

Autumn 2007



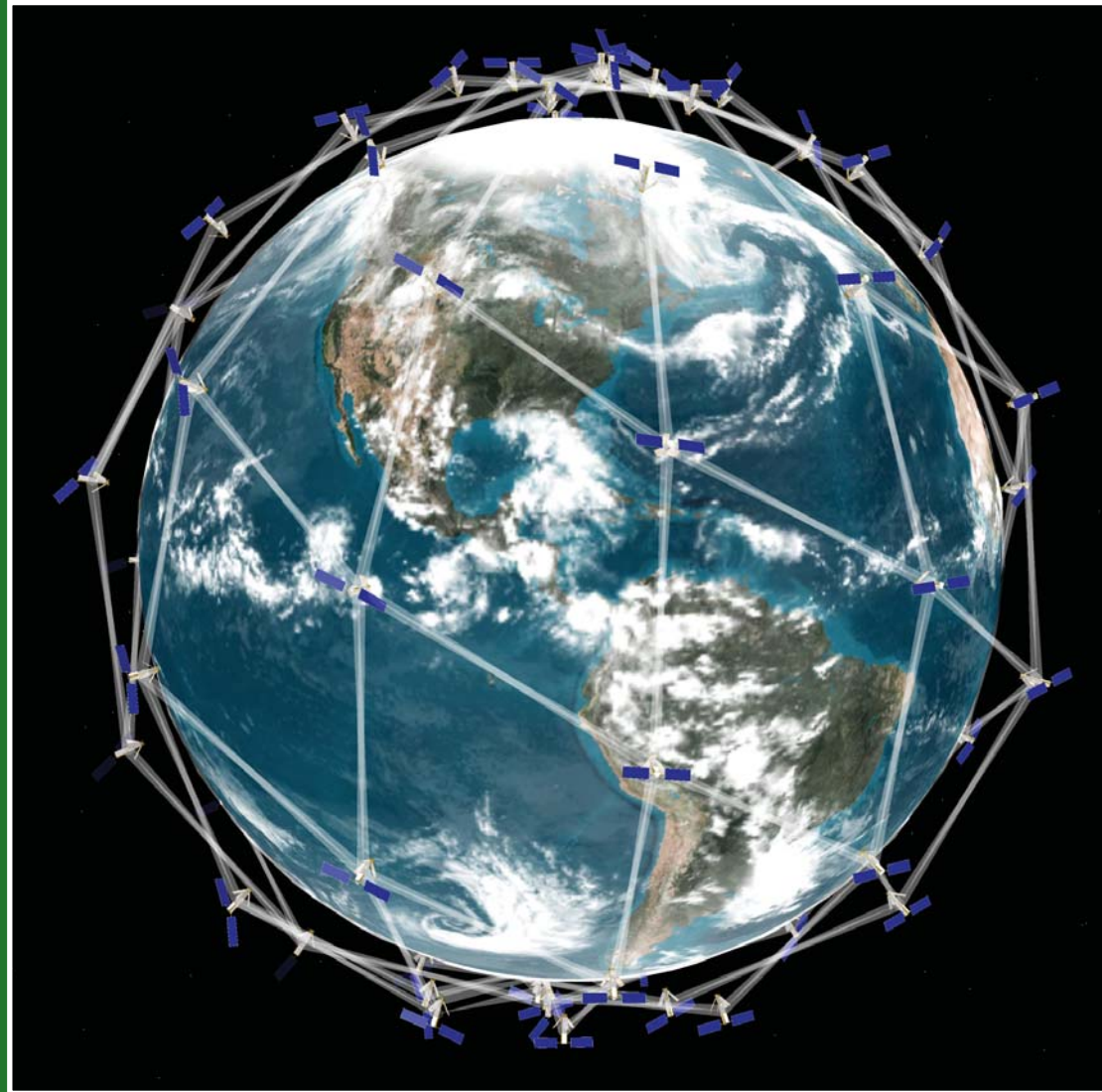
SCIENCE IN PARLIAMENT

Imperial
College
Centenary

Dual Funding

Clinical Trials

Elephant
Survival



Earth Observation from the Iridium Satellite
Constellation, 2013-2030

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.*



Government's re-organisation of the DfES and DTI was done with the best of intentions, but had they thought through the knock-on impact on the existence of the Science & Technology (S&T) Select Committee? The new Department of Innovation,

Universities and Skills (DIUS), with John Denham as its Secretary of State, will give a greater focus on STEM and ensure that the work of our scientists and engineers results in more new products and better use of the knowledge that they gain.

Much of the work of the existing S&T Committee will be covered by the new DIUS Departmental Select Committee, which begins its work after the Queen's Speech, scheduled for 6 November. The plan is to build a DIUS Committee of 14 MPs, rather than the usual 11, so that a S&T Sub-Committee can be created. The current S&T Committee's Chairman, Liberal Democrat Phil Willis, will chair the new DIUS Committee.

But, will the new S&T Sub-Committee have the clout to carry out the powerful cross-cutting investigations of all Government departments and agencies that have been a feature of the current S&T Committee? It will have fewer Members on it, probably about 6, and less resources in terms of travel allowances and administrative staff. In the end, it will probably depend on the commitment of its Members and their new Chairman.

Otherwise, despite all the conference season speculation about a snap Autumn General Election, we coast towards the next Queen's Speech with the same personalities in place. A major debate should then ensue on the proposed Human Tissues and Embryology Bill. I hope that the debate on revising the 1990 Human Fertility and Embryology Act will not be completely hijacked by the inevitable abortion debate. In this edition of SiP we include coverage of a visit by a Chinese delegation to study energy generation in the UK. Whilst their focus was on renewable resources, the P&SC took the opportunity to discuss clean coal technologies. It's a pity though that BP has decided not to go ahead with its carbon capture and storage generation plant in Scotland.

Dr Brian Iddon MP
Chairman, Editorial Board
Science in Parliament

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Government IT failures – fact or fiction?

Andrew Miller MP

How many times do we hear in the media of another government computer failure? A new industry has grown bringing together those who are opposed to new systems because of employment issues and those who have a vested interest in failure.

Examples of the first can be seen in classic HR stories such as:

“Double Government Computer Failure Shows Plans to Axe all Emergency Fire Control Rooms Will Cost Lives.” (PR Newswire Europe November 27, 2004)

The article said, “The latest Government computer crash at the Department of Work and Pensions shows the folly of the Government plans to axe all existing emergency fire control rooms. The move will make the fire brigade 999 service far more prone to catastrophic failure the union (FBU) says, putting lives at risk.”

Similarly a story in the South Yorkshire *Star* of 26 November 2004 was headed: **“Computer failure threat to benefits payments”**

It argued benefit payments to thousands of people in South Yorkshire could be delayed after what is thought to be the biggest-ever government computer failure. And it went on to say, “Trade unions are now calling on the Government to drop plans to cut 40,000 jobs in the DWP.”

The common link is not that they are IT stories but they are about people issues. Whilst it is perfectly understandable for Trade Unions to use all tools at their disposal to represent their members’ needs, examples like these cause an impression that the underlying technology is itself prone to failure. These examples date back before the last election and one simply asks whether the doom mongers’ predictions have come to pass. The answer is of course emphatically no.

And it is these stories that have led to a plethora of publications across the world that present the very real

challenge of any large-scale project as something to fear. In 2006 in New Zealand where Dunedin academics Robin Gauld and Shaun Goldfinch published **“Dangerous Enthusiasms – E-Government, Computer Failure and Information System Development”**, the central theme of which is information technology projects – especially big ones – generally exceed their budgets and timeframes, or fail to deliver the desired results, and it pays to be pessimistic. Similar pessimism can be seen in many other places. Indeed some have joked that *Computer Weekly* couldn’t exist without its diet of Government computer failure stories!

The latest and perhaps the biggest ever is Connecting for Health, the Government’s ambitious multi-billion pound project that is revolutionising the NHS. Is this a challenging programme – yes, is it expensive – yes, but is it broken – no! It has been the victim of concerted efforts by people who should know better than to undermine the tremendous progress and the successful roll-out of parts of the system.

Lord Warner, who, as a previous Health Minister, has followed this project over some years, named names and questioned the role of Professor Ross Anderson of Cambridge University, by quoting from a series of e-mails that have got into the public domain, apparently linking a group of academics, the “Big Opt Out” campaign and parts of the Conservative Party¹. You have to judge yourself the motives of the various people described in these exchanges and in the House of Commons on 6th June, where I set out similar arguments.²

There is room for some political debate in all of that but let us return to the substantive issue: Can the system meet the needs of a 21st Century Health Service?

Perhaps we should examine a few of the myths that are popularly quoted:³

It’s a waste of money: Ovum have



estimated that £4.4 billion is being saved through central procurement of IT systems by NHS CFH compared with what could have been achieved by individual NHS organisations purchasing the same systems separately.

Patients’ lives have been put at risk by systems going down: There is no such evidence. In any case what self-respecting designer would put together such a complex system without safety being paramount and there are always tried and trusted manual systems to fall back on in an emergency.

Technical architecture is flawed: The National Programme for IT is a platform that will ensure that all systems within the NHS can work together. It is not one enormous IT system. There is a robust technical architecture designed to cope with enormous volumes of traffic. The new applications are also being delivered gradually – there will be no “big bang”. This will ensure that the new systems continually evolve and there is a resolution of any problems that arise.

And it is even a myth that Scotland and Wales won’t be able to talk to each other!

We are a nation that has enormous success in “big science” and engineering projects, why on earth should we allow misguided people and sensationalist journalism to put us off our stride? Connecting for Health will be good for the Nation’s health.

REFERENCES

¹ <http://www.publications.parliament.uk/pa/ld200607/dhansrd/text/70621-0010.htm>

² <http://www.publications.parliament.uk/pa/cm200607/cmhansrd/cm070606/debtext/70606-0011.htm#07060669001693>

³ <http://www.connectingforhealth.nhs.uk/>

The Linnaean Tercentenary in London: From the 18th to the 21st Century

The Linnean Society of London is a leading forum for contemporary discussions on natural history, genetics, systematics, biology and the history of plant and animal taxonomy. Founded in 1788, the Society takes its name from the great Swedish naturalist, Carl Linnaeus (1707-1778) who developed the system of binomial nomenclature. This system today provides the fundamental framework for knowledge of the biota of the Earth, supporting effective conservation measures and the sustainable use of biodiversity. Linnaeus' library, botanical and zoological collections have been in the Society's keeping since 1829, having been purchased from the estate of the Society's first President, Sir James Edward Smith (1759-1828).

The year 2007 is a very special time in the Society's history as it celebrates the Tercentenary of the birth of Linnaeus. Its importance was recognised five years ago when the Society appointed a Tercentenary Co-ordinator to plan a year-long programme. Events have been organised worldwide in recognition of the importance of his legacy and The Linnean Society of London planned its own exciting programme. Before this a number of important projects had already been initiated by the Society, including the provision of digital on-line access to the Linnaean biological collections, access to the digital images of the newly conserved Linnaean



The King and Queen of Sweden with the President of the Linnean Society

correspondence, and an online collaborative library catalogue providing bibliographic and location information on all publications by Linnaeus and his pupils. The Society, with its publisher Wiley-Blackwell, are now in the process of digitising all earlier legacy serial publications of the Society, beginning with the first publication of the *Transactions* in 1791. All of these projects are now being delivered online and their completion will enable world-wide access to all of these key collections for the first time.

The Tercentenary year was launched at an evening reception in December 2006. The scientific meetings began

with a presentation by Dr Sandra Knapp on *Linnaeus' Global Outreach* setting the theme for the year ahead. In February Sir David King addressed the Society on the current state of knowledge on *Climate Change*. Joint meetings with the Geological Society of London, the Royal Society, the Royal Botanic Gardens Kew, the Royal Horticultural Society, the Zoological Society of London and the Liverpool Athenaeum provided opportunities for the wider scientific community to discuss the role of Linnaean taxonomy and related subjects giving a broad view of progress since the time of Linnaeus.

A visit from the King and Queen of Sweden on a Sunday in May heralded the opening of the Chelsea Flower show, where the Society's exhibit 'Linnaeus' Legacy: 300 years of naming nature' gained a silver-gilt medal. The same week saw the launch of the book *Order out of Chaos* by Dr Charlie Jarvis, which brings together for the first time information on the typification of all of Linnaeus' plant names. Since 1981, hundreds of botanists around the globe have been studying names, specimens and illustrations in order to allow type specimens to be designated so that Linnaeus' names can be applied clearly and consistently worldwide.

This was followed by our own Tercentenary Anniversary meeting, with its associated tributes, followed the next day by an Anglo-Swedish symposium on *A tribute to Linnaeus and his legacy* (combining the names of the



Herbarium and Library

two Linnaean gardens/exhibits at Chelsea). The visit of the Emperor and Empress of Japan took place immediately after the end of Chelsea Flower Show. The Emperor is a fish biologist and an Honorary Fellow of the Society and addressed the meeting on *Linnaeus and Taxonomy in Japan*. This was later published by *Nature* (Nature 446, 139, 12 July 2007). The tercentenary month ended with an Anglo-Swedish meeting titled *In Linnaeus' Wake*, which combined a whole day meeting on different aspects of marine biology with an evening visit to the replica Swedish 18th Century Merchant ship, the *Götheborg III*, moored in London Docks. That gave all a chance to experience first-hand some of the difficulties experienced by the disciples of Linnaeus as they travelled the world to gather specimens.

Two children's lectures were held in conjunction with the Royal Institution. Other events took place at the Royal Botanic Gardens, Kew, Chelsea Physic Garden and included further joint meetings in the Society's Rooms with the Royal Society for Tropical Medicine and Hygiene, the International Association of Plant Taxonomy and the Institution of Mechanical Engineers. A major international conference in the Netherlands, *Linnaeus 300 - the future of his science*, sponsored by the Society, paid homage to the role of that country in launching Linnaeus and his concepts. Forthcoming meetings include a keynote address on *Parasites, people and poverty* by Lord May, a debate on issues in systematic biology and a final Tercentenary reception and award ceremony in mid December will bring the busy year to a close.

It was at a meeting of the Society that Darwin and Wallace's ideas on evolution by natural selection were first presented. In the early 20th century, the Society was a crucible for the new sciences of evolutionary biology, genetics and ecology, as it was again some fifty years later for the measurement of biodiversity and the practice of conservation. Latterly, the Society has been a midwife to pioneering taxonomic techniques such as cladistics and genomics; it has sparked important developments within medicine and the social sciences through the work of its ethnobotanical Fellows. The availability of online sources to serve the taxonomic community is seen as the best way of fulfilling the aims of our Royal Charter which cites the Society's role as 'the cultivation of the Science of Natural History in all its branches'.

The New Royal Institution

Baroness Greenfield and Kristen Dodd

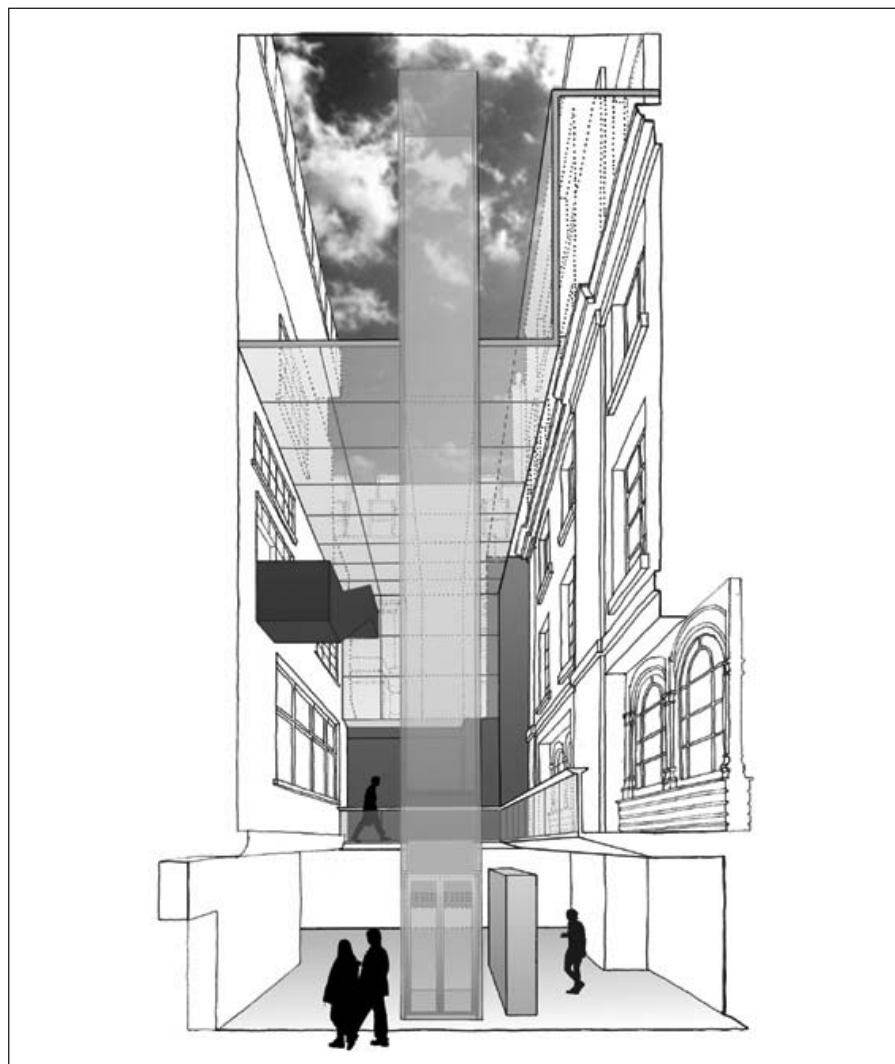
For over 200 years, the Royal Institution of Great Britain (RI) has been 'diffusing science for the common purpose of life'. Our vision is to celebrate science in all its aspects; as well as cutting edge research, but also to promote and facilitate the application of science to politics, education and most important of all, the needs of the general public. The aim of the RI has always been to encapsulate a unique range of activities and events for the general public. We have a long established Young Person's Programme, a vigorous history of science department, ground breaking laboratory research and more recently a Science Media Centre.

It is an independent organisation, free from any private or public sector agendas. Our funding is derived from venue hire, membership fees, corporate sponsorship, gifts and donations, legacies, events and overheads from research.

From January 2006-March 2008, the RI is undergoing a £20 million major refurbishment partly supported by the Heritage Lottery Fund so that we can meet the demands and challenges of democratising science in the 21st Century. The Grade 1 listed building in Mayfair is being re-interpreted by world-renowned architects, Terry



The grand staircase



The Atrium

Farrell and Partners, to provide an iconic series of spaces with new opportunities for listening, thinking and talking about science and its impact on all aspects of our lives.

As Director of the Royal Institution, I feel privileged that this current milestone development of a major refurbishment is happening on my watch. Now all the various activities that have made the RI unique by taking place under one roof will do so under a roof that will become an architectural icon in London. The refurbishment will free up over 40% more space.

As well as a vastly extended public events programme, our facilities will be on offer to outside organisations beyond the scientific community. From spring 2008, these facilities will include a bar, café and restaurant, meeting rooms, and of course the newly refurbished, world famous Faraday Theatre. Faraday's famous theatre, which appeared on the £20 note in the late 1990s, will be equipped with state-of-the-art audio visual technology.

With the Theatre as the traditional icon of the Royal Institution, Sir Terry Farrell was commissioned to conceptualise a modern, original, *piece de resistance* that will transport the RI into the 21st Century. A 5-storey, glazed glass atrium with a scenic lift will be erected as the social focal point of the building. The atrium will not only connect all three floors of exhibition and social spaces, but will offer improved disabled access.

The former Faraday Museum will be re-invented to showcase interactive exhibitions that will encourage all visitors to learn about and engage with science. Amongst the unique items on display are Humphry Davy's miner's safety lamp, Michael Faraday's induction ring, the tube by which John Tyndall explained why the sky is blue, James Dewar's 'Thermos flask' and the X-ray diffractometer used by William and Lawrence Bragg.

The new exhibition will communicate the stories of the world-changing discoveries that originated at the Royal Institution. The new addition of a PDA tour will enhance the visitor's

experience and understanding of the scientific journey that unfolded at the RI.

One of the exciting features will be a reconstruction of Faraday's lab on its original site. This is where Faraday made some of the most important chemical and physical discoveries of the 19th century. It was once the servants' hall and Faraday took it over during the 1820s for his experiments on magnetism. In direct contrast, the construction of a state-of-the-art glass fronted laboratory opposite Faraday's will enable visitors to see for themselves real life science against a backdrop of scientific heritage.

Scientific research continues to be a distinguishing aspect of the Royal Institution with the Davy Faraday Research Laboratory (DFRL). The DFRL was opened in 1896 and has been home to the pioneering work on crystallography by William and Lawrence Bragg, and the ground-breaking development of laser spectroscopy and photochemistry by George Porter and David Phillips. This rich tradition of scientific excellence will be continued with a renewed focus on biological applications of nanotechnology. Indeed, we are very excited to be hosting experimental science in all its aspects, particularly by catering for the researchers of the future.

