 7611 8743
E-mail: enquiries@sciencecouncil.org
Website: www.sciencecouncil.org

The Science Council has a membership of over 27 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. We now have over 10,000 Chartered Scientists.

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
Tel: 020 8332 5212
Fax: 020 8332 5278
Email: s.owens@kew.org
Website: www.kew.org

SAVING THE WORLD'S PLANTS FOR LIFE

The Royal Society of Chemistry

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

SEMTA

Technology Skills For Productivity & Performance

Contact: Dr David J Winstanley
Special Advisor for Science
SEMTA, Wynyard Park House,
Wynyard Park, Billingham, TS22 5TB
Tel: 01740 627021 Mobile: 07973 679 338
E-mail: dwinstanley@semta.org.uk
Website: www.semta.org.uk

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

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

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

Science & Technology Facilities Council

Contact: Nigel Calvin
STFC
Polaris House
North Star Avenue
Swindon SN2 1SZ
Tel: 01793 44 2176 Fax: 01793 44 2125
E-mail: nigel.calvin@stfc.ac.uk
Website: www.stfc.ac.uk

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

Society for General Microbiology

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

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

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

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

Society of Chemical Industry

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

SCI is an interdisciplinary network for science, commerce and industry. SCI attracts forward-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.*

Society of Cosmetic Scientists

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

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

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

Universities Federation for Animal Welfare

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

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

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

Science Diary

The Parliamentary and Scientific Committee

Contact: Annabel Lloyd

020 7222 7085: lloyda@pandsctte.demon.co.uk

www.scienceinparliament.org.uk

Monday 26 November 17.30
Evening discussion meeting
Subject and speakers to be confirmed

Members will be informed of other events as soon as possible.

In 2008 the Committee will meet on Tuesday instead of Monday. Provisional dates for meetings until July 2008 are:
Tuesday 22 January
Tuesday 26 February
Tuesday 22 April
Tuesday 20 May
Tuesday 17 June
Tuesday 15 July
Full details will be available as soon as possible at www.scienceinparliament.org.uk

The Royal Institution

The Royal Institution will be reopening for evening events from late autumn 2007.
See rigb.org or telephone 020 7409 2992 for full details and to book tickets.

Tuesday 23 October 19.00
Debate on creativity and the Internet
Cory Doctorow and Baroness Susan Greenfield

The Royal Society

6-9 Carlton House Terrace
London SW1Y 5AG

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

Highlights in the next few months include:

Thursday 13 & Friday 14 September (all day)
Origin and differentiation of the Earth: past to present

Thursday 27 September 18.30
Mind-reading machines: technologies with People Sense

Please see www.royalsoc.ac.uk/events for the full events programme, more details about the above highlights and web casts of past events.

The Royal Academy of Engineering

29 Great Peter Street
London SW1P 3LW.

www.raeng.org.uk/events or events@raeng.org.uk
For further details contact Jacqueline Cox:
jacqueline.cox@raeng.org.uk

Thursday 13 September 16.00 for 16.30
Lecture Series in Mobile Telecommunications & Networks:
Technological Steps to Future Mobile Communications Networks
Professor Gerhard Fettweis
Chair: Professor Michael Walker FREng
Sponsored by Vodafone
at 29 Great Peter Street, London SW1P 3LW

Wednesday 3 October
International Lecture
Dr P K Pachauri, Chair, Intergovernmental Panel on Climate Change

Wednesday 10 October 18.00
Hinton Lecture
David Waboso FREng, Engineering Director, London Underground Ltd
at 7 Carlton House Terrace
London SW1Y 5AG

The Royal Society of Edinburgh

22-26 George Street
Edinburgh EH2 2PQ.

Tel: 0131 240 5000
Fax: 0131 240 5024

events@royalsoced.org.uk
www.royalsoced.org.uk

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

Wednesday 5 September 17.30
Tall Tales about the Mind and Brain
Professor Michael Corbalis, Department of Psychology, University of Auckland
Professor James E Alcock, University of York, Toronto

Thursday 6 & Friday 7 September
Tall Tales about the Mind and Brain Conference
at Our Dynamic Earth

Wednesday 19 September 18.00
Inspiring People Changing Landscapes: Changing Planet
Edinburgh Lectures 2007/2008
at Sheraton Grand Hotel

The BA (British Association for the Advancement of Science)

Wellcome Wolfson Building
165 Queen's Gate
London SW7 5HD

Sunday 9 – Saturday 15 September
The BA Festival of Science

Hundreds of events will be happening across the city of York.