The new building will house a Young Scientists' Centre (YSC), a unique concept in the UK that aims to provide experimental space for young people to explore science from first principles, and essentially driven by their own curiosity. The YSC will offer teachers and students the chance to ask questions and design ways to answer them, for example taking a computer apart or extracting their DNA, unconstrained by the boundaries of the national curriculum. Indeed the spirit is encapsulated in the strap line: 'where investigation meets experiment'. We are delighted that Mr Jim Knight, Minister of State for Schools and Learners, has given his full support to this initiative.

The Royal Institution has always been an important place for scientific discovery, debate and showcase. In a time when the impact of science and technology on everyone's lives is greater than at any other point in history, the new facilities will ensure that the RI is equipped to continue this work into the 21st Century.

Falling on DEFRA ears

Alan D B Malcolm

Luckily foot 'n' mouth disease hardly ever affects humans clinically. The economic effects are of course extremely serious. The good news is that so far only a few hundred cattle, sheep and pigs have been slaughtered.

Bearing in mind that the laboratories run by government, its agencies and the Institutes it supports, contain brucellosis, anthrax, salmonella, clostridium botulinum, and (possibly) smallpox, this has been a salutary scare.

Will any lessons be learned from this?

We must certainly hope so, but do not be too sanguine. This was an accident waiting to happen which was anticipated by those in charge.

So how could it have happened?

The reports (one by the HSE, and an independent one by Professor Brian Spratt of Imperial College) agree on two major facts.

The first is sad, and reflects weaknesses in human nature. Secure doors were held open (politely) for colleagues to walk through. This did not cause any accidents, but complicated clarification of what had happened afterwards. Similarly the log for lorries entering the site was often illegible. Again this caused no accident, but made it doubly difficult to track vehicle movements after the event.

There were two biological safety officers who did not talk often enough, did not convene enough meetings to engage staff, and were not successful enough in securing funds from the site manager to correct problems.

Anyone who has run any facility, whether containing powerful pathogens, or merely selling postage stamps will recognise these all too normal behaviours.

However, there is also a fundamental structural problem which even in the

absence of such human foibles guaranteed that the site would be unsafe.

Once upon a time, Government and its departments decided what research they needed, and usually owned the facility in which to carry it out. Occasionally it was necessary to commission a contractor to carry it out.

In the 1970s Lord Rothschild was asked to investigate whether this was the best way to get value for money, and concluded it was not.

Laboratories were 'privatised' or turned into 'agencies' or put at arm's length from the department and minister to whom they had once owed allegiance.

They were then told to compete for business. The problem here was that their main competitors were universities. At that time universities had little idea of the Full Economic Cost of doing the research in question. Indeed they received many hundreds of millions of taxpayers' pounds from the University Grants Committee, later to become HEFCE (Higher Education Funding Council for England), which ensured that they had no motive for doing so. Many small businesses, particularly in engineering, used to complain that they were being undercut whenever they bid for public contracts by universities who were subsidised by their taxes.

Laboratories owned by Government departments or Research Councils didn't complain too much either, because they too received funds to support their infrastructure.

In the early days, departments such as MAFF (later to become DEFRA) would guarantee a 'commission' which would ensure a level of funding in exchange for an agreed programme of work.

DEFRA became increasingly convinced that a university could and would carry out the research less expensively, because the university wanted both



the money and the prestige. It could afford to undercut any organisation which was attempting to charge FEC.

And so ten years ago, the 'safety net' of the commission was removed, and Institutes had little choice if they wished to retain the contracts. They had to cut costs to the bone, and in practice that meant reducing overheads such as maintenance of grounds, facilities, and equipment.

Many at Pirbright, and those who visited the site in an official capacity, knew that the drains (and lots of other features, according to reports) were well below the standard of a Category 4 containment laboratory. But everyone simply passed the buck.

Sir Keith O'Nions, the Director General of the Research Councils, and ultimately responsible for IAH, recently told the Parliamentary and Scientific Committee that he had been unable to identify any specific infrastructure flaws in university laboratories.

Senior civil servants know that if you tell a minister the true cost of a project (the Dome, the Scottish Parliament, the Olympic Games), it will then be rejected out of hand. They also know that the minister responsible for the 'underestimate' will have moved on long before the chickens come home to roost.

If a Select Committee wants to get its teeth into something meaty when it returns in October, it could do worse than to find out why no-one has an interest in telling the truth about the true cost of doing frontline scientific research of national importance.

The forensic use of bioinformation: ethical issues

*Professor Sir Bob Hepple QC
Chairman, Nuffield Council on Bioethics and Chair of the Working Group on
The forensic use of bioinformation: ethical issues*

Bioinformation has been a valuable tool for detecting and prosecuting offenders ever since fingerprinting was first introduced in the late 19th Century. DNA profiling came along much later, in the 1980s, but its use in the UK grew rapidly. We now have by far the largest forensic DNA database in the world, per head of population, holding 4 million samples (or 6 per cent of the population).

Many criminals have been, and will continue to be, caught and convicted through the use of forensic bioinformation. In the year 2005-2006, DNA samples from suspects or volunteers were matched with around 50,000 samples found at crime scenes. The crime detection rate increases from 26 per cent to 40 per cent when DNA evidence is available.

However, the establishment of the National DNA Database and subsequent extensions to police powers were effected without any meaningful public debate. It was for this reason that, while recognising the value of bioinformation for forensic use, the Nuffield Council on Bioethics, an independent body, decided that a critical examination of the subject was needed.

The Council appointed a Working Group in 2006, which included members with expertise in law, genetics, philosophy and social science. As part of the inquiry, the Group held a public consultation, which elicited over 135 responses. These revealed a wide range of views, from those who wholeheartedly welcomed the expansion of forensic databases, to those who viewed the increase in police powers with deep suspicion.

Although fingerprints are more commonly used by police, the taking and retention of DNA is seen as far



more sensitive because of the additional information which can be derived from a person's DNA. For this reason, particular attention is paid in the report to the forensic use of DNA.

Scientific reliability

The science and technology of DNA profiling is increasingly robust and reliable. However, problems can occur with deliberate or accidental contamination of crime scene samples, misinterpretation of mixed samples (those originating from more than one person), and mistaken interpretation of partial profiles. Our recommendations regarding the use of DNA in the criminal justice system are designed to reduce the risks of mistaken identification resulting from (relatively rare) cases of flawed science.

Ethical values and human rights

The protection of the public from criminal activities is a primary obligation of the state. It is also necessary to protect certain fundamental ethical values, such as liberty, autonomy, privacy, informed consent and equality. The Working Group broadly endorsed a rights-based approach, which both recognised the importance to human beings of respect for their individual liberty, autonomy and privacy, and the need, in appropriate circumstances, to restrict these rights either in the general interest or to protect the rights of others.

The principle of 'proportionality' is at the heart of the recommendations in the report. This means that any interference with legally enforceable human rights, such as the right to a

fair trial, the right to respect for private and family life, and the right to equal treatment, must be proportionate.

The use of DNA in criminal investigation

Collecting DNA

The powers of the police in England and Wales to take DNA are wider than those in any other country. DNA can be taken, without consent, from any person arrested for a 'recordable' offence (mostly offences that can lead to a prison sentence). The Government recently announced plans to expand these powers further, by allowing police to take DNA from those arrested for 'non-recordable' offences as well, such as littering and minor traffic offences. It is our view that this is disproportionate to the aims of identifying a person and of confirming whether or not a person was at a crime scene, and suspicion of involvement in a minor offence does not justify the taking of bioinformation without consent.

We would like to see the police instead put more resources into the collection of DNA from crime scenes. At present, fewer than 20 per cent of crime scenes are forensically examined.

Retaining DNA

The police can permanently store DNA on the National DNA Database even if the individual is later found to be innocent. There are personal implications for these individuals, such as loss of privacy, and anxiety about being associated with a 'criminal' database. We recommend that the police should only be allowed to keep the DNA of people who are convicted of a crime, with the exception of people charged with serious violent or sexual offences. These changes would bring the law in England, Wales and Northern Ireland into line with that in Scotland.

Volunteers

As part of a criminal investigation, victims or witnesses may be asked by the police to volunteer DNA and allow it to be added permanently to the DNA Database. There is currently no option for it to be removed at a later date. We recommend that volunteers should not be asked to

consent to the permanent storage of DNA beyond the conclusion of the relevant case. At the very least, volunteers should be able to remove their DNA at any later time without having to give a reason.

Children

There are around 750,000 under-18s on the National DNA Database. The United Nations Convention on the Rights of the Child requires that special attention be given to children in the legal system, including opportunities for rehabilitation. We recommend that there should be a presumption in favour of removing DNA taken from children from the Database, if requested, unless there is a good reason not to, for example, if it was a very serious offence.

DNA evidence in court

DNA evidence is very influential in court, but the statistical implications of it can be difficult to understand. We recommend that legal professionals should acquire a minimum understanding of statistics with regard to DNA evidence. Information should also be made available to jury members about the capabilities and limitations of DNA evidence.

Other uses of the DNA Database

Familial searching

When DNA collected at a crime scene does not match exactly any profile on the Database, it is possible to search for relatives whose DNA would provide a partial match. Many possible relatives can be found, and the process may reveal previously unknown family relationships. We recommend that familial searching should not be used unless it is specifically justified in each case.

Ethnic inferencing

When DNA is collected from individuals, the arresting officers allocate them to one of seven broad ethnic groups. This information has been used in research and now forensic analysts can tell the police the likely ethnic group of a DNA sample collected from a crime scene. The police may use this to narrow down their pool of suspects. However, the practice of assigning a 'racial type' to individuals is subjective

and inconsistent, and genetic research does not support the idea that humans can be classified by appearance into a limited number of 'races'. We recommend that 'ethnic inferences' should not be routinely sought, and they should be used with great caution.

Non-operational research

By the end of 2006, 33 requests had been made to conduct research using the DNA Database that was not directly related to particular police investigations, termed 'non-operational research'. However, the publicly available information about this research is inadequate. We recommend the regular publication of further details about, for example, the purpose of the research and whether the research has been scientifically and ethically reviewed.

A population-wide DNA database?

Some believe that taking the DNA of everyone at birth to build a population-wide forensic database would assist the police whilst also removing problems of discrimination. However, this would be hugely expensive and would have only a small impact on public safety. The intrusion of privacy incurred would therefore be disproportionate to any possible benefits to society. For these reasons, we are against the establishment of a population-wide forensic DNA database at the current time.

Governance and ethical oversight

The current legislative regulatory structure for the collection and retention of forensic bioinformation is piecemeal and patchy. We recommend that there should be a statutory basis for the regulation of forensic databases, which should include oversight of research and other access requests.

The Council also suggests that an independent tribunal should be set up to oversee requests by individuals to remove their DNA from the Database, and that safeguards should be put in place regarding access to the Database by international law enforcement agencies.

Further information about the report *The forensic use of bioinformation: ethical issues* is available at www.nuffieldbioethics.org

Science in Scotland – Making a Difference

Professor Anne Glover, Chief Scientific Adviser for Scotland

My first 12 months as Scotland's first Chief Scientific Adviser have been a baptism of fire. Days have been filled with delivering talks, establishing networks, fact-finding visits and getting to grips with the complexities of the civil service and a change of Government. Most of all though, it's been a fantastic opportunity to sell science. From the children I met in National Science and Engineering Week, to Chinese journalists, and Irish government officials, I've spent the past year not just talking about the career opportunities that science presents in Scotland but also the strength and depth of the science base we have here, and the opportunities this offers to both our indigenous industries and to inward investors. It is important that the wider business community in Scotland and globally is aware of and can take advantage of developments in our science base. The Scottish public can be justifiably proud of our impact on the rest of the world as science is one of the areas in which we truly excel as a nation.

Like the rest of the UK, Scotland has its fair share of doom-mongers and nay-sayers: the people who complain about falling uptake of science at school and degree level, and those who talk of a brain drain in the upper echelons of research. But the truth is more positive than they would have you believe. Year after year,

Mathematics is the second most popular subject at Higher/A level, followed by Chemistry, Biology and Physics – with a slight increase in uptake of all four over the last year.

At degree level, the overall picture is good with a sustained upward trend in the overall numbers of Scots studying science subjects at Scottish Higher Education Institutions, particularly in the Mathematical and Biological Sciences. It is true that there are fewer students choosing Chemistry, but other areas – including Forensic Science (which contains an awful lot of analytical chemistry) – have grown, highlighting an apparent shift from 'pure' science subjects to those with a more applied or vocational focus. Encouragingly, the report also suggests that there will be a strong demand for scientists within the Scottish labour market in the future.

The strength and quality of our science and research base impacts very positively on our teaching and this is reflected in the high numbers of foreign students studying science in Scotland. They may be developing the global research partnerships of the future and this type of early interaction can provide links to Scotland they can call upon later in their careers.

And what about those students who decide to continue to work in science after graduating? Talk of a brain drain



from Scotland is somewhat premature. Dundee, for example, is recognised worldwide as a major centre for life sciences research and is also home to a cluster of computer animation studios able to attract IT specialists from around the globe.

Other areas of Scottish expertise involve world-leading stem cell research in Edinburgh, home to Europe's largest stem cell network, including a new Centre for Regenerative Medicine that is bringing together basic research as well as technology development and more commercial activities. Scotland is also home to the Institute of Nanotechnology, the UK Astronomy Technology Centre, and several centres of excellence in computing and informatics that generate cutting edge research as well as underpinning other disciplines such as genomics and proteomics. Neither should we forget that our environment and abundant coastline mean we are predisposed to be at the forefront of developments in renewable energy. We are not short of wind, waves, tides and water.

Scotland has only 0.1 per cent of the world's population yet we publish 1 per cent of all scientific papers. This level of activity in high-quality scientific research means we can

attract scientists of the highest calibre to Scotland. In turn, it makes Scotland an appealing place in which to invest – and major investors such as Wyeth and the Wellcome Trust are testament to that. Through initiatives in research pooling, we have provided the means to allow our universities to work more closely together, including having joint graduate schools, in a number of areas such as Physics, Chemistry, Environmental Sciences and Life Sciences. Our scale and connectivity allow us to maximise the use of resources and compete internationally in research, attracting some of the world's best scientists to come and work here. The next challenge is to ensure that scientific excellence is translated into commercial activity and business innovation. This is no small task but we have some interesting examples of imaginative ten year investment in pre-competitive research through three Intermediary Technology Institutes (ITIs) in Life Sciences (Dundee), Techmedia (Glasgow) and Energy (Aberdeen). These aim to bridge the gap between publicly-funded early stage research and privately-backed commercial development and recognise that effective translation of research takes time and specialised input.

I believe the science base is strong in Scotland, but I don't think we can be complacent. Investment has to be maintained, and a key role in ensuring that future generations study and work in science has to be played by our scientists themselves. All of us with an interest in the future of science share this responsibility. A back-of-an-envelope calculation comes up with 1 in 75 of the population working in science – imagine the difference it could make if we all talked to schools

and to the public, engaged with all sectors of society to show the relevance of science in everyday life, made it accessible and even showed how much fun it can be. Importantly, we need to get the public fully engaged with science's role in answering some of the most pressing issues of our time, including climate change, curing diseases, and the future of the developing world.

On this last point, I think our science community can play a key role. There are lots of areas where Scotland has significant expertise and can make a real difference in developing countries, for instance renewable energy technologies and health research. The recent announcement that the Scottish Government will double its international aid budget is good news, and I'm convinced that aid can be effective and sustainable through the practical appliance of science. I want to work to strengthen the international links that our universities and research institutes have with the developing world so we can exchange information and grow together. It would be hard to better Louis Pasteur's sentiments when he said "Science knows no country, because knowledge belongs to humanity, and is the torch which illuminates the world."

Closer to home, as Head of Science and Engineering Professions within the Executive I'm keen to represent the views of scientists working here, and to ensure a variety of satisfying career paths that make the most of their talents. We are working closely on this with colleagues within Government throughout the UK. I also want to promote science within the civil service in Scotland, as part of the evidence base for Ministers. I'd like to see science as fundamental a consideration

as funding when policy is developed. I was surprised when I started working within the Executive how few scientists consider a career in the civil service. It would be good to attract more to increase the diversity of backgrounds and skills found here to reflect, and meet, the wide-ranging demands of Ministers across their portfolios.

The truth is that science matters and touches everyone in their daily lives but we are so dependent on science and technology – our phones, our internet, our transport systems, the food that we eat, our health and environmental services – that we have almost lost sight of it. Science is inspirational and exciting and it would be fantastic to see a cultural shift in Scotland, with science becoming as valued as the arts and music scene. My team also deals with funding for science engagement, including supporting the Royal Society of Edinburgh, the four science centres in Aberdeen, Edinburgh, Dundee and Glasgow, and vibrant science festival activity stretching from Edinburgh to Shetland. These activities show just how fun, exciting and inspiring science can be. We aspire to a Scotland where science is accessible, whatever your age or background, where science literacy amongst the general population is high and provides the tools with which to engage in debate about science and technology issues that will shape the 21st century.

Scotland's future depends so much on science, engineering and technology – not just our economy but our quality of life, health and environment. There are challenges of course, but I believe the outlook for science is good in Scotland, and that it can make a significant contribution to the rest of the world.

UK Biobank – Half a Million Steps to a Healthier Future

*Professor Rory Collins, UK Biobank Chief Executive
& Principal Investigator*

In April 2007 a small, mixed group of people entered a commercial office building in Manchester city centre to embark on one of the most ambitious health research projects ever undertaken.

Their ranks, over the course of that week, swelled to 300 – and now stand at more than 20,000, and are growing all the time.

Another 480,000 people aged 40-69 will follow in their footsteps over the next four years, and most, if the first participants are anything to go by, will be motivated by one simple desire – to improve the health of future generations.

So, after the years of deliberation, discussion, review and successful piloting, UK Biobank, a prospective study of lifestyle, environmental and genetic determinants of a wide range of diseases, is finally on its way.

UK Biobank assessment centres are now recruiting participants in Oxford, Manchester, Glasgow and Cardiff, with others planned in towns and cities across the country as the programme rolls out.

Participants in this visionary medical project are helping to build an unparalleled resource to give scientists of the future access to new information that will help cure and prevent many life-threatening, painful and debilitating illnesses such as cancer, heart disease, diabetes, stroke, dementia, arthritis and depression.

Crucial to this is that participants answer questions about their current health and lifestyle, allow UK Biobank to take some standard body measurements (blood pressure, bone density, lung function, height, weight, grip strength and body mass), that they donate small samples of blood and urine for long-term storage and

analysis, and that they consent to follow-up of their health over many years (electronically, using health records).

This will provide scientists of the future with the most detailed information ever collected to help determine why some people get certain illnesses and others do not – paving the way for better prevention and treatment.

UK Biobank's non-intrusive approach to the detailed questionnaire – interview by touch-screen computer, rather than by a person – is resulting in high responses to all questions, even some which may stop you in your tracks. Would you feel comfortable telling an interviewer how many sexual partners you have had? Probably not, but most participants respond to all the computer's questions.

Working together

UK Biobank is a massive project and all those centrally involved have learnt an enormous amount during its inception and now its delivery.

It is funded by the Wellcome Trust, the Medical Research Council, the Department of Health, the Scottish Executive and the Northwest Regional Development Agency. It is hosted by the University of Manchester, has the support of the National Health Service (NHS) and the Welsh Assembly and is a collaborative effort between 22 UK universities.

Practical, scientific, ethical and legal questions have been addressed, from just how big should the study be, to what is the best recruitment strategy (bearing in mind costs and questions of privacy) for half a million people?

The approach has been discussed by the funders, scientists, ethicists and members of the public and,



throughout, UK Biobank has sought to deliver the 'gold standard' in prospective epidemiological study design. Many reviewers, including UK Biobank's prestigious International Scientific Advisory Board, which met in June, believe it is achieving that.

Building trust with participants is crucial to the long term success of the project. UK Biobank seeks dialogue with participants and their GPs before the first invitations are mailed. It has systems in place to ensure it responds quickly to concerns and worries.

Communication with participants takes a number of forms:

- An Information Leaflet enclosed with the letter of invitation;
- A Further Information Leaflet available on request;
- A UK Biobank website: www.ukbiobank.ac.uk;
- Information in: Welsh, Arabic, Chinese, Bengali, Turkish, Gujarati, Hindi, Polish, Russian, Urdu, Punjabi, Somali;
- A free telephone information service, six days a week (8am-7pm), which also allows participants to confirm and change appointment times;
- Senior UK Biobank staff available to respond to urgent calls that require immediate action (this escalation process underlines the importance with which UK Biobank takes all questions or concerns about the study);
- Alerting GPs to the fact that people registered with them will soon receive their invitations;

- Publicity campaigns involving local and regional media, as well as awareness raising side-of-bus adverts;
- Engaging with like-minded charities and researchers at universities across the country to enhance the resource.

Making contact

Contact details without any medical information are provided for people aged 40-69 years by the NHS centrally. The only information provided about an individual is their name, address, sex, date of birth, NHS number and general practice.

Approval for the release of this information in confidence for the purpose of inviting participants into the UK Biobank project was obtained from the Patient Information Advisory Group (PIAG) in accordance with Section 60 of the Health and Social Care Act. Confirmation that this processing of contact details complied with the Data Protection Act was obtained from the Office of the Information Commissioner.

The UK Biobank Protocol, including the approach to recruitment, has also been approved by the NHS North West Multicentre Research Ethics Committee (MREC).

UK Biobank understands the need for transparency at all stages of its development. Its continued integrity and good name is crucial to the long-term success of the project. Participants need to be able to trust in the project since it deals with the most sensitive, private matters of past, present and future health.

Storage and follow-up

Participants' blood and urine are being stored in specially constructed state-of-the-art facilities near Manchester. Computer equipment able to hold information anonymously and securely, but also able to match health updates with individual records and the relevant blood and urine samples, has also been developed.

Great care is taken to ensure the confidentiality of all data, and details that might identify participants are removed from any information and samples before they are provided to researchers.

Electronic follow-up is planned through various databases of health records, some of which already exist in an easily accessible national form (eg death and cancer registers; occupational and dental records; hospital episode statistics) and some that are being brought together in a national format through Connecting for Health (eg GP records).

UK Biobank is largely dependent on national sources for the provision of health care follow-up data for consented participants. Ideally, this data should be comprehensive and complete for each participant and should be routinely refreshed throughout the duration of the project.

This in itself is a challenge, though given the long-term nature of UK Biobank (it may be ten years before the resource accrues enough cases of a particular disease to begin analyses) a consistent and thorough approach should be possible.

Agreement will also be sought on the data requirements – how it will be structured and provided and how UK Biobank will know it is complete and accurate.

Robotics technology has come together in novel ways to allow accurate processing of 20,000 1.4ml tubes containing samples every day. And the practicalities of storage have been imaginatively addressed. Purpose built facilities use a 3D 'barcode' embedded into the container of each frozen sample to provide for rapid storage and retrieval by robots. The technology needs to withstand many years of sub-zero temperatures. With around 15 million aliquots eventually stored away, efficiency and accuracy here is essential.

It is important that we take a very structured approach to the custodianship of data in UK Biobank which means that, with core systems, we are pursuing ISO accreditation and are subjecting all key technologies to audit.

We have adopted a principle of complying with and helping to define appropriate data standards, which means that we are working to the HL7 standard (Health Level 7), which supports the development, promotion and implementation of standards in ways which meet the needs of the

healthcare community. This will improve our ability to link to external data sources and means that we are active in the international community (EU Framework 6 and proposed Framework 7), and working on harmonising data standards for biobanking worldwide.

Governance

The independent UK Biobank Ethics and Governance Council was established by the Wellcome Trust and the Medical Research Council (MRC) to act as guardian of the UK Biobank Ethics and Governance Framework. Its remit includes advising more generally on the interests of research participants and the general public in relation to UK Biobank. The EGC is chaired by Graham Laurie, Professor of Medical Jurisprudence at the University of Edinburgh.

The future

Any study as ambitious as UK Biobank will arouse comment and questions. The public interest in UK Biobank means it is important to monitor our levels of service and to respond and improve when appropriate.

Scientifically, the focus is on delivering enhancements to the dataset, ensuring the quality of the data so far recorded and encouraging widespread engagement with the whole UK health research and scientific communities, and, indeed, with researchers from overseas. Access to the health records that participants have so kindly agreed we can follow is also important.

UK Biobank is building a health resource for researchers from around the world. Access will be governed by strict ethics and scientific criteria that comply with its stated aims. An Access Policy is currently being framed and will soon be available on the UK Biobank website.

It has been a privilege to visit our assessment centres in recent months and find out what motivates people to join UK Biobank. The overwhelming desire is to do something positive to help improve the health of future generations. Belief that science can deliver is inspiring. We do bear that in mind all the time as we strive to make this project a major force for health improvement not just in the UK, but around the world.

Further information:

UK Biobank: www.ukbiobank.ac.uk or call Andrew Trehearne on 01865 743960

EGC: www.egcukbiobank.org.uk

Science City York – Prosperity through Knowledge

Paul Taylor, Project Director

Nearly a decade since its launch, Science City York continues to be at the forefront of driving innovation, creativity and enterprise in science and technology across York and North Yorkshire.

The latest major undertaking for the successful business and skills development initiative was as key organiser of over 200 science-related events and activities which took place across York in September for the city programme of the BA Festival of Science.

One of the UK's largest, most prestigious science festivals, the 2007 BA Festival of Science saw 350 of the UK's top scientists visiting York to discuss and share the latest developments in science and technology with a diverse audience.

Organised by the British Association for the Advancement of Science in partnership with the University of York, Science City York and City of York Council, the festival receives support from the Department for Innovation, Universities and Skills, British Petroleum (BP) and Yorkshire Forward, the regional development agency for Yorkshire and Humber.

In addition to the city programme, hundreds of additional lectures and activities for visitors and schools took place on the University of York campus.

With an estimated 50,000 visitors attending, Science City York sees the BA Festival as an important component in promoting science, technology and innovation in its ongoing public engagement strategy.

Science City York – A Leading Science City

Science City York was launched in 1998 by Lord Sainsbury as a partnership between the University of York and City of York Council with subsequent investment from Yorkshire Forward.

The main aim of the Science City York initiative has always been to generate new high quality business and employment opportunities in the City of York. This was based on an identified need to diversify the economy away from its then dependence on declining industries, particularly heavy engineering.

Following success of its interventions over the first eight-year period, Science City York, two years ago, moved to extend its services beyond York, enabling technology-based businesses across North Yorkshire to access the knowledge and guidance of the Science City team in business and skills development, whilst promoting career opportunities in science and technology.

Science City York is recognised nationally and internationally for its track record in creating new business and employment opportunities, and in driving regional economic growth through knowledge-based exploitation in three specific sectors – bioscience and healthcare, IT and digital and creative technologies.

One of its key objectives is to be recognised internationally as the UK's leading Science City, and a target was set to create over 15,000 jobs and £1 billion investment in Yorkshire's



knowledge base by 2021. This will build on the 87 new businesses and 2,800 new jobs which have been created since Science City York was launched. The most recent figures available from the Office for National Statistics reveal that more than 35,000 people are employed in technology-related occupations in York and North Yorkshire across almost 3,000 businesses.

The engagement of the wider community in Science City York activity has been an integral part of its strategy, ensuring the 'hearts and minds' of local citizens understand and support the concept of science and technology as a creator of new employment opportunities.

Science City York's holistic vision with the integration of community science strategies has placed effective science communication and public awareness at the core of its strategy and business development activities. This has been complemented by ensuring that enhanced education, lifelong learning and workforce development are embedded locally.

'Bringing Science to Life'

The 2007 BA Festival of Science, which returned to the city for the first time in over 25 years, builds on the success of York as a host for other major science-related events.

From 'bite-size' science taster sessions, business and enterprise courses, monthly informal 'Café Scientifique'

debates, through to its own city-wide annual science festival, Science City York, in partnership with the business community and education experts, delivered more than 60 activities and events last year.

In March over 15,000 people from across the region took part in the 10th York Festival of Science and Technology, informing, engaging and sparking the imagination of people from all backgrounds, and of all ages.

Knowledge-intensive Networks

Science City York prides itself on the flexibility and accessibility of its services – ‘a first point of contact’ for new and existing technology-based businesses within the bioscience, creative and IT and digital sectors.

Its sector-specific technology networks (Bioscience York, Creative York and IT & Digital York) offer a business-driven programme of events, from informal networking, skills and professional development programmes through to major industry conventions. The science and technology community across the sub-region benefits from an active, supportive business environment, assisting supply chain development, offering opportunities to engage with national players and venture capitalists and fostering a climate of innovation and collaboration.

Emma King, a freelance museums consultant, attended a Business and Enterprise Skills course run by Creative York earlier this year in partnership with Learning City York, supported by funding from Yorkshire Forward.

Emma comments, “I found the course extremely useful. In fact it's the most worthwhile training course I've been on since I became self employed. It was fantastic and very motivating to have trainers who understand creative businesses and have an empathy with people who are in business because they love what they do. It's also very useful to meet other people in the same situation and know that you're not alone.”

Impartial, Practical Business Support

Science City York Business Promoters provide a focused, fully funded business development service for start-up, early-stage and established technology ventures in York and North Yorkshire.

Hands-on advice and support extends from help with drawing up a viable, investor-friendly business plan and identifying funding opportunities, through to advising on supply chain issues and international partnering opportunities.

York-based Rapita Systems Ltd is one such business benefiting from the support on offer from Science City York and its network of contacts. Founded in 2004 after five years' research at the University of York, the company has developed ‘RapiTime’, a product that computes the longest time taken by a piece of software to run, important in real-time safety-critical and mission-critical software systems.

Science City York has worked with Rapita from the outset in providing strategic advice to the company, helping Rapita to review their business plan, and advising them on potential funding streams.

Rapita's Managing Director Dr Guillem Bernat comments, “We knew when we had a world class idea and the scientific ability to make it happen. Science City York has proved invaluable in helping us turn the idea into a functioning business.

Three years on we are negotiating contracts with some of the biggest names in automotive engineering, avionics and consumer electronics.

Without Science City York the whole process would have been much harder and I'm sure we wouldn't be in the position that we are in today.”

Science City York's Proof of Concept Fund and Technology Growth Fund offer a source of financial assistance for new and early-stage businesses at a time when securing investment can

seem beyond reach for many ventures.

The micro-funds are helping to turn ideas and talent into marketable products and services, paving the way for growth and additional investment opportunities. Previous recipients range from the inventor of a mobile personal safety system through to the developers of an innovative web-based creative resource for teachers.

The Way Forward

Science City York is ‘stepping up a gear’ as Project Director Paul Taylor explains:

“Our focus is on raising the profile of Science City York nationally and internationally as a major source of innovative solutions in business development. A new company has been created with the present partnership formalised as stakeholders and Science City York has recruited Richard Hutchins from Advantage West Midlands as Chief Executive to lead the new organisation.

A significant development for York in 2007/2008 is additional investment in facilities for technology-based enterprises in collaboration between the three Northern Regional Development Agencies under the Northern Way project, with investment in projects on the former Terry's Chocolate Works site alongside York racecourse, on the University of York campus and at York Science Park.

The Northern Way projects are set to provide a citywide network of dedicated incubation and grow-on space linking bioscience, creative and digital companies and researchers over the next three years.

We will continue to work with Government in advising how best to co-ordinate efforts in promoting science, technology and innovation, in addition to providing continued support to our businesses and promoting York and North Yorkshire as a prime location for new and existing technology enterprises. Hosting the BA Festival of Science in York in September will further raise the profile of the City as the premier Science City in the UK.”

Global Climate Change – Plans for a 15-year Space Odyssey

Dr Bill Simpson
Trident Sensors Ltd

A unique opportunity has arisen for a revolution in how we view our planet from space. It is an opportunity that will allow UK Government, science and industry to play a leading role.

Between 2013 and 2016 Iridium Satellite LLC¹, a US company, needs to replenish its constellation of 66 low Earth orbit communications satellites for operation to 2030 and beyond. The constellation is arranged in 6 polar orbit planes of 11 satellites (see front cover) giving complete global coverage, all the time. In September 2006, Trident Sensors suggested that the next constellation might host Earth observation sensor payloads. Since then, Iridium and Trident have worked together to look at the feasibility of this idea. This includes an assessment of current priorities for Earth observation, their societal benefits and fit with political priorities, the identification of candidate payloads and their manufacturers, consultation with the scientific community and production of a business plan.

This is a true revolution in how missions are conducted, a move away from R&D-driven, single satellite, one-off missions to fully operational, continuous observations. The most important issue facing us is global climate change and in particular obtaining long term continuity in measurement of the processes that influence it. These include the accurate knowledge of the Earth's radiation budget, understanding climate dynamics and monitoring of the air-sea interactions that drive our weather system. The broader benefits to society required of Earth

observations were presented by the Group on Earth Observations (GEO) in the GEOSS 10-Year Implementation Plan². The key themes and the functions are summarised in the first two columns of Table 1.

Due to the short time scales (see Figure 1), a high degree of readiness is essential, so heritage instruments will be flown, that is, ones with space-proven track records. Reviews by Trident, GEO and ESA have reached a



consensus on four suitable payloads (see Table 2) that match all the criteria concerning priorities, themes, social benefits, heritage and the strict payload specification (50kg weight, 30 x 40 x 70cm dimensions and 50W average power consumption).

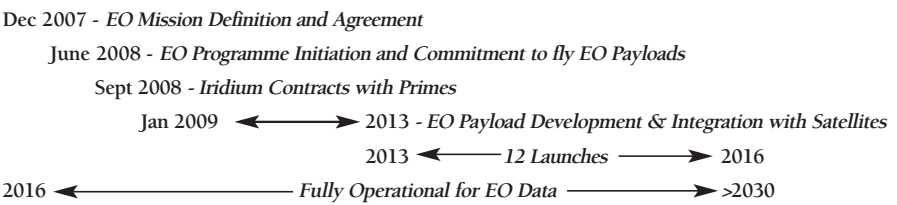
Table 1. The Group on Earth Observations - Themes and Function [2]

THEME	FUNCTION	INFORMATION FROM SENSOR DATA
Agriculture	Sustainability & desertification	Land use & change of use; drought; crop diversity
Biodiversity	Monitoring & conservation	Loss/change of habitat (e.g. coastal, terrestrial, ice)
Climate	Variability & change	Air-sea interactions; clouds; moisture content; global climate change models
Disasters	Natural & man-made	Tsunami & extreme weather early warning; wild-fires; response & remediation
Ecosystems	Management & protection	Fisheries; ocean colour; forest canopy
Energy	Management of resources	Sea state; tide & wind for renewable energy
Health	Environmental factors & security	Monitoring marine pollution; crop management
Water	Resources & global cycle	Ice loss; sea level change; ocean currents
Weather	Forecasting & warning	Invaluable data set in real-time for accurate forecasting

Table 2. Sensor Payloads (at time of publication)

SENSOR	QTY	MEASURED PARAMETER(S)
Altimeter	24	Wave height, wind speed; canopy height; ice height
GPS Occultation	12 (66)	Atmospheric water vapour & temperature soundings
Imager	6 (18)	Multi-spectral for ocean colour & land imaging
Radiometer	24	Earth radiation budget; energy source for the climate system

Figure 1 SCHEDULE



Brief summaries of what the sensors measure and the number of each type to be flown in order to optimise the data coverage are given in Table 2. The four missions will produce a powerful, coherent, data set that will provide valuable information on a plethora of environmental parameters as listed in the third column of Table 1, cross-cutting all the GEO themes.

Taking each mission in turn, the altimeter uses radar to range to the Earth's surface. Sea surface height can be measured to 5 to 10 cm at the first pass of data processing then to 2 to 3 cm with incorporation of accurate knowledge of the satellite's position as given by onboard GPS sensors. The constellation of 24 altimeters will give unprecedented coverage of coastal and ocean waters, including information on open ocean currents, the change in ice fields and Tsunami early warning. Real-time data will be of value to fisheries, shipping and insurance markets.

The GPS Occultation sensors intercept radio signals from the GPS satellite network. These signals pass through (are occulted by) the atmosphere close to the horizon and so take a path through a deep cross section of the atmosphere. Variations in electron density and air density, a function of temperature and moisture content, bend the signal and slow its speed. By measuring these shifts in the signal, scientists can determine the atmospheric conditions that produced them. The result: profiles or soundings along thousands of angled, pencil-like segments of atmosphere, each about 200 miles long and a few hundred feet wide. The general consensus is that as many as possible of these sensors should be deployed, hence the option to fly 66. The benefits include: high accuracy temperature measurements around the globe for climate models, long term variations in temperature and their input into models, good data over the poles and open oceans where weather balloons are not used, high quality water vapour measurements for forecasting hurricanes, typhoons and violent storms and improvement in the reliability of weather forecasting.

The aim of the broadband radiometry is to determine the variation in the

Sun's output and how this impacts on the terrestrial climate. These data are of greatest importance to climate change models, as the Sun drives the Earth's climate system and small changes in solar energy can have a dramatic effect on climate. For example, it is estimated that the change in solar activity is responsible for a 0.2°C rise in temperature over the last 150 years. Although the input of energy from the Sun is well understood, the amount of radiation leaving the planet is not and it is a very complex system. This data also will help improve weather forecasting.

A multi-spectral imager that will use between 6 and 16 discrete wavebands in the UV-visible is under consideration. The measurement of ocean colour gives information on phytoplankton, suspended solids, coastal erosion and pollution and their relationship to eddies and data can be used to estimate biological production. Also these instruments can image clouds, detect wild-fires (eg Greece recently), help in disaster management and monitor desertification, deforestation and land usage.

The missions need to complement existing or planned Earth observation programmes both on the Earth's surface and from space. Iridium's core business is communications and currently the network is used to transmit data from, for example, ocean drifters and maritime and terrestrial meteorological stations. Scientists receive data within 20 seconds, irrespective of the remote station's position on the planet. An advantage of the new constellation is that data from the ground platforms will be transmitted to the observing satellite overhead allowing for real-time calibration of sensors. This opens up the possibility of now-casting of extreme weather events. The missions will complement others such as ESA's Sentinel series and those planned by NASA³. Furthermore the 15-year life of the constellation assures data continuity where many space missions have a lifetime of typically <5 years and where repeat launches are both expensive and not guaranteed.

The space industry at home and abroad has been consulted and indeed the Request for Information for the

satellites was issued in July 2007. The international political and scientific interest is gaining momentum. GEO, BNSC, NASA and NOAA have set up working groups to review the payloads, including other options such as atmospheric chemistry, space weather, and cloud vector monitoring.

The GEO Executive, based in Geneva, is actively seeking the opinions of the international community through various channels. The project was mentioned at a recent meeting hosted by UNESCO in Paris⁴ and will be tabled for consideration by the GEO Ministers and Agencies at the Summit in Cape Town in November 2007.

The total cash budget for the whole of the Earth observation segment, including the purchase and integration of all the sensors, their launch, data retrieval and dissemination, from start of funding in 2009 to 2030, is estimated at ~£800M, equivalent to £0.58M per satellite per annum. In space terms this is staggeringly good value for money because operational science is underpinned by Iridium's commercial space and ground infrastructure investments. A 7-year plan (2009-16) to cover all costs, including the pre-buy of data through to 2030, is under consideration which will free the community from the vagaries of funding and inflation after 2016. As Public-Private Partnerships go, there can be absolutely no slippage in the schedule because Iridium must have continuity in connectivity for its communications business.

The proposal meets all the priorities of the Space Studies Board² for Earth observation: contribution to the most important scientific questions; societal benefits (application and policy); contribution to long-term observational record; how it complements other observational systems; degree of readiness (technical, resources, people); affordability (the mission and annual support); risk mitigation and strategic redundancy; cross-cutting other themes.

However, to reinforce comments made at the PSC briefing on satellites in November 2006⁵, the UK is in a very strong position to tender for space

contracts. The Iridium and Earth observation hardware business alone is >£1B for the build of satellites and sensors and the 12 launches. In addition to this is the delivery of the second level ground segment in terms of data retrieval, calibration, quality control and dissemination.

The Government has a key role to play in the support of not only the UK space industry, where it may provide the mainstay of a national space focus at the top level of government⁵, but also the science community, in the provision of data for the development of climate models in which the UK is a world leader through the efforts of NERC and Met Office scientists. The development of business around value added products for the maritime and

service industries should be encouraged. Then there is the kudos of taking a lead on the international stage. With the benefits comes the responsibility of Government to commit to the opportunity on a timescale consistent with deployment of the commercial venture (Figure 1).

Moreover, there is a higher purpose for the support of this programme. Unlike the “one giant leap for mankind” that was motivated by the Cold War, the objective here is to bring to fruition a vision that really will touch all of mankind – every man, woman and child on the planet – in being proactive to the effects of global climate change, with an outreach that transcends geo-political boundaries. “These are extraordinary times. And

we face an extraordinary challenge.” – Kennedy’s words from the address that announced the Apollo programme⁶. These too are extraordinary times and this is a unique chance to meet the challenges of global climate change.

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- ⁵ C. Paynter & M. Sweeting, (2007), “Satellites for Science, Engineering, Technology and Business”, Science in Parliament, 64, (1), Spring 2007, 20-23
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“A cross-disciplinary think tank, very cool!”

The Royal Academy of Engineering, The Engineering and Physical Sciences Research Council, The Institution of Engineering and Technology and The British Computer Society co-hosted a ground-breaking forum in July for some of the UK’s most exciting engineers to network with documentary film-makers at the BRITDOC 07 festival in Oxford. The idea was to introduce those at the cutting edge of shaping society to those with the ‘power’ to engage society so they could exchange ideas.

Bringing together 15 of the UK’s leading innovators with 16 film-makers, this year’s *Would like to Meet the Innovators (WLTM)* provided a rare opportunity for film-makers and innovators to share their experiences of working in two creative, yet radically different, industries. Adopting a “speed dating” format, the sessions enabled each innovator to spend five minutes with every film-maker, to offer an insight into their research or design work, hopefully paving the way for future



“Innovators might think we want to make films ABOUT them, WITH THEM would be a better mind-set,” said one film-maker after the event.

collaborations. From nanotechnology to climate change, the discussions were designed to act as a catalyst for future documentaries between film-maker and innovator.