Organised in partnership with the University of York, Science City York and the City of York Council and supported by the Department of Trade & Industry, BP and Yorkshire Forward.

For more information, including an online programme, visit www.the-ba.net/festivalofscience or contact festival@the-ba.net.

Royal Pharmaceutical Society of Great Britain

Contact: science@rpsgb.org
www.rpsgb.org

Monday 10 – Wednesday 12 September
British Pharmaceutical Conference
Manchester Central
Details: www.bpc2007.org

Monday 1 – Wednesday 3 October
International Analytical Validation and Regulatory Issues for the Pharmaceutical Industry
Hilton Hotel, York

The Geological Society

Burlington House
Piccadilly
London W1J 0BG

Tel: 020 7434 9944
Fax: 020 7 439 8975

Email: enquiries@geolsoc.org.uk
Web: www.geolsoc.org.uk/bicentenary

London Lecture Series
Entry to all lectures is free to all, but by ticket only.
They take place at the Society's refurbished offices at Burlington House, starting at 17.30 for 18.00; finish 19.00

Wednesday 17 October
Volcanoes
Professor Steve Sparks FRS, University of Bristol

Tuesday 20 November
Water Resources
Professor Paul Younger, Newcastle University

Thursday 13 December
Man's History: Out of Africa and Beyond
Stephen Oppenheimer, University of Oxford

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Tel: 020 7222 7085 Fax: 020 7222 7189

Editor:	Professor Peter Simpson
Editorial Assistant:	Mrs Annabel Lloyd

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1807 - 2007

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The Geological Society of London

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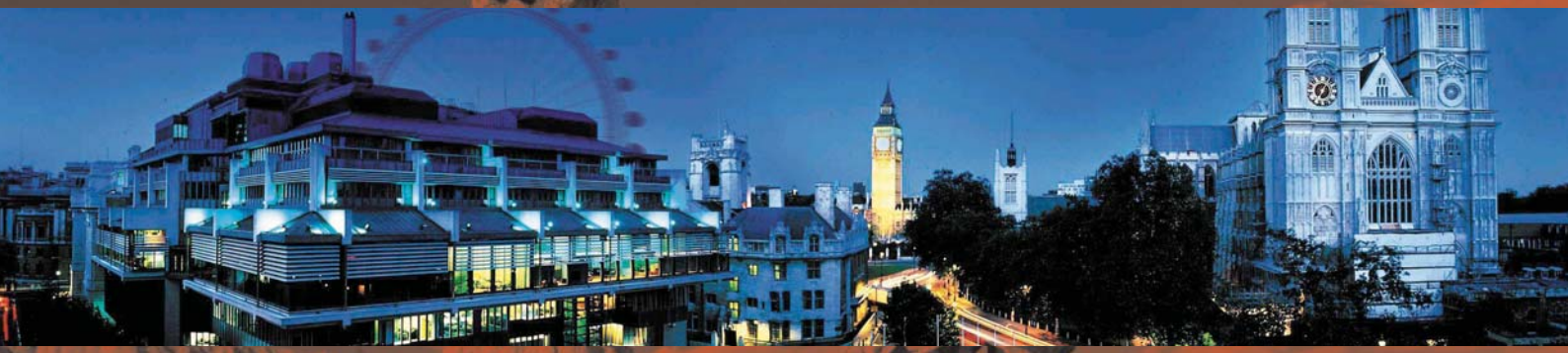

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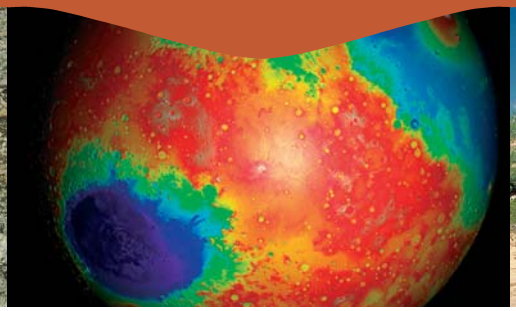

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