Christo Hird, Managing Director and Executive Producer at Fulcrum TV and

Chair of WLTM, says “WLTM is an essential, effective and entertaining way for film-makers to meet those with great stories to tell. Every specialist with a passion believes there is a documentary in it; every film-maker wants to find the subject that no-one else has spotted. But today it is

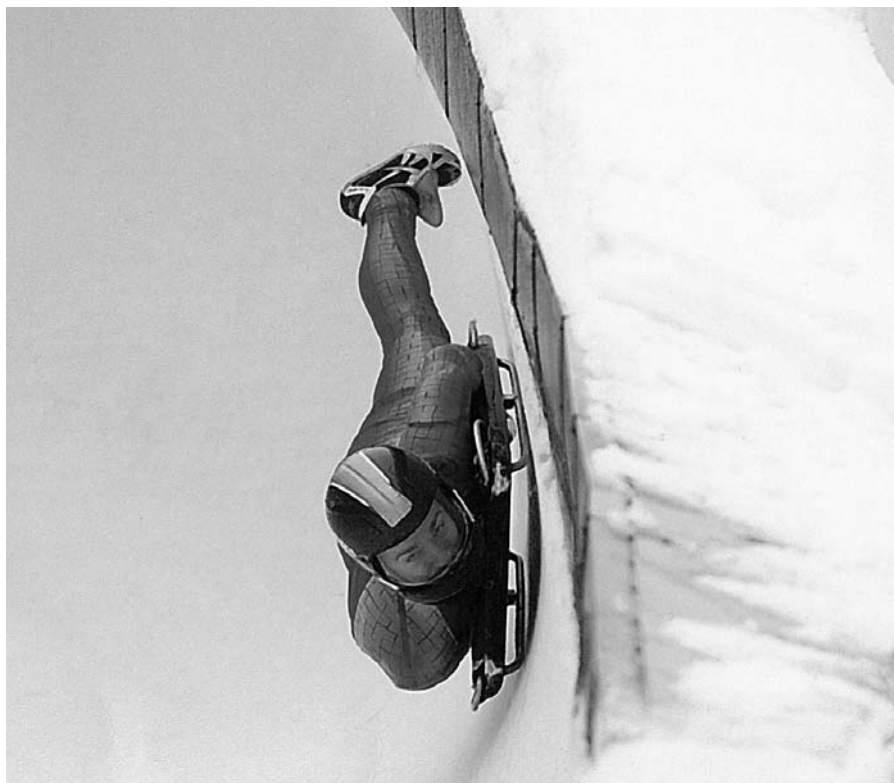
harder and harder for these two parts of the documentary-making process to meet. WLTM is a fast way for specialists to meet lots of different film-makers. People understand how they can collaborate. No time is wasted but valuable contacts are made."

Overwhelmingly, film-makers' perceptions of innovators (and engineering) were changed positively. Many of them felt they had realised for the first time the broad scope of engineering and how fascinating it was as a subject. Over half the film-makers said the session would change the way they worked with innovators in the future; they will be more likely to go to them for inspiration and ideas rather than as an afterthought as a comment or 'talking head' in a documentary. There is potential to work more on this area in the future, in terms of setting up a bespoke, mediated brain-storm with interested film-makers and innovators. Several innovators said afterwards that they would like to be sounding boards for programmes and ideas at an early stage, not necessarily with a view to being involved in the production process itself.

Speed is king

Edinburgh University PhD student Iain Roberts is passionate about applying engineering principles to improve his understanding of his sport – skeleton bobsleigh. His PhD is on the mechanics of skeleton bobsleigh and ice friction. It involves F1 style instrumentation and data-logging to measure sled performance and ultimately build a new tailored sled.

Protected only by a lycra body suit, skeleton bobsleigh involves sliding head-first down an ice track at up to 85 miles an hour on a sled steered by the slider shifting their weight. "It all depends on weight transference and actual bending of the sled. The better you understand how the sled interacts with the ice and how your movements transfer through the sled to the track, the better you can perform," says Iain. He started sliding three years ago and competes at an international level. "Medals are won and lost by 0.01 seconds, a sled tailored to the individual could be the advantage that wins a gold medal." Iain's plan is to build up track knowledge and advance the sled design, aiming for success at



Skeleton bobsleigh designer/Olympic hopeful Iain Roberts was among the engineers meeting film-makers at BritDoc 07.

the 2010 Winter Olympics in Vancouver.

Life in the canopy

Dr Graham Dorrington's research bridges aeronautical engineering and biological sciences, allowing him to study one of the most fascinating but inaccessible places on the planet – the tropical rainforest canopy. Graham, based at Queen Mary, University of London, hopes to design, manufacture and fly a new type of airship (dirigible) over the northern Amazon. This will not only capture the outstanding natural beauty of the canopy but enable him to discover new species of insects, arboreal fungi and possibly even new trees.

Given the rate of tropical forest destruction, Graham's research is not only timely but of paramount importance. He has worked with the late Survival Anglia cinematographer, Dieter Plage, and has already been the protagonist in a film called 'The White Diamond' directed by Werner Herzog (2004). The airship used in this film proved to be a good, stable filming platform, but was technically limited. Graham's new airship will be more capable although there are still many engineering challenges to tackle.

Bubble, bubble

Dr Eleanor Stride is RAEng/EPSRC Research Fellow and Lecturer in Ultrasonics at University College London. She works on ultrasound imaging, at the interface between engineering and medicine, developing miniature diagnostic tools (in the form of tiny bubbles injected into the blood stream) for cancer, heart problems and arthritis.

The microbubbles are first coated with a substance to form a "shell" which acts as a contrast agent to provide strong ultrasound echoes and give much better images. The flow of blood, containing these coated bubbles, can be traced throughout the body and anomalies, such as cancer or poor functioning of the heart, can be observed. The microbubbles can be used for targeted drug delivery and gene therapy by incorporating drugs or DNA. The bubbles can be tracked through the body using low intensity ultrasound and then destroyed with high intensity ultrasound to release the drug in a specific region, for example at the site of a tumour. By localising the treatment in this way, the harmful side effects associated with many forms of chemotherapy can be greatly reduced – dramatically improving patients' lives.

Toppling the ivory towers - why university science is central to all our lives

Sir Richard Sykes, Rector, Imperial College London



Can you imagine a world without penicillin, the world's most widely used antibiotic? If it were not for British universities, we may still be trying to get along without the drug that has saved millions of lives.

It was in a laboratory at St Mary's Hospital Medical School, now part of Imperial College London, that the brilliant but notoriously chaotic researcher Sir Alexander Fleming spotted signs of anti-bacterial activity in mould-covered culture dishes. His discovery was later developed by a team at Oxford University under Sir Howard Florey and Sir Ernst Chain and mass produced in the USA just in time to save many lives during World War II. Penicillin, in its various forms, continues to be vital to the treatment of life-threatening conditions such as meningitis, pneumonia and septicaemia.

Penicillin's serendipitous discovery is one of the celebrated stories of science, but it also highlights the fundamental role that universities play in pushing forward the breakthroughs that save and improve countless lives. The strength of university science is that we can carry out the speculative, blue-skies research that underpins the inventions and innovations that the world relies on.

Now more than ever, the UK needs its universities. Economically and technologically, global competition grows increasingly fierce. Asia and China are investing with mounting determination in their science base,

and the USA continues to make it an urgent priority.

Universities have always been the knowledge-base of the UK, the powerhouses of its economy. My own institution, Imperial College London, was founded one hundred years ago for precisely that role - to carry out the research and educate the students critical to maintaining British industry's world standing. Our Centenary celebrations have been characterised by a buoyant sense of optimism that the impressive achievements of the past will be matched and exceeded over the next one hundred years.

The twenty-first century will confront the world with some of its greatest ever tests, which scientists, engineers and medics will be critical to overcoming. Tackling climate change and mitigating its consequences, sourcing sustainable energies, and containing potential pandemics – these are issues that affect us all. It is notable that what these major challenges have in common is that they cannot be solved by scientists of a single discipline alone. It will take an array of tools and techniques to tackle them – and that is where the unique capability of our universities lies.

Business and industry simply cannot build up the kind of intensive research hub that is comparable to a top university. Imperial has at its fingertips world class authorities in a wide range of disciplines, all working side by side. Engineers, computer scientists and clinicians collaborate to create the

technology that allows us to see deep into our bodies and observe why they go wrong; scientists of many expertises join together to develop new low-polluting fuels and find innovative responses to growing concerns such as national security.

Amongst our academics there is a great and growing passion for entrepreneurship, to see their exciting ideas and developments move out of the lab and into society where they can make a concrete difference. It is here that the backing of our industrial collaborators is vital. Universities are packed with experimenters and thinkers, but we do not have, for example, the vast experience of taking new therapies on the long and difficult journey to licence that a pharmaceutical company has. Imperial is fortunate to receive a great deal of support from its commercial partners, and this approach has paid dividends for us, for them and for the country as a whole.

An illustration of what can be achieved when universities, industry and government work together is the £50 million Clinical Imaging Centre recently opened at Imperial's Hammersmith Hospital campus. The product of a partnership between Imperial, GlaxoSmithKline and the Medical Research Council, the Centre uses state of the art technology to observe how diseases such as cancer develop and how the body responds to the drugs provided to target them. It will undoubtedly lead to better and earlier therapies, offering the prospect of significantly improved outcomes to

many patients. The diagnostic tools Hugh Laurie calls on the TV series *House* may look impressive, but they are lagging far behind what we will be able to do here. None of the partners could have accomplished this alone and it represents an ideal model for future collaborations.

Vital, too, is the generosity of the new philanthropists – active donors who, like our Victorian founders, wish to see their wealth do good. Pre-eminent amongst these are Jeremy and Hannelore Grantham, who earlier this year provided £12 million for the establishment of an Institute for Climate Change at Imperial. Personal wealth and a sense of global responsibility do not always go hand in hand, but when they do the difference it can make is enormous.

So in many ways the future for UK science is bright. International competition is tough, but while the importance of research is recognised at the highest levels of politics and industry, we will maintain our edge. The UK Government's attitude and actions over the last decade have

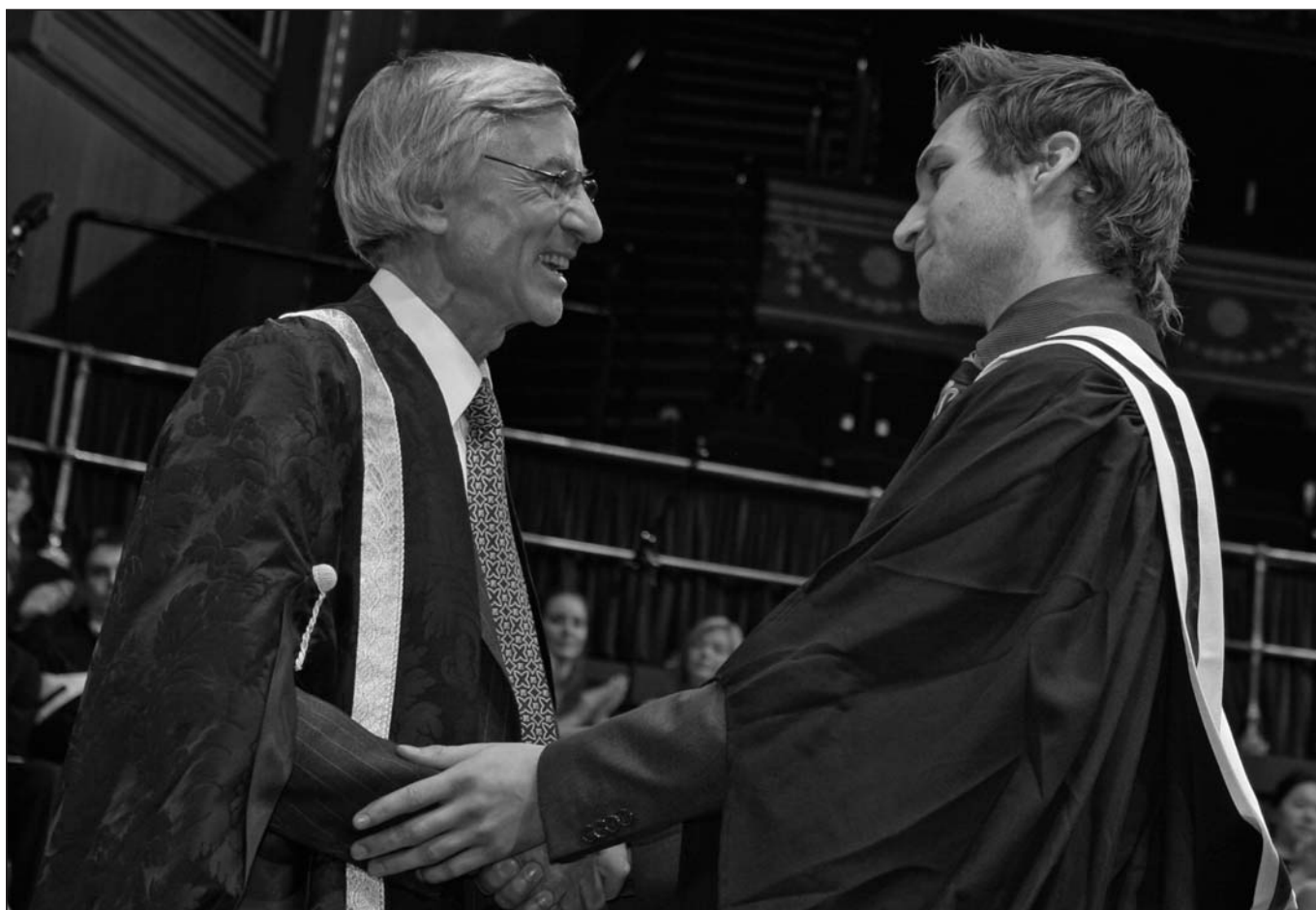
created a very supportive environment for research. Today's scientists can be confident that their vital work will continue to make a difference in the world.

But what about the scientists of tomorrow? The world grows ever more reliant on technology, and we will fall behind quickly if we do not nurture the scientific interests and abilities of the next generation. It is here that my optimism begins to falter.

The Government is clearly aware that the diminishing number of young people studying science post 16 poses a problem that must be urgently addressed. However one of the proposed solutions – a new GCSE offering bite-sized chunks of topical science rather than a good understanding of the different disciplines – introduces more difficulties than it overcomes. Degree level science demands a thorough grounding in the fundamentals, and it would be reckless of universities to admit students without this onto their courses. I do not believe that the new 'twenty first century science' GCSE will

stop the number of young people abandoning science as soon as they have the opportunity.

So at the beginning of its second century, Imperial faces some difficult choices. It is a UK university, established to support British technology and industry, and it remains true to that founding mission. But it is also an academic institution dedicated to providing a top quality education for those who will truly benefit from it, the world's brightest and best young people, regardless of background or nationality. Increasingly, those with a drive for science and the education to back it up are coming from outside the UK – over 40 per cent of the students Imperial now teaches are not UK citizens. Some will stay here, but many more will return to their home countries, which will be immeasurably enriched by the abilities that a UK education has nurtured. If we do not replicate this dedication to science amongst young people here, we will waste talents and squander opportunities, and the result will be a poorer society for all.



Graduation day success for Imperial students, but where will the UK's future scientists be found?

More than Samba : UK and Brazil as Partners in Science

Damian Popolo, Vice-Consul Science and Innovation, Sao Paulo

The story of UK-Brazilian formal collaboration in Science goes back to 1997, when the two countries signed a Memorandum of Understanding on Science and Technology. Since then, the relationship has been growing from strength to strength. The visit to Brazil by Sir David King in June 2005 and the identification of Brazil as a target for co-ordinated UK focus by the Global Science and Innovation Forum's strategy in 2006 are signals of the UK's renewed recognition of the importance of working with Brazil.

During the State Visit to the UK by President Lula in March 2006, the UK and Brazil established a Joint Action Plan in Science, Technology and Innovation. The purpose is to drive UK/Brazil R&D relationships to a new level. The initiative included a "UK-Brazil Year of Science & Innovation", which Sir David King formally launched in March 2007.

As of September 2007 the Year of Science has achieved notable success. A total of five Memoranda of Understanding have been signed between key stakeholders in Brazil and the UK involving the fields of space technology, agricultural sciences, chemistry and synchrotron technology. Meanwhile, the Brazilian Agricultural Sciences Research Agency (EMBRAPA, acronym in Portuguese) is considering setting up a laboratory at the Norwich Research Park. The UK Research Councils have proposed a major funding agreement to Brazilian research funding organisations: this would enable joint research projects to be funded by both countries on the basis of a common peer review system. Finally, collaborations in the areas of bioenergy, organic electronics and

fusion research are being designed and implemented with the full support of the UK Research Councils. All of this was possible thanks to a £300k OSI-FCO funded program that enabled key UK researchers to showcase their activities to a wide audience of scientists in Brazil. That is the essence of the UK-Brazil Year of Science and Innovation.

One of the main objectives of the Year is to showcase the most innovative research coming out of the UK science base in recent years, and to foster collaboration between relevant academic communities on those bases. The themes for the Year are akin to the areas identified in the Joint Action Plan. The Year is being implemented by the Foreign and Commonwealth Office's Science and Innovation Network and DIUS' Government Office for Science, with the active collaboration of the UK Research Councils and the Brazilian Federal Government. The project's website – which records over 400 unique hits per month – contains all the details of the project: www.anodaciencia.com.br

The Brazilian Science Base

Brazil has one of the strongest science bases outside the OECD. Among developing countries, its scientists contribute more of the most-cited research papers than any other country except China and India. According to statistics regarding 10-year country rankings for papers and citations, Brazil occupies the 15th and 23rd positions respectively, and the trends indicate that the sector is expanding rapidly. For example, the number of science PhDs granted has grown by an average of 12% per year over the last decade.

Brazil is currently producing over 10,000 PhDs per annum. This increase has been exponential since approximately 1993, and does not seem to have been affected by strong variations that occurred in Brazilian Science and Technology budgets since 2000. The increased share in the percentage of world publications indicates that Brazil is not only producing more science and more scientists, but that such scientists are producing better science too.

Brazil is producing PhDs in sectors that are in crisis in the UK. The UK is experiencing a well-documented health of disciplines problem in key sectors involving science and engineering. For example, the UK produced 230 PhDs and 910 MAs in Agricultural Sciences in 2005/6. The 2001/2002 figures for Brazil stand at 4,027 PhDs and 5,504 MAs. In the case of Engineering and Technology, the UK 2006 figures stand at 2,205 for PhDs. Brazilian 2002 figures (that is, conservative figures) stand at 5,928. In some disciplines Brazil is producing comparatively more PhDs than much larger and expanding science bases, including India and China.

Agricultural sciences – which play a crucial role in bioenergy and biofuel research, for example – represent but one instance.

The UK is a partner of choice for Brazilian researchers when it comes to selecting collaborators for international publications. Indeed, 12.8% of all Brazilian-based publications involving international co-authors are done with UK researchers. This puts the UK third after the US and France (39% and 13.8% respectively).

The Elephant Management Dilemma

Dr Ian John Whyte

*Research Manager Large Herbivores,
Kruger National Park, South Africa*



Elephants can contribute significantly to the maintenance of biodiversity in African savannas. Such contributions include the following:

- They are important dispersers of some plant species' seeds, and in some cases passage through an elephant's gut may even facilitate germination.
- In the late dry season some trees sprout new leaves before the arrival of the first rains. Elephants sometimes push such trees over making these nutritious leaves available to lesser browsers who otherwise may be experiencing severe food shortages.
- Trees killed by debarking become available to invertebrates such as wood borers and termites which themselves serve as major food resources for reptiles, birds and other insects.
- Trees felled by elephants are important refuges for many invertebrates, reptiles and small mammals.
- Elephants dig for water in dry river beds making this important resource available to other species that would otherwise not be able to survive in such arid environments.
- Elephants open up woody habitats facilitating species that favour more open habitats

In the absence of elephants, such benefits are lost. Biodiversity is suppressed as habitats tend towards thicker woodlands, and grassland species are compromised. The presence of elephants is therefore important in African savannas. As elephant numbers and densities increase from very low levels, many species benefit, and at intermediate densities, biodiversity benefits most. But as elephant densities increase further, they tend to over-utilise certain favoured food plants, and eventually biodiversity is also compromised as woodlands are gradually converted to grasslands and the survival of woodland species is increasingly compromised.

The fundamental question facing managers of free ranging elephants is therefore a simple one, but not an easy one. Should protected areas be managed for elephants or for biodiversity?

Elephants are social animals and they live in societies made up of permanent families which in turn make up larger social entities known as "clans". Female elephants never leave their mothers as long as both are still alive, but young males leave their natal families at puberty (about 14 years of age). Elephant families therefore consist of an older female (the matriarch) and her daughters and their respective offspring. These bonds are life long, and management practices which disrupt such families are considered very inhumane.

What are the available management options?

Translocation

Translocation, when families can be moved intact, is considered a humane option. It is very expensive, but usually funding can be accessed through willing NGOs. The far greater problem is that markets are now saturated and new destinations are extremely limited. Private and public protected areas which received translocated elephants are already experiencing elephant-related problems and nobody wants excess elephants.

The newly created Limpopo National Park adjacent to Kruger National Park (KNP) in Mozambique was considered a major opportunity for translocation of considerable numbers of elephants. This Park is about 4,000 miles² in extent but still has about 22,000 people living in it, and the Mozambique government does not yet want elephants for fears of escalating human elephant conflict.

Contraception

Though many different contraception techniques exist, only two have been tested in the wild. The first one used hormones (oestrogens) to regulate breeding. This method was quickly terminated as the metabolised

oestrogen passed in the urine signalled to males that the females were in oestrus when in fact they were not. This led to disruption of families and greatly elevated mortality rates in the small calves.

The second technique uses a vaccine known as the Porcine Zona Pelucida (pZP) vaccine. This is a far more humane technique as there are no influences on behaviour. The vaccine is made from the follicular fluid extracted from the ovaries of pigs harvested at commercial abattoirs. Antibodies produced in response to proteins in the vaccine attach to the ova released during oestrus. These prevent penetration of the ovum by sperm and thus also conception. The vaccine is generally considered a humane one, but there are some financial and logistical constraints in large populations, and also some ethical questions which still require some debate.

Financial and logistical constraints

This vaccine can be delivered remotely by dart syringe from a helicopter which facilitates its use in wild populations. However, a single vaccination does not raise antibodies to a level which achieves a contraceptive effect. Two boosters are required at three week intervals after the initial inoculations. Thereafter, annual or at least bi-annual boosters are required to maintain contraceptive levels. This considerably elevates both financial and logistical considerations.

It has been shown from computer models that to achieve stabilization of an elephant population, 75% of breeding females must be under treatment. In a natural population this gives a rule of thumb proportion of 40% of the total population. The current elephant population in the KNP is 12,500 which means that about 5,000 adult females would need to be included in the above vaccination regime. Logistically and financially this becomes almost unachievable. Larger populations such as those in Botswana and Zimbabwe could not be managed in this way.

An elephant population can not be reduced over the short term through contraception. To achieve any reduction would require that almost all breeding females must be treated and natural mortalities would then gradually lower the population. Elephants can achieve an age of around 60 years, and natural mortality rates are very low. Meaningful reduction of the population would thus take many years to achieve.

Ethical considerations

As has been described, elephants live in large pyramidal families with the matriarch at the apex, and the younger calves forming the broad base. In between there are many young females which provide care and supervision of the calves and there are many opportunities for learning and play. This structure is the social basis of elephant life. Over time, contraception would alter a family's structure to a more upright, linear one which would still have a matriarch, but the lower ranks would be considerably reduced. How would this altered family structure affect elephants' social lives?

pZP contraception prevents conceptions, and elephant females who fail to conceive will return to breeding condition (oestrus) in 15 weeks. While under treatment, this recycling will continue. Elephant reproductive organs were not evolved to cope with this and captive elephants have shown that constant recycling can lead to development of pathologies of the genital tract.

Range expansion

Range expansion is a desirable outcome from an ecological perspective – bigger is better. These days however, there is little land unoccupied in Africa that can still be designated to conservation. Elephants' requirements, particularly access to water, compete with those of humans. Range expansion for elephants would require removal of people from suitable areas. This would rarely be possible in present-day Africa. Limpopo National Park is currently facing these problems.

These problems apply also to the establishment of corridors which could connect other protected areas for the creation of meta-populations. Such meta-populations have been proposed as a possible management option for elephants in which elephants could move freely between populations, and mortalities in one population would be offset by immigration along such corridors. Most managers consider this to be an unlikely and unfeasible option.

Culling

Culling is a fourth option that has been shown to be effective in the KNP, but is it ethically acceptable? Many people find culling abhorrent as elephants are considered by some to be sentient animals because of their strong sense of family, and they show an awareness of death, and compassion for other elephants. Do humans have the right to kill such animals? But the converse also needs consideration – is it ethical to do nothing about rising elephant numbers and impacts, and allow the losses of other species when it is within our means to prevent it?

Herein lies the dilemma. To manage for elephants requires no further consideration of management options. But this decision will not be an easy one as losses of species will undoubtedly occur from the protected area over time. The acceptance of these losses will tax the consciences of managers!

On the other hand, to manage for biodiversity objectives will require limiting the elephant population in some way. To manage for biodiversity will equally tax the consciences of managers as they will have to consider management options which may be unpleasant, even abhorrent to some!

There is no middle of the road option which will cater for both an unlimited elephant population and for the maintenance of biodiversity.

The Elephant Conundrum

Population control : Inaction leads to disaster

W R Allen

*Jim Joel Professor of Equine Reproduction,
University of Cambridge Equine Fertility Unit*



As observed by Dr Richard Laws FRS, noted population biologist, in 1988, “animal populations within the boundaries of the sanctified ghettos called Game Parks tend to increase up to, and then beyond, the limits of food supply. In this context, the elephant is second only to man in its capacity to inflict long-term irreversible damage on its environment”.

Within the six nations that comprise Southern Africa, Zimbabwe and Botswana have elephant populations of 150,000 and 100,000 respectively. In Hwange Park alone in north-west Zimbabwe, the population exceeds 50,000 to give an elephant density of $>3/\text{km}^2$, the widely accepted norm being $0.5/\text{km}^2$. Tremendous habitat damage is plainly visible throughout the park, especially around the 64 artificial water points installed in the

1920s and still filled today by 80-year-old breakdown-prone Paxman diesel engines. Unusually large numbers of elephant congregate around the increasingly fouled water holes in the dry period with consequent stress on the females and their youngsters in the daily trek between edible forage and drinkable water.

Of the 5 potential passive management options for the elephant, no action will result in an anticipated population explosion to $>500,000$ animals in the six Southern African nations by 2020, extensive fencing may contain elephants within protected areas but not effectively exclude them from crops and communal land farms, and optimistic range expansion in the region, as well as requiring considerable benefits for communal farmers, would house a maximum of 75,000 elephants, only

one third of the anticipated increase over the next 12 years. Amongst the active management options, translocation is very stressful and is logistically and financially prohibitive. Furthermore, all the small Southern Africa parks are now full of elephant.

Contraception, by means of immunisation against zona pellucida protein (PZP), is feasible in small parks with individually recognisable populations of elephants, but is totally impracticable in the larger parks where the need is rapidly to reduce, not just simply contain, an already gross overpopulation situation. It also has the potential to cause major disturbances in family structures and behaviour patterns.

Large scale professional culling, as carried out in Hwange Park in the 1980s, or regular cropping as practiced annually in Kruger National



Six months to die



Elephant damage

Park in South Africa until 1994, is the only viable and practical option effectively to reduce large elephant populations. It is efficient and humane, it has great utility potential in terms of meat, skins and ivory to produce food and local income, it

preserves the habitat and it forestalls the great suffering and waste associated with drought-driven “die-offs”. The cessation of culling in Zimbabwe in 1989, and South Africa in 1994, and the failure to activate a planned large-scale culling operation in Botswana in 1991, have led to the frightening overpopulation problems these three countries face today. The dreadful disaster that struck Tsavo Park in Kenya in the early 1970s when over 30,000 overcrowded elephants and countless thousands of rhino tortuously starved to death from overpopulation and mismanagement by foreign interests, and simultaneously

caused the desertification of 8,000 square miles of former Commiphora woodland, looms on the horizon once more.

If we wish to let elephants and other large mammals in Southern Africa live decently and safely, we simply must manage their populations properly and preserve their habitats. Hence, we must strive to convince the governments of these countries to disregard the well-meaning but anthropomorphic and ill-conceived clamour of the so-called animal protectionist movements, who argue against any sort of realistic intervention. In the long run, to cull is to be kind.

In discussion the following points were made:

Although the elephant population may need to be managed locally, there is no compelling evidence presented for the need for a general reduction in elephant numbers in the Kruger National Park. The loss of trees was attributed to the large elephant population, although trees continue to decline even at lower elephant densities which may suggest that some other factor is also involved. It has been shown that it is impossible to maintain a pristine habitat even when elephant are at a low density. There were no elephants in the Kruger National Park when it was declared a Game Reserve hence the change to the current situation is probably attributable to the initial introduction of elephants. Tsavo has shown a dramatic recovery of habitat which is attributed to 30,000 elephants being culled by poachers. The Amboseli Park habitat will not recover while elephants are still present. The Conservation Areas consist of separate isolated entities and cannot recover from the damage done by elephants. There is no possibility of maintaining a natural landscape in National Parks. If this is required then culling is essential and must be undertaken humanely. Different management strategies, including culling, will be required if game parks are to be able to recover biodiversity in the longer term. There is a parallel to be found with deer in the Scottish Highlands where there are no woodlands left in the areas occupied by deer in the wild.

This paper has been submitted in response to those delivered at the meeting

Elephant Survival Needs Good Science and Clear Thinking

Dr Keith Lindsay

Independent consulting conservation biologist, Oxford

Elephants face many challenges to survive and conservationists must make use of the best available knowledge. Two papers were presented, by Dr Whyte and Professor Allen, apparently to address this subject, but their arguments seemed instead to narrow in on one particular issue: is there any alternative to culling “surplus” animals? The answer in both papers, each in their own way and in combination, was that “elephants must be culled, and soon”. I was

disappointed that the speakers missed the opportunity for a balanced review of more important issues in elephant conservation, in particular the need to find innovative ways for elephants to co-exist with people in increasingly populated landscapes. In reality, the apparent problem of “too many elephants” is just part of this bigger picture of “not enough space” and solutions must support creative policies with good science, rather than alarmist rhetoric.

Dr Whyte’s paper was based on field experiences, reported with varying degrees of accuracy, and led the listener, via some interesting natural history, towards the ineluctable conclusion that elephants almost always cause unacceptable damage to habitats, their numbers must be controlled and the urgency precludes most methods apart from culling. Professor Allen’s paper was more direct, making much of the apparent suffering endured by elephants which

die during food shortage, dismissing alternative population control methods and, in the end, calling on British parliamentarians to lobby Africans to cull early and often. His presentation included quotes from Peter Beard, a New York fashion photographer turned amateur wildlife expert, and Norman Borlaug, an agriculturist instrumental in the Green Revolution, neither blessed with experience in the science or practice of conservation of wild ecosystems. Pithy sound-bites they may have been, but they added little to the advancement of knowledge.

Both papers did a disservice to their audience, by presenting opinions, however strongly held, as scientific truth. The fact is that there are no compelling reasons to drastically and urgently reduce elephant numbers, although their management certainly needs careful, site-specific attention. The science of elephant conservation has been most recently debated in South Africa, where the Government has led a highly consultative process, culminating in a Science Round Table, which sought advice from a wide range of scientific opinion – including Dr Whyte and myself. The findings of this group, reached by **full consensus**, have been summarised by Owen-Smith *et al* (2006). The main conclusions, which have implications for elephants everywhere in Africa, are:

1. There is **no** compelling evidence supporting the need for immediate, large-scale reduction of elephants in Kruger National Park.
2. In some protected areas, including Kruger, elephant population density, distribution and population structure **may** need to be managed **locally** to meet biodiversity and other targets.

The group concluded that there was no scientific basis to set the “carrying capacity” of Kruger for elephants at 7,000 in the 1960s, against which the current level of 13,000 should be judged. Perceived damage to trees was the original justification for the target, yet big trees declined even with numbers held very low for 30 years. To keep woodlands “pristine” would have required **extremely** low elephant densities, since the benchmark for the supposed ideal state of vegetation in Kruger was set in the early 1900s, when there were few if any elephants

following their Africa-wide extirpation by the ivory trade of the 1700-1800s. In addition, since elephants avoid areas of human settlement, the parts of Kruger that were occupied intensively by people – who were moved out to create the park – would have had few elephants for centuries.

Claims of ecological disasters elsewhere have been greatly exaggerated. Tsavo East National Park in Kenya has been portrayed, by Professor Allen among others, as the scene of a devastating population crash and habitat holocaust. Tsavo East is subject to periodic dry spells and, following elephant increases during the 1950-60s, there was a decline of some 20% during a severe drought in the mid-1970s (hardly a “crash”, since 80% survived), a change in vegetation from shrub thickets to open bushland and a shift in the wildlife community from woodland species towards grazers. The much steeper decline in the later 1970s and 1980s, attributed by, for example, Peter Beard to over-population, was actually due to fierce poaching by Somali bandits, fuelled by the late 20th century ivory rush. Much woody vegetation has now recovered, accompanied by returns of woodland wildlife species. Evidence from paleoecology shows alternating periods of woodland and grassland dominance over the past 1400 years (Gillson 2004), indicating that dynamic change is the rule, not a recent problem.

In Chobe National Park (Botswana) and Hwange NP (Zimbabwe), woodland changes are localised near water, either rivers in Botswana or artificial waterpoints in Hwange. Norwegian and African researchers recently concluded that, as in Kruger, these woodlands had expanded “unnaturally” during the ivory trade and are now being re-shaped by the returning elephants. Ironically, in a recent drought, managers in Hwange, who had been calling for reduction of elephant numbers, were bemoaning the natural deaths of elephants through food limitation.

Amboseli National Park, Kenya, (where I have been part of the 30-year elephant research programme) has experienced loss of its *Acacia* woodlands, but salinity was the main cause. Woodlands survived along swamp fringes and outside the park on different soils, where salinity is low

and elephants administered only the *coup de grace* to already diminished woodlands. Research cited by Dr Whyte on fenced exclosures (Western & Maitumo 2004) is misleading, since the experiments were located in the swamp margins, not the saline areas. In fact, the experiments show that the *Acacia* woodland change is rapidly reversible, and elephant impacts are entirely temporary. Historical records show that the *Acacia* woodlands were a recent development, dating from the early 1900s. Exactly the same effect of soil chemistry, rather than elephants, on *Acacia* death has been seen in Ngorongoro, Tanzania (Mills 2006).

In none of these supposed “disaster areas” has overall biodiversity actually suffered, despite claims by some authors. The parks are all parts of larger ecosystems, and impacts in all cases were localised and temporary.

In addition to the ecological arguments, the SA Science Round Table noted that the model guiding conservation has undergone a dramatic change in recent years – see reviews by Pickett *et al* (1997) for a general discussion and du Toit *et al* (2003) for its application in South Africa. Under this “paradigm shift”, the rigid Balance of Nature model has been replaced by the acceptance of heterogeneity in space and time. Intensive management is still appropriate in agricultural landscapes and those that have been deeply, fundamentally modified by human activity, such as most of Britain, but in ecosystems that retain significant functional elements at different trophic levels, it is better to identify and work with ecological processes, rather than imposing arbitrary stability with blanket “command-and-control” measures. The alternative, of suppressing change and homogenising habitats, makes ecosystems more vulnerable to loss of species and reduces biodiversity.

In Kruger, widespread provision of waterpoints is now seen as responsible for damaging effects on populations and habitats, by evening out animal distributions and spreading impacts. The new approach also encourages density-dependent wildlife population regulation, including food-limited mortality, and managers have abandoned the control of wildlife populations at fixed “carrying capacity”. Periodic droughts, as in

Hwange and Tsavo, have a further important role to play in the self-regulating mortality of juvenile and adult elephants. The Round Table saw this as a process to be encouraged, rather than prevented as advocated by Prof Allen.

“Adaptive management” or learning-through-doing, is now seen as the best way to find out what works in wild ecosystems, where future outcomes remain uncertain. Trying different approaches in different areas of elephant range, and accepting that results of ecological experiments take time, are important aspects of an experimental approach to discovering how to work with, rather than against, ecosystem processes. Landscape-level planning looking at the whole ecosystem, including corridors for

dispersal between protected areas, is an important means for encouraging population and habitat heterogeneity.

Finally, the Round Table recognised that social issues are important, but distinct from the scientific issues in elephant management. Ethical issues may be debated on their own merits, with sympathy for elephant intelligence and sociality, or intervention to “save” elephants from dying naturally, becoming an important talking point. Economic considerations are clearly necessary, and again, should be evaluated on their own terms. In summary, it is essential to distinguish the different strands of argument over elephant management, and to keep the question over whether or not to cull in its proper place as one, rather blunt, tool

hardly deserving the overblown argument that it all-too-often receives.

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IS DUAL FUNDING OF OUR UNIVERSITIES FIT FOR PURPOSE IN THE 21ST CENTURY? MEETING OF THE PARLIAMENTARY AND SCIENTIFIC COMMITTEE ON MONDAY 18TH JUNE

Is Dual Support funding of our universities fit for purpose in the 21st Century?

Rama Thirunamachandran

Director, Research and Knowledge Transfer, Higher Education Funding Council for England



The dual support funding arrangement for research is a well established cornerstone of research policy in the UK.

Traditionally dual support has been described in terms of the two major arms of public funding for university research – namely the Higher Education funding bodies which provide core funding to universities for permanent staffing and infrastructure

and the seven research councils which provide project and programme funding for specific areas or themes. Though there may not be many countries with explicit dual support arrangements akin to the UK it is nevertheless the case that most research rich countries have multiple streams of public funding. In most large research strong private universities in the USA very

substantial endowment income performs the functions of the HEFCE research grant (QR). In Western Europe funding from state governments provides the equivalent to QR. It is also important to recognise that almost half of the £3,800 million research income of English higher education in 2005/06 came from a range of other sources including charities, Government departments

and the NHS, business and overseas sources. This presentation focused on the HEFCE side of dual support.

HEFCE's QR funding provides for the 'well found laboratory' through a stable funding stream supporting staffing and infrastructure which in turn enables universities to seek project funding from a range of sources. QR also provides funding for institutions to undertake 'blue skies' research and respond quickly to new ideas. As such it is an important source for institutions to plan and shape their research strategies. QR plays a crucial role in the arts, humanities and social sciences where it provides for over 80% of total research income recognising that the research approaches and methods in these subjects are less amenable to 'project grants'. Otherwise arts and humanities scholars would simply be writing grant applications to recover their salary costs which would not be the most efficient use of intellectual talent.

QR is allocated to institutions as a block grant based on the outcomes of the most recent Research Assessment Exercise (RAE). The RAE, which was first run in 1986, is based on peer assessment of research across the full range of subjects and has a role both in informing the allocation of QR funding and in demonstrating the power of the national research base. RAEs have been held in 1989, 1992, 1996 and 2001 with the next RAE taking place in 2008.

There is ample evidence to demonstrate that the RAE has had a positive effect on UK research by driving up research quality. Evidence Ltd, an independent consultancy, have

published data to show that the UK share of world citations had declined in the first half of the 1980s reaching the lowest point of 5% in 1989. The data also show a steady increase in the UK's share of the world citations with each RAE cycle reaching the current high level of 12%. Equally significantly the RAE has also driven institutions to take a more strategic approach to managing their research and better utilisation of infrastructure.

The review of the RAE by the late Sir Gareth Roberts in 2003 led to a number of changes to the RAE including the introduction of a 'quality profile' and better approaches to assessing applied, practice-based and interdisciplinary research and joint submissions between institutions.

However, it is undoubtedly true that, 20 years on, the RAE has created some less desirable behaviour in the HE system including influencing institutional missions to the possible detriment of teaching and other activities. Though the administrative costs, in relation to the grant allocated using the outcome, are considerably lower than the costs of the research council operations, the burden on the system as a whole has increased due to what many call 'games playing'.

There is therefore now a growing consensus that the RAE in its current form has run its course and it is time for change to a new approach, at least in the sciences, which, whilst reducing the burden, continues to recognise excellent research and to enable QR to be allocated on this basis wherever excellence may be found. Following consultation, the December 2006 pre-budget report announced a new approach to replace the RAE after

2008. Any new approach will need to be both robust and transparent; to have 'buy-in' from the sector; and to continue to provide well founded quality indicators for both funding and benchmarking purposes. In the sciences the assessment and funding system will be based on bibliometric indicators of quality, research income and postgraduate student data. Some seven large subject groupings are envisaged in the place of 26 subject units of assessment in the current RAE. Expert panels will continue to play an advisory role so that subject specific differences in data are properly understood and applied. In the arts, humanities, and social sciences and in mathematics a light touch peer based system will need to continue given the immaturity of bibliometrics in these subjects.

As the largest single source of funding for research, over the past five years HEFCE has been engaging in policy development across a range of research related issues: bringing on and supporting the next generation of researchers; supporting the development of a sustainable research base; building research capacity and capability in certain subjects; promoting research collaboration; improving infrastructure and knowledge transfer. The remainder of this presentation highlights some aspects of this work.

An explicit element in our QR is support for the training and development of postgraduate research (PGR) students. In recognition of concern about the variability in the quality and standards of postgraduate research training in the sector we have worked with the HE sector, the research councils and the Quality

Assurance Agency to introduce minimum threshold standards which are now a condition of our PGR grant. I believe that this, together with HEFCE's plans to publish research student completion rates, will have a positive impact on the research student experience.

At the next level many postdoctoral and other researchers are funded by project grants and employed on short term contracts. We are working closely with the research councils and other funders to develop a new research careers concordat which will be in line with the European Charter for Researchers. Research is fundamentally about people and knowledge and HEFCE remains committed to ensuring that the UK is well placed to produce the next generation of researchers.

We recognise that there are a number of disciplines which are not yet well

established in research terms. This has led to HEFCE providing specific research capability funding in the following subjects: art and design; drama, dance and performing arts; communication, cultural and media studies; social work; nursing; other studies and professions allied to medicine; and sports-related studies. Even in well established areas there are specific sub-disciplines where our research capacity may be low. In recognition of this, we are working in partnership with the research councils to support research in specific areas of national priority. For example, with the AHRC and ESRC we are providing funding to support area studies and related languages in Chinese, Japanese, Middle Eastern/Arabic and Eastern European Studies.

Public funding for research will always be limited. Very few institutions are

able to conduct cutting edge research across the full range of disciplines. Therefore collaboration between institutions and subjects will become increasingly important as we drive to maintain a world class research base which is also financially sustainable. We consider that collaboration works best where it emerges from within institutions and departments rather than from external pressure, and are happy to consider proposals for our support for strategic research collaboration on this basis.

Ultimately, HEFCE wishes to see its policies and funding lead to not just the creation but also the dissemination of knowledge. HEFCE/OSI's Higher Education Innovation Fund is central in promoting the dissemination of knowledge or knowledge transfer which is central to wider economic and social benefits.

IS DUAL FUNDING OF OUR UNIVERSITIES FIT FOR PURPOSE IN THE 21ST CENTURY?

Is Dual Support Fit for Purpose in the 21st Century?

Sir Keith O'nions FRS

Director General of Science and Innovation

The UK's dual support system has broad counterparts in a number of other countries. These also separate core funding support from project based research. The question is not so much whether or not dual support is a good thing,

but more about how well-tuned it is to our current needs.

We should first consider just what a dual support system is trying to achieve. An essential requirement of the research base must be to deliver



world class research. The UK is demonstrably very successful in this regard – bibliometric analysis shows the UK is second only to the US overall in the output and impact of its research. A second key requirement is successful exploitation of the research base for economic benefits. This too is an area where the UK is performing well, and has been improving rapidly in recent years. Successful links between universities and business is a recognised part of this successful exploitation. Finally the research base should have the capacity and ability to address national priorities which are often cross-cutting and interdisciplinary in nature and include such topics as energy, climate change, ageing and security.

What is required in order that the UK research base meets these aspirations? It is vital that the system is sustainable in both financial and functional terms. We must be able to attract and retain the best people and train them with the skills required for a range of careers which are relevant to a globally competitive economy. Everything we do in this regard must be world-class.

To answer the question we must first consider the state of play in the following three areas:

1. Research excellence
2. Knowledge transfer and economic benefits
3. Sustainability

Research Excellence

The research base is overall in very good shape. In many areas (bioscience, health and medical science and social sciences) the UK is second only to the US, and leads the world in the most highly cited biomedical publications. However, there is no room for complacency – some parts of engineering and the physical sciences for example could be stronger.

Knowledge Transfer and Economic Benefits

It remains difficult to achieve an overall measure of the economic impact of research. The Worry Report, a review of knowledge transfer undertaken by Research Councils, and published last year, stated that “the output of highly educated people rather than research results is widely regarded as the most effective knowledge transfer mechanism”. This view is widely endorsed but is difficult to quantify fully. In those areas that are easy to quantify the UK is performing well. For example, the number of patents granted in the UK more than doubled between 1998/99 and 2003/04 and over the last three years some 25 university spin outs reaching IPO have a combined capitalisation of £1.5bn. When normalised to the research expenditure of US then the UK is seen to perform at least as well in patent generation, at a lower expenditure, with around half of the IP income of the USA.

Sustainability

Until the early 1990s Research Councils funded only a contribution to the direct costs of research projects. A contribution to indirect costs (of 46%) was introduced in 1992 and since 2005 Research Councils have, rather than identify a particular set of direct costs and a tariff to cover some part of the indirect costs, been paying a fixed proportion (set at 80%) of the full economic costs of research. An historic backlog of infrastructure investment in universities estimated at £10.6b in 2001 by JM Consulting has been very substantially reduced on the research side by the Investment Fund (SRIF) and is expected to reach a manageable level before the end of this decade.

Since 2002 Councils have also changed the way they fund some large capital projects that can be difficult for one Council alone to fund. This has led to the introduction of the Large Facilities Capital Fund, which currently stands at £110m pa and is supported by an agreed roadmap for large projects. The EU and US have also produced large facility roadmaps. This central fund enables long term investment in capital intensive projects, such as the Diamond synchrotron, which was recently completed and is the largest single science facility in the UK for 30 years.

The scope of Research Councils' support has also increased, with the creation of the Arts and Humanities Research Council. Finally, Research Councils have changed the way they work together through the creation of RCUK. This is a successful change that has been welcomed widely and helps Councils to address cross-disciplinary challenges such as climate change and ageing. RCUK also provides a single brand for international collaboration; this will be rolled out through RCUK offices opening in Washington and Beijing later this summer.

These changes have undoubtedly increased the effectiveness of the Dual Support system over time but we do need to consider what else is needed. The introduction of SRIF and FEC has made a significant contribution to sustainability but there may still be more to do. Anecdotal evidence suggests that the Higher Education Innovation Fund (HEIF) has prompted a real change in the way universities approach knowledge transfer. Not all funding sources currently consider the full economic cost of research. In order to maintain a diverse range of funding sources we should consider if we currently have appropriate incentives in place to encourage access to these sources.

IS DUAL FUNDING OF OUR UNIVERSITIES FIT FOR PURPOSE IN THE 21ST CENTURY?

Dr Peter Cotgreave

Campaign for Science & Engineering in the UK (CaSE)

In answering the question of whether the dual support system of funding university research is fit for purpose, the starting point must be that a dual support system of some kind is essential. Whatever defects the current system may have, nobody who has studied the issue would conclude that we should scrap the system and develop a wholly new one. But the current system has some serious flaws, and in the light of changed and changing circumstances, needs significant improvement.

In theory, the dual support system is easy to explain, but in practice, there is great confusion. The Research Council half is relatively simple. Researchers obtain grants for specific projects and the funds they receive pay for specific things that are detailed in advance. Over the years there have been changes to precisely what is included, and the current developments of a mechanism for identifying 'full economic costs' are a good example. But for any given Research Council grant, a researcher has always known to a high degree of precision what the money was for.

However, the Funding Council half of dual support has always been rather vaguer, and this can be illustrated by some quotations from official Government publications that purport to describe its purposes.

The White Paper, *Realising Our Potential* in 1993, which set up the system in its current form, had a very simple description of the Funding Council's allocations for research – "general funds available for use at the institutions' discretion". Seven years later in 2000, another White Paper on science, *Excellence and Opportunity*, had an even shorter definition – "infrastructure money".

The point about these is not just that they are rather different in detail, but that they take wholly different approaches. *Excellence and Opportunity* defined Funding Council support in terms of what the money was spent on – infrastructure, which might include

buildings, equipment or human resources. But *Realising Our Potential* used a definition based on the process by which spending decisions were taken. The key point was that power was explicitly devolved from the centre to the universities.

These are not the only different official definitions of the purposes of the Funding Councils' funding of research. The Treasury's *Cross-cutting review of science* in 2000 described it as providing "the capacity to undertake research, and in particular the flexibility to pursue 'blue skies' research and develop new areas of excellence". This is yet another completely different kind of definition, focused not on who decides how to spend the money or on what types of thing that might be bought, but on the expected outcomes of the research that is funded.

When the Treasury repeated its *Cross-cutting review of science* in 2002 it once again came up with a new description of the purposes of the Funding Councils' pot of research funding. It contains elements that had appeared in some of the earlier ones, but also has a fresh form of words about providing "the base from which academics can make credible proposals [to the Research Councils, charities, the European Union, industry and so on]". It differs in a significant way from some of the previous attempts at definition by saying that Funding Councils should pay for "the costs of training new researchers," when earlier versions had suggested that it should include only a contribution to these costs.

The Government's overall strategy for science published in 2002, *Investing in Innovation* had another, longer, definition, while in 2004, the *10-Year Science and Innovation Investment Framework* reverted to a short, simple one – "a foundation allowing university leaders to take strategic decisions about the research activities of their own institutions". This harks back to the original definition from 1993, and seemed to put the decision-



making power back into the hands of managers within institutions.

Anyone not already immersed in the system could be forgiven for being confused. Apart from anything else, few of the definitions included any reference to the fact that this funding pays the salaries of academic members of staff, but in reality that is what the vast majority of it is actually used for.

A composite list, trying to encapsulate the wide range of elements in the various descriptions would include:

- strategic investment in new areas
- 'blue skies' research
- training new researchers
- rapid reaction to changing circumstances
- a base to apply for other funding
- high risk, potentially high-reward research
- research that cannot be funded from elsewhere
- capacity-building
- infrastructure [including laboratories and libraries etc. but also the staff salaries that support human infrastructure]
- filling the shortfall on other sources of funding such as grants from Research Councils, charities, the European Union or industry

Although it would be possible to deal in detail with all of these things, the two at the top of the list are important for special reasons.

Strategic investment is crucially important in allowing universities to start new areas, and to develop their

research as exciting opportunities become available. To do this, research leaders need a modest financial surplus, after they have paid for all the essentials. Because of changes in the two funding streams of dual support, the freedom created by such a surplus no longer exists.

Over the last twenty years, the proportion of funding that comes through the two different streams of dual support has changed. The practical effect of these changes on the ground is that whereas in the mid-1980s, for every pound that the Research Councils were distributing, the universities were getting £1.27 from the Funding Councils towards the costs of all the things in the composite list of purposes for this funding stream. Now they get 64p.

In other words, after university managers have paid for the shortfall on Research Council grants, the costs of training new researchers, their basic infrastructure, library and salary costs, there is now little if anything left for investment in strategic future priorities.

'Blue skies' research suffers from the same problem, but its difficulties are exacerbated by the processes that have been invented for rationing funding. Over recent decades, the number of researchers expecting to share in public funding has grown faster than the availability of funds. The number

of academic institutions receiving cash from the Funding Councils (or their predecessor the University Grants Committee) has grown by almost four fold since 1970, and the number of academic staff has grown by a factor of at least 2.5. There has also been a massive growth in the number of postdoctoral researchers who are not classed as academic staff, so the total number of people doing university research has expanded by a very large multiple. Although funding has grown rapidly, it has not kept pace in the same way.

Because there are now so many more people eligible to receive public funding for university research, the system has had to invent mechanisms for rationing it in fair ways. Both halves of dual support have invented their own methods of doing this. The Research Councils have special themes and panels and ring-fenced pots for particular subjects. They even reached the point of issuing a document with a list of questions that UK researchers would "work to solve within the next few years" which ranged from "What is gravitation?" to "What does it mean to be a member of an expanding European Community?" This is a far cry from the words of the Council for Science Policy in 1966, said that the task of science policy was nothing more than "to maintain the environment necessary for scientific discovery".

On the Funding Council side of dual support, the mechanism for rationing funds is the Research Assessment Exercise, which a very senior scientist in the UK recently described as "immense timewasting".

As soon as these methods of rationing funds are introduced, it is inevitable that anything that does not fit with current themes and paradigms finds it almost impossible to get funded. And indeed, a recent report commissioned by the Higher Education Funding Council for England could find no evidence that its funding was "supporting research which has led to fundamental breakthroughs or radical changes in research areas".

So for many parts of the research system, the dual support system works well. Indicators such as citation rates show that the vast majority of research funded by the Research Councils and Funding Councils is excellent, judged against the international competition.

But some particular areas – including 'blue skies' research and strategic investment in new priorities – are much less well served by the current arrangements. So while the dual support system is fit for many of its current purposes, it is very far from perfect if the UK is to sustain the truly innovative and exciting science and engineering base it needs to thrive in the coming years and decades.

In discussion the following points were made:

The 'cliff face' drop down of QR money means that any department that does not get a five rating may as well fold up as far as 'blue skies' research is concerned.

Infrastructure money was transferred to Research Councils when new universities were created from polytechnics and never returned subsequently due to the fear that Vice Chancellors had too much freedom in the 1970s on how the infrastructure money was spent and they would direct funds away from scientific research. Has this situation been changed subsequently?

The £98 million recently transferred to bail out the Rover Car Company by the DTI from the MRC budget, that had been previously ring-fenced for clinical medical research training purposes, will not be restored although everyone regrets such adjustments. The Cooksey review will secure the MRC and NHS research funds in the future. Prospects for clinical research will not be starved. "It felt like a slap round the face with a wet kipper." The science community felt very badly treated as a result. All sources of funding need consideration together especially when the two halves of the dual support system contract simultaneously. Is there anyone who is taking a realistic overview of the whole situation?

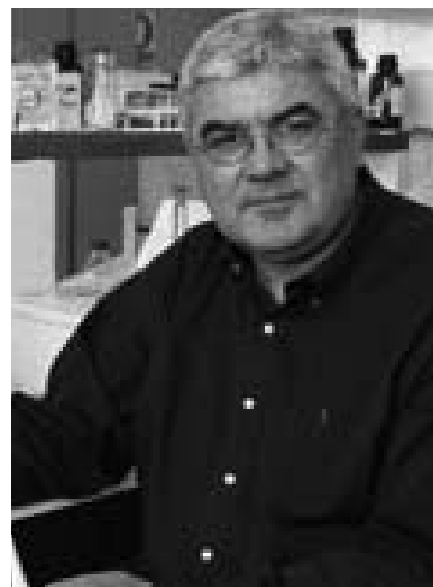
Deliberate obfuscation on the costs of what universities do with their money results in the closure of chemistry departments as there is no clear understanding of the financial commitments needed to keep them open. Chemistry department closure is a complex subject which is cyclical and could lead to catastrophic loss of infrastructure. 120 institutions have some, but not much, funding for QR and this funding is mainly absorbed by departments with a higher mark.

The system is working fairly well at the 90% level, however 80% of research funding goes to only 20 universities which leaves many universities very short of facilities for supporting research. Universities have to make everything add up as a whole including teaching. Innovative ways of increasing overall funding for universities from a wider range of sources are urgently needed.

Recommendations to increase the safety of first-in-human clinical trials following the TGN1412 clinical trial in 2006

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Background

In March 2006, a first-in-human clinical trial of a monoclonal antibody, TGN1412, took place in a private facility at Northwick Park Hospital in London. The clinical trial was suspended immediately when very serious adverse reactions occurred in all six of the healthy volunteer subjects. TGN1412 was being developed as a medicine to treat leukaemia and autoimmune diseases such as rheumatoid arthritis. Its target was a molecule that can activate T lymphocytes, key cells of the immune system. The rationale was that this stimulation by TGN1412 would improve the regulation of immunity.

In the clinical trial, all six healthy volunteers experienced life-threatening reactions soon after receiving TGN1412 by intravenous infusion. All six trial subjects required intensive treatment and supportive measures that were provided by the Intensive Therapy Unit at Northwick Park Hospital. Subsequent clinical investigation showed that the recipients of TGN1412 had experienced a large release of cytokines, small proteins that signal between cells of the immune system. The phrase 'cytokine storm' has been used to describe this life-threatening reaction.

Previously, first-in-man clinical trials had had a very good safety record, and the outcome of the TGN1412 trial, where all recipients experienced such severe and similar adverse reactions, was unprecedented.

The Expert Scientific Group

Following this, the Secretary of State for Health set up an Expert Scientific Group (ESG) to learn from these events and to make recommendations to increase the safety of future trials involving the first human exposures to new medicines that warrant special consideration because of their scientific innovation or the novelty of their pharmacological targets.

The ESG terms of reference and ways of working:

1. To consider what may be necessary in the transition from pre-clinical to first-in-human Phase I studies, and in the design of these trials, with specific reference to:

- biological molecules with novel mechanisms of action;
- new agents with a highly species-specific action;
- new drugs directed towards immune system targets.

2. To provide advice, in the form of a report, for the future authorisation of such trials with an interim report to be provided within three months

The ESG comprised 19 individuals including two lay members and specialists in clinical medicine, clinical pharmacology, toxicology, immunology, clinical trial design and ethics. The opinions and advice of stakeholders was sought and considered in detail before formulating interim recommendations that were published on July 26th 2006. Further written and verbal submissions from stakeholders, including four of the

trial subjects and their representatives, the Northwick Park physicians, patient groups, individuals, national and international public sector institutions, the biotechnology and pharmaceutical industries and contract research organisations were received after the interim report was published in the form of an open consultation document. These submissions were taken into account in formulating the final report with 22 recommendations published in December 2006.

Approach to the Problem

The need for better and safer medicines is clear, as is the fact that the first human exposure to a new medicine will always carry some risk, even if extremely small. The aim of the ESG was to optimise the safety of future first-in-human trials of the types of medicines within its remit without stifling innovation or raising unnecessary barriers to the development of useful new medicines.

The ESG reviewed the pre-clinical development of TGN1412, the results from MHRA investigations and the likely causes of the unpredicted severe toxicity at the dose given in the trial. Toxicity had not occurred in the cynomolgus monkey, the animal model chosen for studies to calculate the dose for the first human exposure to TGN1412. At a dose that was numerically 500 times larger than that given to human volunteers, cynomolgus monkeys did not experience any apparent adverse effects.

Results of independent scientific tests carried out by the National Institute

for Biological Standards and Control (NIBSC) to clarify the toxicity seen in the TGN1412 trial may provide some answers to scientific questions surrounding the adverse reactions in human recipients, and why similar reactions were not detected in pre-clinical testing in animals or in tests using human blood cells. The results of these NIBSC studies were summarised in the final report and will shortly be published in detail.

Risk reduction and risk management are the cornerstones of safe clinical trials. Understanding the potential risks in clinical trials of new agents or agents with new pharmacological targets cannot entirely be guided by previous experience, and such agents should receive special scientific consideration. The ESG focused on risk reduction and risk management.

Scope of the Recommendations

What kind of clinical trial?

The recommendations apply to first-in-human clinical trials, and not to Phase 1 Trials in general (which might include trials of agents with an established record of safety in humans). Special caution is needed during first human exposures to new medicines at doses likely to cause a pharmacological effect.

However, added caution is also needed when administering a medicine with the potential for risk to a distinct new population, be they healthy volunteers or patients, or of different age, gender, ethnicity or medical condition.

What kind of agent?

The remit covered three categories of medicines that may require special consideration before being given to humans for the first time: biologicals with novel mechanisms of action; new agents with a high degree of species-specificity; and new agents with immune system targets.

The recommendations were intended to apply to medicines or potential medicines in any one of these three categories, unless a careful assessment of the physiological role of the target molecules supports a low risk of harm in first human exposures. It was not suggested that any agent that falls into one of these categories necessarily poses a high risk on first human exposures, but that a clear and strong scientific case should be provided in support of an assessment that the risk of harm is extremely low.

For example a conventional vaccine, although aimed at stimulating an immune response, may not pose a high risk, or a new agent similar to

one with an established safety record in humans and aimed at a known target where the pharmacology can be predicted with confidence, may not require special consideration beyond the conventional careful approach to risk assessment and risk management that must be taken in all clinical trials.

When might special consideration be needed?

In the report factors were discussed that should raise the level of caution for first human exposures to new agents. No comprehensive list can be made but such factors might include:

- potential to cause severe physiological disturbance to vital body systems;
- agonistic or stimulatory actions;
- novel agents and novel mechanisms of action where there is no prior experience;
- species-specific action making pre-clinical risk-assessment difficult or impossible;
- pharmacological potency, eg compared with normal physiological processes;
- multifunctional agents, eg bivalent antibodies with FcR binding domains;
- cell-associated targets;
- targets that by-pass normal control mechanisms;
- immune system targets;
- targets in systems with the potential for large biological amplification in vivo.

A thorough assessment of risk should always be carried out before first-in-human trials. The risk assessment should be clearly described in the trial documents and be fully examined by the regulator.

Increasing the safety of future first-in-human clinical trials

The ESG made 22 recommendations that covered:

- pre-clinical and early clinical development;
- preparation and review of clinical trial applications, and early access to advice for both regulators and sponsors;
- determining and administering the initial doses in humans;
- the clinical environment and conduct of first-in-human studies;
- developing the skills and training to meet future needs.

There was a focus on sharing of information relevant to safety, the calculation and administration of first doses, the conduct of the clinical trial and regulatory access to independent specialist opinion in the appraisal of trial applications.

Stakeholders raised several areas of concern that were not within the ESG remit. These included topics such as the process of informed consent, insurance cover, the role of Research Ethics Committees, and clinical follow-up of trial subjects who had experienced an adverse reaction. Although beyond the ESG remit, these wider concerns are all extremely important, and it was recommended that they should be considered in detail by the appropriate agencies.

The recommendations have been accepted in the UK, and the EU is in the process of developing very compatible new guidance for the design and conduct of first-in-human clinical trials of innovative agents where special consideration may be needed in risk assessment and risk management. New guidance along similar lines will also be available from The Association of the British Pharmaceutical Industry (ABPI). It is important that a similar approach is adopted at international level to ensure that equal protection is given to clinical trial participants worldwide.

Biological advances are providing an ever-increasing number of pharmacological targets for the development of new and better medicines that are vital for the public health. There is no single answer to the question of how to optimise the safety of first-in-human clinical trials. Each new potential medicine must be considered on a case-by-case basis by appropriately trained and experienced teams taking account of all the available information.

Summary

First-in-human Phase 1 studies are the gateway between scientific research and clinical practice, and we must ensure that such clinical trials are safe for the human subjects, whether healthy volunteers or patients, and efficient in gaining new knowledge.

The safety of clinical trial subjects must always be the primary concern. The ESG made 22 recommendations to increase the safety of first human exposures to new agents that require special consideration because of their novelty or intended pharmacological target. The recommendations, while aimed at increasing safety, should not unduly inhibit innovation.

The Expert Group on Phase One Clinical Trials: Final report is available free of charge on the DH web-site:

http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_063117 and can be purchased as a bound paper version (600 pages) from: TSO Publications Centre, PO Box 29, Norwich NR3 1GN. Tel: 0870 600 55 22 Fax: 0870 600 55 33

Clinical trials and the MRC Clinical Trials Unit

*Professor Janet Darbyshire
Director, Clinical Trials Unit, Medical Research Council
Professor of Epidemiology, Royal Free and University College
London Medical School*



Clinical trials are the foundation of evidence based medicine and underpin the evaluation of all new interventions which prevent or treat disease, such as vaccines or drugs. Once they have been shown to be safe and have activity in laboratory and animal experiments most interventions will go through a series of clinical trials which start by testing it in a small number of volunteers, usually healthy individuals but sometimes patients, to assess safety known as a Phase I trial. If there is no evidence of serious toxicity it will then be tested in a larger number of people with the disease (or normal people if it is a preventive intervention such as a vaccine) to assess both safety and activity, a Phase II trial. If the trial is successful then much larger trials referred to as Phase III, are undertaken to assess the benefits and risks of the treatment, and its role in clinical care.

Most of these trials are:

- randomised (that is treatment is allocated by a chance process) to avoid bias in the selection of treatment
- controlled, which means they compare the new treatment with the best current treatment to assess its role in clinical care

- and are often blinded by using a placebo, which is inert but indistinguishable from the new drug so that participants and their doctors do not know what treatment they are getting to avoid biases in the management of the participants and decisions about the outcome of the treatment.

The final stage is to set the results of a trial in the context of all other similar trials by bringing together the evidence in a systematic review or meta analysis to provide the most robust evidence base for decisions about the role of the new intervention.

In the MRC Clinical Trials Unit (CTU) our main focus is on clinically important questions which will not be of interest to Pharma as their primary purpose in setting up trials is to lead to licensure of a drug or vaccine.

These may include different approaches to using drugs in combination for cancer chemotherapy, the use of surgical procedures or other modalities of therapy or prevention such as radiotherapy or behavioural interventions. Our research programme is centred on a limited number of disease areas, primarily cancer and HIV, which are both major causes of morbidity and mortality. Benefits from new interventions may be greater efficacy, less toxicity or

improvement in quality of life – ideally all three.

Two recently completed trials in cancer demonstrate the importance of exploring different approaches to the treatment of cancer. The first, the MAGIC trial, showed that by giving a standard chemotherapy course before and after surgery for cancer of the stomach and lower oesophagus 5-year survival could be increased to 36% compared with 23% in those who had surgery alone. In the second, there was no evidence that the surgical removal of pelvic lymph nodes (lymphadenectomy) in women with endometrial cancer confined to the uterus improved overall survival and there was a tendency for recurrence free survival to be poorer and side effects to be worse in those who had lymphadenectomy.

Over the last 10 years antiretroviral therapy (ART) using combinations of drugs has led to dramatic improvements in survival and quality of life in people with HIV infection in the UK and many other countries which can afford both the drugs and the cost of monitoring the therapy. With the reduction in cost of drugs and the commitment to roll out ART in resource poor countries an important question is whether the intensive and expensive monitoring

undertaken in resource rich countries is necessary.

The DART trial, funded by MRC, DFID and the Rockefeller Foundation, co-ordinated by MRC CTU and Imperial College, was set up to address this question by comparing clinical plus laboratory monitoring with clinical monitoring alone in patients who all receive a standard 3-drug ART regimen. It has recruited over 3,000 patients in two sites in Uganda and one in Zimbabwe who will be followed up for 6 years. Already the impact of ART in these sites has been demonstrated by comparing the survival with a similar group of patients who were followed up before ART became available; the 2-year survival rates were over 90% compared with about 25% respectively.

Sometimes there are areas which are less attractive to Pharma where new interventions come from small companies or academic departments and in these areas the MRC CTU is involved in the whole development process working closely with the company or group which developed the drug or vaccine. A current example here is the MRC/DFID funded Microbicides Development Programme led jointly by the MRC CTU and Imperial College which is working with a small biotech company (Indevus) to evaluate a vaginal gel as a potential microbicide product to prevent HIV transmission. This is a major international collaboration with many partners in Africa, the UK and Spain in which nearly 10,000 women will take part and over 4,000 have been recruited already. The challenges of developing a microbicide and concerns about the likely return on investment make it an area which is not attractive to Pharma.

Most of the trials that the MRC CTU

undertakes are large trials exploring better ways of using existing treatments or part of a development programme in areas of limited interest to Pharma. When the MRC CTU was established in 1998 it was also given the remit to work in areas outside cancer and HIV where there are important questions but no strong tradition of clinical trials. Collaboration in trials in musculoskeletal disease have been set up with the Arthritis Research Campaign and with the National Blood Service and trials in a number of other areas such as tuberculosis and diabetes set up with clinical colleagues at University College Hospital.

Underpinning the clinical trials are a number of other areas of research, which contribute to the design, conduct and analysis of the trials to ensure that the results are reliable and timely. Observational epidemiological studies tell us about the outcome of disease in a population on current treatment and therefore help to estimate the size of trials needed to demonstrate reliably whether a new intervention is better. Methodological research is important both to address problems encountered in trials, such as how to handle missing data, and to improve trial design so that answers can be obtained more quickly. Systematic reviews and meta analyses can both assess what the results of a new trial add to the current knowledge or bring together all the information in a clinical area to identify questions which new trials are needed to answer.

Clinical trials units such as the MRC CTU which have expertise and experience in designing, conducting and analysing clinical trials and related clinical and epidemiological research studies are a key part of the 'whole system' which underpins clinical research in the UK with the goal of

improving health care. Other key components are the clinical infrastructure in the NHS which enables the recruitment of patients and healthy volunteers to the studies and the funders, whether Government, medical charities or industry which provide the resources. Equally important are the involvement of patients and the public at all stages of the research process, and academic and clinical investigators to identify research questions and priorities and, working with the CTUs, turn these into successful trials.

Cancer trials in the UK have a long and successful track record but in 2000 were struggling to recruit rapidly because of insufficient clinical time of doctors and nurses. The National Cancer Research Network (NCRN) was set up by NHS R&D in 2001 to provide infrastructure support through local research networks across England, with parallel developments in Scotland, Northern Ireland and Wales. By 2006 the proportion of newly diagnosed cancer patients recruited to trials had increased from less than 4% in 2000/1 to 12.5% in 2006/7. Building on the success of NCRN, further networks have been set up under the UK Clinical Research Network in mental health, diabetes, stroke, dementia and other neurodegenerative diseases, medicines for children and primary care.

Currently the UKCRN is being extended to cover all areas of health care and disease by the establishment of the NIHR Comprehensive Research Network across the whole of England with parallel activities in the Devolved Administrations. The ultimate goal is to achieve benefits for patients through the more rapid introduction of better treatments including the industry pipeline and resources and by dissemination of excellence in clinical care through the research process.

A third speaker (see below) had been invited to represent the Medical Healthcare products Regulatory Agency who was unfortunately unable to attend.

If the Northwick Park trial was unethical it would not have been approved. Would it have been possible to devise a prior experiment to prove the safety of the planned trial? Were there any prior indications or warnings that the experiment was likely to be unusual in any way? No-one knew previously about the cross-linking effect. It took 60 scientists working for six months knowing what they were looking for to work out what had happened. There were four companies involved in the trial, each one making their own contribution to different stages of the trial. In future it will be vitally important for some one individual person to be responsible for knowing everything that it is relevant to know in a drug trial involving first-in-human exposure.

In the past, work was performed in test-tubes but experimental medicine requires testing on human beings. This creates a huge demand for increased training of new researchers to undertake this work, involving new challenges, new biology, and new knowledge, and there are not nearly enough people to do the work at present. Much more exchange and collaboration will be required in the future between commercial organisations such as drug companies and academic institutions such as universities.

Some first-in-human tests may give a very steep, explosive, and apparently all-or-nothing response to a marginally small dose increase. Such dramatic responses over a narrow dosage interval can be very difficult to predict in advance. The only way to perform such tests safely therefore is to develop an experimental model and perform the initial experiments on primates. In addition, risk must be managed within the clinical trial by giving a dose to the first person and then waiting before giving a similar dose to the second person. Do not treat everyone simultaneously. An Expert Advisory Group has now been established, chaired by Sir Gordon Duff, for consultation on the design of first-in-human trials.

With patents running out on many drugs, biosimilars manufactured by other companies may differ slightly from the originally patented drug. These may behave differently under trial conditions which may require very careful consideration in case of unpredictable responses. However biosimilars may become very important economically as they will increasingly form the basis for health care in the future.

THE DESIGN AND REGULATION OF MODERN CLINICAL TRIALS

Medicinal Products for Paediatric Use

Dr Julia Dunne

Medicines and Healthcare Regulatory products Agency (MHRA)

(Dr Julia Dunne was unable to be present at the meeting but has submitted the following article for publication)

Background

Before any medicine is authorised for use in adults, the product must have undergone extensive testing including pre-clinical tests and clinical trials to ensure that it is safe, of high quality and effective. The same may not be true for medicines used to treat children. Over 50% of the medicines used in children may not have been studied in this age group. In the European Union, the paediatric population (0-18 years) represents about 75 million people, that is 20% of the total population. This is a vulnerable group with developmental, physiological and psychological differences from adults, which makes age and development related research particularly important.

The absence of suitable authorised medicinal products to treat conditions in children is an issue that has been of concern for some time. Pharmaceutical

companies have been reluctant to invest in developing specific treatments or adapting existing medicines to meet the needs of the paediatric population, mainly because the market is small and therefore of lower commercial interest and the studies can be difficult, long and expensive. In addition, developing a suitable formulation which can provide an exact dose, for example a syrup, may be technically difficult and expensive on an industrial scale. This often leaves no alternative to the prescriber than to use 'off-label' and unauthorised products, without evidence-based information to guide prescribing and give information about the risk-benefit assessment.

The need to conduct trials in the paediatric population

The paediatric population is not a homogeneous group; it ranges from pre-term newborns, through toddlers

and children to adolescents. They are not miniature versions of adults. Specific clinical trials in paediatric populations are normally required due to age-related differences in the drug handling or drug effects which may lead to different dose requirements to achieve efficacy or to avoid adverse effects. Paediatric studies conducted in response to US legislation led to the introduction of new paediatric information in around 130 labels for established medicines between July 1998 and June 2007. The new information includes new dosing information or a dose change in recommended dose, new safety data, advice that safety and efficacy are not established in the paediatric population and new dosing instructions in younger populations. These changes have an impact on the safe and effective use of the medicine in the paediatric population. Further information is available on the US

Food and Drug Administration (FDA) website (<http://www.fda.gov/oc/opt/default.htm>). Without such specific studies in the paediatric population this important information would not be available. In addition, the US legislation led to the development of age-appropriate formulations to avoid difficulties in swallowing or, more significantly, serious calculation errors when using adult formulations to obtain paediatric dosages.

EU Regulation on paediatric medicines

The EU Regulation on Paediatric Medicines was adopted on 12 December 2006 and came into force on 26 January 2007. The Regulation establishes a legislative framework that will fulfil the following main objectives:

- increased availability of medicines specifically adapted and licensed for use in the paediatric population
- increased information available to the patient/carer and prescriber about the use of medicines in children, including clinical trial data
- increase in high quality research into medicines for children.

These will be achieved through a system of requirements and incentives. Work began on the draft texts in the Council Working Group in late October 2004. Achieving progress on the Regulation was a priority of the UK Presidency of the EU and political agreement on a text was reached in December 2005. A second reading agreement between the Council, the European Parliament, and the European Commission was achieved in June 2006. The main elements of the finalised Regulation include:

- the establishment of a new body, the Paediatric Committee, sited at the European Medicines Agency (EMA)
- for new products and certain changes to the marketing authorisation for products still covered by patent protection
 - o a requirement for paediatric data based on a paediatric investigation plan (PIP)*
 - o a six-month extension of the supplementary protection certificate (SPC) if information arising from a completed PIP is incorporated into the Summary of Product Characteristics (SmPC)
- for orphan medicinal products

- o a two-year extension of market exclusivity if information arising from a completed PIP is incorporated into the Summary of Product Characteristics (SmPC)

- for off-patent products
 - o a new category of marketing authorisation called the paediatric use marketing authorisation which will be associated with a ten-year period of data and market protection
- a European database of paediatric clinical trials, part of which will be publicly accessible including trial results
- co-ordination of a European Paediatric Clinical Trials Network
- funding for the study of off-patent medicines provided through the Community framework programmes
- an identifying symbol on the package of all products authorised for use in children.

UK Medicines for children research network (MCRN)

The EU Regulation will lead to more paediatric clinical trials being conducted in the EU. The Medicines for Children Research Network (MCRN) was created in 2006 to provide the best possible framework for such trials in the UK. The network aims to improve the co-ordination, speed and quality of randomised controlled trials and other well designed studies of medicines for children and adolescents, including those for prevention, diagnosis and treatment. The network has extensive knowledge and experience of paediatric research, and supports non-commercial, pharmaceutical/biotech-sponsored and investigator-led partnership studies in over 100 NHS sites that serve approximately 6 million children. The MCRN supports studies through its infrastructure, which includes the MCRN Co-ordinating Centre, Clinical Studies Groups (CSGs), Local Research Networks (LRNs), Clinical Trial Units (CTUs) and a Neonatal Network.

The MCRN Co-ordinating Centre is led by a consortium comprising the University of Liverpool, Royal Liverpool Children's Hospital, Imperial College London, National Perinatal Epidemiology Unit (NPEU; University of Oxford), Liverpool Women's Hospital and the National Children's

Bureau. The MCRN is funded by the Department of Health and works in partnership with the UK Clinical Research Network (UKCRN) to improve the UK's clinical research environment and maximise the development of safe and effective medicines and formulations for children.

Protection of children in trials

Although there may be ethical concerns about conducting trials in the paediatric population, this has to be balanced by the ethical concerns about giving medicines to a population in which they have not been tested.

There is a complementary framework of European and national legislation, implementing texts and national and international guidelines aimed at protecting children involved in clinical trials. The European Clinical Trials Directive sets out the provisions which must be followed if minors are to be studied in a clinical trial. The directive covers the protection of all clinical trial subjects and includes additional protection for minors. This includes informed consent from a parental/legal representative; provision of information to the minor on benefits and risks in language that he/she can understand; respect for the explicit wish of the minor to refuse to enter a trial or withdraw from a study; compensation is allowed but no financial or other inducements; the group of subjects involved in the trial should derive a direct benefit from involvement; trials should be designed to minimise pain, discomfort, fear; the Ethics Committee approving the trial should have paediatric expertise or input and the patient's interests should always be considered above the interests of society. The directive is reinforced by the Regulation on Paediatric Medicines which contains provisions to prevent unnecessary studies or duplication of studies. In addition the European Commission is co-ordinating the preparation of a document on *Ethical Considerations for Clinical Trials Performed in Children – Recommendations of the Ad Hoc Group for the development of implementing guidelines for Directive 2001/20/EC relating to good clinical practice in the conduct of clinical trials on medicinal products for human use*. This was released for public consultation in 2006 with comments requested by 31 January 2007.

*This does not become law until 18 months after entry into force of the Regulation

Chinese visitors review UK progress on energy generation

Anthony Darbyshire – Environment Fellow, Comino Foundation

In June the Parliamentary and Scientific Committee were asked by the Chinese Embassy if they could organise a tour for representatives of the Committee of Population, Resources and Environment (CPRE) which is one of the nine special committees of the National Committee of the Chinese People's Political Consultative Conference (CPPCC). The purpose of the tour was to focus on the UK's progress in moving towards energy generation from renewable sources and in reducing greenhouse gases.

Part of the Comino Foundation's work is to help address global warming and the Foundation was asked if I, as Environment Fellow, could organise this tour in the second week of September.

The Chinese Embassy advised that the CPPCC is similar, in some ways, to the House of Lords although its role is purely advisory, not legislative. Each committee, such as the CPRE, has a large number of experienced public figures in the committee's area of responsibility who work together to investigate and research important issues. The committees report their findings, opinions and suggestions to the central committee and the State Council for reference in policy and decision making. Their recommendations are usually adopted.

The CPRE delegation was to be led by the Chairman supported by senior members of the committee. I realised that this was an important opportunity to promote not only the UK's range of activities in renewable energy generation but also developments in clean coal technology, bearing in mind that over 80% of electricity in China is generated from coal.

Initially it was important to provide an overview of UK Government policy on energy generation and the first morning of the visit was spent in



Dr Wang Baoqing, Mr Chen Bangzu, Dr Douglas Naysmith MP, Mr John Slater and Mr Dang Dexin on the Terrace of the House of Commons

visiting the Energy Group of the Department of Business, Enterprise and Regulatory Reform (BERR). This session concentrated on the content of the recent Energy White Paper and the principles of energy security and greenhouse gas reduction on which it is based. The delegation were particularly concerned to understand the role of the EU Emissions Trading Scheme (ETS) in stimulating investment in renewable and 'clean' electricity generation. It became clear, however, that, as a delegation, they were not aware of carbon capture and storage (CCS) technology although a near Zero Emissions Coal Project had been established between the UK and China in 2005.

After their visit to DBERR the delegation had lunch at the House of Commons, hosted by the Parliamentary and Scientific Committee, with Dr. Douglas Naysmith MP in the chair.

The UK has access to 40% of the wind resources in Europe and to substantial tide and wave resources. It was

important to demonstrate to the delegation how the UK is harnessing this asset and the delegation visited the British Wind Energy Association to gain an overview of how 20% of electricity generation will be generated from renewable sources by 2020. Through a visit to East Anglia the developing technology of wind turbines for both onshore and offshore wind farms were studied.

China also has access to substantial wind resources and has a well established programme to build wind farms. This programme is rapidly accelerating as is witnessed by Scottish and Southern Energy recently signing a contract to supply 4 x 50MW wind farms in North East China. European companies are working closely with China to develop wind power which is planned to reach 30GW by 2020.

Whilst in East Anglia the delegation also became aware that 60% of the UK's chicken litter is used, in co-firing with other renewable fuels, to produce electricity. The UK is well advanced in this area of renewable energy

generation. Energy Power Resources Ltd, who are based in East Anglia, are the largest biomass electricity generator in the UK with a number of chicken litter plants plus a plant that burns 200,000 tonnes of cereal straw per annum. Whilst China does not have large chicken farms there is extensive use of agricultural biomass in rural areas for cooking and heating. With large residues of agricultural waste the Government has set a further target of 30GW of electricity being generated from biomass sources by 2020.

Whilst in East Anglia the delegation explored the Zicer Building which houses the Zuckerman Institute for Connective Environmental Research at the University of East Anglia. This building, which has many innovative energy saving features, won the Low Energy Building of the Year award. Also at the University of East Anglia the delegation reviewed the CRed carbon reduction programme which is led by the School of Environmental Sciences. Beyond its development in the UK this programme is now expanding abroad and has a well established programme in China, based in Shanghai.

30-50% of UK electricity is generated from coal fired power stations. Many of these are due for replacement. As in China, coal in the UK is an abundant and cheap source of power but the level of greenhouse gases emitted from this form of power generation is unacceptable. To preserve a balanced fuel mix, and consequently security of electricity supply, the UK Government is concerned to ensure that new investment in 'clean' coal fired power plants becomes a reality. This means that the carbon price established under ETS for the period 2008-2012 has to be such as to attract new investment.

This investment may, initially, be in upgrading existing coal fired plants to a more efficient, or 'super critical' state with the potential to move to full CCS at a later date. Alternatively investment may be in new types of plant which capture the carbon dioxide for storage underground. CCS technology, although apparently not known to the delegation, is now well established. A UK CCS demonstration plant is now being planned for 2012 with some 15

similar plants being targeted by the EU by 2015.

Given that, currently, over 80% of electricity in China is generated from coal and that this will continue for many years to come I considered it appropriate to devote some of the time on the tour to developments in coal fired electricity generation. This was done in two ways.

Firstly Richard Budge, the Chief Executive of Powerfuel, explained in detail the technology behind the Integrated Gasification Combined Cycle (IGCC) process. Powerfuel are at an advanced stage in their plans to build a 900MW IGCC power plant for operation by 2012. In explaining the technology and the commercial criteria involved he stressed the importance to their investment of an effective price for carbon through the ETS.

Secondly I made arrangements for the delegation to visit Ferrybridge Power Station which was originally built in 1960. It is now owned by Scottish and Southern Energy. The visit to this power station, although familiar to the delegates, was able to illustrate several important points.

Firstly, the plant is co-firing up to 10% biomass. At present this is mainly the waste from olive oil production. This is significantly reducing greenhouse gas emissions and other plant investment is reducing other damaging emissions. Secondly, plans are well advanced to upgrade the plant to 'super critical' status with a further 15% reduction in emissions. However, establishing the right price for carbon though the ETS is critical to this investment. Thirdly, if investment conditions are favourable the plant could move to CCS at a later stage when the CO₂ pipeline grid is in place.

The Ferrybridge visit demonstrated to the delegation that it is possible to upgrade existing old coal fired power stations, which is one of the possible solutions to combat greenhouse gas emissions from the ever increasing number of coal fired stations in China. It is important to note that towards the end of the visit to Ferrybridge the Chairman of the delegation said that he could see that carbon capture and storage had an important future role.

As one member of the delegation said, "We know that our economic expansion has been damaging but we are very concerned to reduce greenhouse gas emissions and reduce global warming." To me this visit demonstrated that China is moving swiftly ahead with various forms of renewable energy solutions but has yet to understand how to address the greenhouse gas problem of its coal fired power stations. There are plans to close many small coal fired power plants and I believe there is a genuine desire to solve the emissions problem.

The UK is well advanced in developing clean coal technology and there must be an opportunity to further advance the relationships that already exist in the energy field to help China find an acceptable solution. If this occurs the Chinese political framework is such that change could occur swiftly.

If the CPRE report to the State Council recommends swift action to explore the potential for CCS in China I believe this will be the major outcome of their visit to the UK.

Members of the CPPCC delegation:

Mr CHEN Bangzu: Standing Committee Member, National Committee of the CPPCC; Chairman, CPRE; Former Executive Vice-Minister of State Economic and Trade Commission

Mr MA Fu: Member, CPRE; CPPCC National Committee; Former Deputy Director General of State Forestry Administration

Mr DANG Dexin: Director General, Office of the CPRE; CPPCC National Committee

Mr HE Guangsen: Deputy Director, Division of International Co-operation, Chinese Academy of Forestry

Mr CAO Boyu: Deputy Division Director, State-owned Asset Supervision and Administration Commission of the State Council

Miss WANG Yanan: Senior Staff Member, Office of the CPRE; CPPCC National Committee.

Earth Air Fire Water

Science and the Global Challenge



The Attlee Suite was packed to capacity and standing room only for the annual Parliamentary Links Day on 26 June organised by the Royal Society of Chemistry on behalf of the whole scientific and engineering community and co-sponsored on a bipartisan basis by Dr Brian Iddon MP and Mark Lancaster TD MP with the support of the Commons Science and Technology Select Committee.

The range of speakers was remarkable – drawn from right across the scientific, parliamentary and governmental spheres – and the morning session was introduced by Professor Jim Feast, President of the RSC, who spoke of his pride that the RSC has been able to play such a

consistent part over the years in providing Parliament with its largest and single most important science-related event held in the House.

The Keynote Address was given by the (then) Secretary of State for the Environment, the Rt Hon David Miliband MP, who outlined the Government's approach to global climate change issues and the importance the Government placed on the Climate Change Bill.

Major scientific presentations were given by Lord Rees of Ludlow, President of the Royal Society, Dr Sue Ion, Vice President of the Royal Academy of Engineering, Sir Christopher Llewellyn Smith from the Institute of Physics, Professor Alan Malcolm from the Institute of Biology,

Dr Jeff Hardy from the Royal Society of Chemistry and Dr Peter Cotgreave, the (then) Director of the Campaign for Science and Engineering.

Dr Jeff Hardy, energy manager at the RSC, highlighted a few goals that will need to be met because without the chemical sciences it was very unlikely that the Government will be able to achieve its target of a 60% reduction in CO₂ by 2050. On the technology front, chemists were working with engineers to build four smart energy homes for Europe. These homes, which are expected to consume zero energy, will rely on new energy-saving materials such as smart windows and nanofoam insulation materials, ie foams with tiny nano-sized air bubbles that make them more efficient than conventional insulation materials.

Parliamentary contributions came from Alan Duncan MP, Shadow Secretary of State for Trade and Industry, who conveyed the renewed commitment of the Opposition to science and innovation and outlined their plans for a new strategy, and Phil Willis MP, Chair of the Commons Select Committee on Science & Technology, who observed that his experience had led him to the view that so many of the ostensibly 'separate' issues considered by the Select Committee were in fact profoundly connected one with another.

The concluding speaker was Sir David King, the Government Chief Scientific Adviser who gave a *tour d'horizon* taking in sustainable development where he argued that each generation should leave at least as large a productive base for its successor as it inherited from its predecessor. His comprehensive presentation covered world population growth, the world's water deficit, the interaction between



population and water supply distribution, health challenges including infectious diseases such as avian flu, and growing obesity, the growing need to invest in sustainable farming and research on food, current models of the Earth's atmosphere, global fossil resources, and future world energy demand. Professor King highlighted the role of the Foresight

programme in a sustainable future that will depend on using "our wealth and technology not only to manage our economies within finite natural resources but also to adapt to a warming planet while reducing the extent of that warming by drastically reducing CO₂ emissions and sustaining the lifestyle we want."



Special Messages

This year's Links Day had messages from the Minister of Science and the Speaker of the House of Commons. There was also a unique 'double' of *Special Messages* from in effect two Prime Ministers. The outgoing Prime Minister, Rt Hon Tony Blair MP, praised Links Day as "the foremost scientific gathering in the Parliamentary calendar" and ended with a renewed plea for education: "It is our teachers on whom we depend for inspiring, encouraging and training the next generation of scientists."

The Rt Hon Gordon Brown MP stated his wish for "the UK to be the most attractive place in which to do science" and that public investment in the science base "will reach a record level of £6.3 Billion by 2010-11" together with "enhancing the R&D tax credit to incentivise private investment."

The Leader of the Opposition, Rt Hon David Cameron MP, said Links Day was "a great opportunity for Government and Opposition alike to continue their dialogue with the scientific community" and that "only by recognising the links between science, engineering and technology that we can tackle the scientific challenges we face."

Lord Browne of Madingley, President of the Royal Academy of Engineering, conveyed the message that "on climate change, engineers have the means to do something practical about it... (such as) practical alternative sources of energy to hydrocarbons."

The Man who Fed the World Nobel Peace Prize Laureate Norman Borlaug

By Leon Hesser

Durban House Publishing Company 2006 ISBN: 1-930754-90-6

As you read this sentence now – 800 million people in the developing world are suffering from chronic hunger and twenty children have just been born. Think about this for a while and its implications. How do we ensure we feed those in current need and those who will need food in the future – the world's growing population of another 2.5 billion people within the next forty years? From 1914, in the span of one man's lifetime, the world's population has grown from 1.6 to 6.4 billion, outstripping food supply in many countries of the world. If it had not been for the Nobel Peace Prize Laureate and internationally acclaimed scientist Norman Borlaug, millions upon millions of people's lives would, in less than that lifespan, have been lost to the suffering of malnutrition and starvation. Hence, the very apt title for Norman Borlaug's biography, *The man who Fed the World* – a concisely written and a well balanced account of a modest unassuming man whose achievements have been of global importance.

The story of Norman Borlaug is a remarkable one – a clear case of ability matched with opportunity to enable one man to really change the world. Having recently survived another summer of obsessive navel gazing over GCSE and A-level examination results it is refreshing to read of a man born in 1914, a child of the Iowa prairie, who attended a one-teacher, one-room school; failed the university entrance exam; had an ambition to be a high school science teacher and athletic coach and yet in his 93rd year has obtained more than 50 honorary doctorates from 18 different countries and is acknowledged as one of the hundred most influential people of the twentieth century. It reminds us that ability is not just about exam performance and that some of the world's greatest individuals succeed in spite of apparent disadvantage and their education system.

The story of Norman Borlaug is a great story – a story of scientific endeavour, courage, hard work, personal sacrifice and duty – the stuff with which heroes abound. And Norman Borlaug clearly is one of our 20th Century heroes. As a thirty-year-old US scientist, based in Mexico, Norman Borlaug embarked on three innovations that formed the basis of a wheat revolution in Mexico that ultimately fostered the *Green Revolution* in Asia. First, he painstakingly crossed thousands of wheat varieties to identify those resistant to the devastating fungal rust diseases of wheat. Next, against all the better judgement of his superiors and the prevailing wisdom, he initiated a 'shuttle-breeding' programme that halved the time needed to develop new cultivars, and fortuitously, resulted in the seeds that were globally adaptable. Then, he changed the

architecture of the wheat from gangly tall to a short-strawed, heavy-tillering structure that responded well to fertiliser. The combination of these three innovations caused wheat yields to rocket. If this was all that Borlaug's work had achieved it would have been remarkable enough, however there were further knock-on effects that changed global agriculture.

The principle elucidated by Borlaug of growing dwarf varieties and creating globally adapted cultivars was transferable to other staple crops such as rice. This then formed the basis of a different approach to plant breeding that enabled the *Green Revolution* – averting starvation in Asia and many other countries during the 1960-80s. The Borlaug approach to plant breeding also lent itself to the establishment of internationally funded research centres to complement the national agricultural research and training programmes. Originally the centres were established primarily as plant breeding institutes but they have since diversified and there are now fifteen such centres around the world with an annual expenditure of around \$350 million (which sounds a lot until you consider that the same amount would probably buy you only five Euro-fighters) specialising in tropical, dry-land and semi-arid crop development for cereals, potatoes, pulses and vegetables, but also addressing key research issues in water, forestry, livestock, fish and preservation of genetic resources. The UK supports these institutes through funding from DfID.

Although Norman Borlaug's contribution to the world has been in providing a means of averting starvation and malnutrition, his biographer points out that Professor Borlaug has always recognised that the real battle is with population growth – the 'population monster' as he calls it. Borlaug is right of course to highlight the source of the problem that has been the driving force of his life's work and asking the question of the future, 'Where will the food come from?' Let's hope that those who have failed to include population issues in the Millennium Development Goals and those organisations and governments who fail to prioritise and support continued scientific and technological advance in agriculture know the answer to this question because if they don't, after reading this immensely interesting book, I know a man who does – Norman Borlaug – the man who fed the world!

In the time it has taken you to read this review more than 500 children have been born and 800 million people remain chronically hungry!

David Dent

LETTER TO THE EDITOR

Cambridge, August 2007

Sir,

It was with considerable disappointment that the Nanotechnology Industries Association (NIA) noted the motion passed by the House of Commons on the 24th July 2007 to abolish the current House of Commons Science and Technology Select Committee, and to replace it with a Committee on Innovation, Universities and Skills, who will decide whether to establish a sub-committee on science and technology.

Nanotechnology is the latest example of a series of recent science- and technology-based public affairs topics, which the House of Commons Science and Technology Select Committee represented in an objective and balanced manner, by examining evidence from across all affected Government Departments.

The existence of a full Committee is vital to the provision of an adequate oversight of the support requirements and potential impact of science and technology in the UK, as well as providing a strong input into science policy and science-based policy. In spite of the widespread recognition that science and technology are key drivers for economic strength and growth, the disbandment of the House of Commons Science and Technology Select Committee sends the message that it is no longer considered sufficiently important to merit a separate Select Committee.

In line with recent recommendation of the Council of Science and Technology (CST) to establish a cross-Government body to drive forward strategic nanotechnology action¹, and the establishment of a Ministerial Group on nanotechnology by the Minister of Science and Innovation², we would strongly advocate the establishment of a departmentally independent sub-committee on Science and Technology, in order to uphold and strengthen the UK's outstanding reputation for fostering and supporting science.

Dr Steffi Friedrichs

Director of the Nanotechnology Industries Association (NIA)

www.nanotechia.co.uk.

¹ Nanosciences and Nanotechnologies: A Review of Government's Progress on its Policy Commitments, Council of Science and Technology, March 2007.

² 'Accordingly, I am establishing and will chair a small group, comprising Ministers from the Departments of Health *DH; Environment, Food and Rural Affairs (Defra); and Work and Pensions (DWP). The group will bring together those Ministers with responsibility for the research base, innovation, health, safety and the environment. Together, I intend that we should consider how departments should prepare to maximise the considerable benefits that nanotechnologies may offer, while ensuring that the risks are minimised. The purpose of the group will be to agree and regularly review the Government's overall approach on nanotechnologies, develop a communication strategy and monitor progress of delivery against our objectives.' (Malcolm Wicks MP, Minister of State for Science and Innovation, in a letter to Professor Sir John Beringer CBE, Chair of the CST's Nanotechnologies subgroup, 17th May 2007)



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 Ffello (Lab, Stoke on Trent South), Mrs Nadine Dorries (Con, Mid Bedfordshire), 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), 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.

Future of the Committee

The House of Commons passed a motion on 24 July 2007 to replace the Science and Technology Committee with a Committee on Innovation, Universities and Skills with effect from the State Opening of the next session of this Parliament (6 November 2007). It will be a matter for the new Committee whether to establish a sub-committee on science and technology.

Inquiries

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. A report is expected to be published in October.

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. On 20 June 2007, the Committee took evidence from Ecsite-uk, The Deep, INTECH, Tyne & Wear Museums, the Wellcome Trust, NESTA, and Ministers from the

Department for Children, Schools and Families, the Department for Innovation, Universities and Skills, and the Department for Culture, Media and Sport. A short report is expected to be published in October.

Scientific developments relating to the Abortion Act 1967

On 20 June 2007, the Committee announced an inquiry into scientific developments relating to the Abortion Act 1967. Written evidence was invited on a number of points including the scientific and medical evidence relating to the 24 week upper time limit for abortions, and medical, social and scientific research relevant to the impact of suggested law reforms to first trimester abortions. The deadline for written evidence was 2 September 2007. Oral evidence sessions will take place in October.

Oral Evidence

Improving Research Conduct and Preventing Scientific Fraud

On 2 July 2007, the Committee took evidence from Professor Sir David King, Government Chief Scientific Adviser and Co-Chair of the Council for Science and Technology, and Professor Janet Finch, Vice-Chancellor of Keele University and Independent Co-Chair of the Council for Science and Technology. A transcript of this session is available on the Committee's website.

Written Evidence

Renewable Energy-Generation Technologies

On 15 May 2007, the Committee announced an 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. This evidence is available on the Committee's website.

It is unlikely that the Committee will be able to proceed with this inquiry in the time remaining to it, and it will be a matter for the new Committee on Innovation, Universities and Skills whether it will include this issue in its programme of work. The Committee is grateful to all those who have submitted written memoranda to this inquiry. These memoranda have been published on the Committee's website.

Reports

2007: A Space Policy

On 17 July 2007, the Committee published its Seventh Report of Session 2006-2007, *2007: A Space Policy*, HC 66. The Report was wide-ranging covering topics including satellite navigation, manned spaceflight, Earth observation, launchers and research. The Committee made several recommendations intended to strengthen the role of the British National Space Centre and recommended that investment in certain areas be increased.

Chairman of the Medical Research Council: Introductory Hearing

On 31 July 2007, the Committee published its Eighth Report of Session 2006-2007, *Chairman of the Medical*

Research Council: Introductory Hearing, HC 746. In its report, the Committee criticised Sir John Chisholm for being "vague" and "evasive", and for "a lack of focus and clarity" in his dealings with the Committee. The Committee also criticised the manner of the appointment of Ernst & Young as consultants to a review conducted jointly with the MRC.

International Policies and Activities of the Research Councils

On 31 July 2007, the Committee published its Ninth Report of Session 2006-2007, *International Policies and Activities of the Research Councils*, HC 472. The Report acknowledged that the Research Councils had already taken steps to develop their international work, developing an over-arching strategy, creating a Research Councils UK (RCUK) international team, and establishing more offices overseas. However, the Committee found that the Research Councils' activities still lacked co-ordination and were not sufficiently high-profile. It recommended that RCUK drive cross-Council co-ordination and communication between the Research Councils, Royal Society, British Council and others.

Government Responses

Office of Science and Innovation

On 19 June 2007, the Committee published its Second Special Report of Session 2006-2007, *Office of Science and Innovation: Scrutiny Report 2005 and 2006: Government Response to the Committee's Sixth Report of Session 2006-07*, HC 635

The Cooksey Review

On 30 July 2007, the Committee published its Third Special Report of Session 2006-2007, *The Cooksey Review: Government Response to the Committee's Third Report of Session 2006-07*, HC 978.

Research Council Institutes

On 30 July 2007, the Committee published its Fourth Special Report of Session 2006-2007, *Research Councils Institutes: Government Response to the Committee's Fourth Report of Session 2006-07*, HC 979.

Further Information

Further information about the work of the Committee or its current inquiries 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.

Personal Internet Security

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

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

Allergy

The Committee published its Allergy report on 26 September. The report examined the increasing prevalence of allergic diseases across the United Kingdom, the reasons behind this, and the social and economic costs these diseases bring. The report set out a series of recommendations to improve NHS allergy services, and explored current areas of research and preventative guidance. The Committee also examined the impact of allergy upon sufferers' quality of life, and made recommendations on topics ranging from food labelling and catering establishments, to complementary therapies, and the management of allergy in the school and work environment. The Committee is now awaiting the Government's response before calling for a debate.

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's report 'Radioactive Waste Management: an update' was published on 4 June 2007 and the Government's response was received on 25 June. The Committee's report will be debated in the new session.

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 focused on progress made in implementing recommendations contained in the Committee's report published in 2000. The report is expected to be published in the Autumn.

New inquiry: Waste Reduction

The Select Committee has appointed a sub-committee, chaired by Lord O'Neill of Clackmannan, to hold an inquiry into waste reduction. A call for evidence was published in August. The inquiry will focus on the first tier of the waste hierarchy, waste reduction, and will examine ways in which the waste produced from products and production processes can be reduced. The inquiry will cover issues such as better design and the use of materials. The inquiry will be launched in November and the sub-committee's report is expected to be published in the summer of 2008.

New inquiry: Medical Screening

The Select Committee has also appointed a second sub-committee, chaired by Lord Patel, to investigate the scientific basis underlying medical screening programmes. The call for evidence for this inquiry is expected to be published in early November and a report will be published in the summer of 2008.

Further information

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



Parliamentary Office of Science and Technology



Recent POST publications

Grids and e-science

July 2007

POSTnote 286

Governments and industry worldwide are spending billions of pounds developing Grid computing – an evolution of the Internet that pools computer resources to process, store and access large amounts of data. Grids already have widespread applications in research and potential in industry and Government. They are also an important part of e-science (science using advanced information and communications technologies). This note describes e-science and Grids and details key UK and international projects. It examines the potential impact of the forthcoming Comprehensive Spending Review on e-science, as well as wider policy issues such as Grid security.

Eating disorders

July 2007

POSTnote 287

1.1 million people in the UK are estimated to be directly affected by eating disorders. These represent a significant public health concern due to their severe physical and emotional consequences and high rate of recurrence. They often develop during adolescence, thus impacting on social development and education. This POSTnote reviews the prevalence, possible causes and treatment of eating disorders, and highlights issues relevant to Government policy in this area.

New industries in the deep sea

July 2007

POSTnote 288

More than 70% of the Earth is covered by the oceans, which have an average depth of four kilometres. In the deep sea there is no light, low temperatures and crushing pressure, yet a wide variety of creatures are adapted to these extreme conditions. New technologies give unprecedented access to deep waters, revealing a wealth of new habitats and organisms, and also presenting opportunities for exploiting new resources. This POSTnote examines the specific cases of deep-seabed mineral extraction, bioprospecting and storage. It highlights the difficulties in promoting development of economic opportunities while protecting the deep sea environment.

Urban Flooding

July 2007

POSTnote 289

Urban flooding due to drainage systems being overwhelmed by rainfall is estimated to cost £270 million a year in England and Wales; 80,000 homes are at risk. Its impacts are expected to increase if no policy changes are made. This POSTnote sets out the current approaches to managing urban drainage and examines proposals for improving them.

Voluntary carbon offsets

July 2007

POSTnote 290

Carbon offsetting involves calculating a person or entity's

greenhouse gas emissions and then purchasing 'credits' from emission reduction projects that have prevented or removed the emission of an equivalent amount of greenhouse gas elsewhere. The voluntary carbon offset market is growing at a rapid rate. However, there is considerable debate over both the merit of carbon offsets themselves, and the different types available. This POSTnote reviews the arguments over the availability of offset programmes, describes the carbon market and highlights some of the defining characteristics of a carbon offset.

Electronic waste

July 2007

POSTnote 291

The UK produces around 15% of the EU's total waste electronic and electrical equipment (WEEE). The disposal and low rates of recycling of electronic and electrical appliances, many containing toxic components, may pose an environmental hazard. The UK introduced new legislation in January 2007, to minimise WEEE, to support greater recycling and re-use and to improve the monitoring of final disposal of materials. This POSTnote outlines the types of WEEE and examines the implementation and potential impacts of the legislation.

Radio spectrum management

July 2007

POSTnote 292

The radio spectrum supports services from air traffic control to wireless Internet. Demand for it is increasing with the rise in wireless and mobile services. This POSTnote discusses the UK move towards more liberalised spectrum use. It also outlines debate over the 'Digital Dividend': the forthcoming release of radio spectrum as a result of the switchover from analogue to digital television.

Transport biofuels

August 2007

POSTnote 293

Transport accounts for 25% of the UK's carbon dioxide (CO₂) emissions. Low carbon fuels such as biofuels are expected to play a part in reducing CO₂ emissions from the transport sector. Biofuels are produced from biomass (plant or animal material). They are renewable and have typically lower lifecycle CO₂ emissions than petrol or diesel. 'Second generation' biofuels may offer even lower CO₂ emissions, but these are not yet commercially available. Although biofuels can provide carbon savings, some groups are concerned about the environmental and socio-economic impacts of biofuel feedstocks, especially in developing countries. This POSTnote examines the issues relating to current and future transport biofuels.

Current work

Biological Sciences - Alternatives to Custodial Sentencing, Assisted Reproduction, Synthetic Biology, HIV and AIDS in the UK, Domestic Violence and Animal Abuse, Autistic Spectrum Disorders.

Environment and Energy - Ecological Networks, Uncertainties in Climate Science, Smart Metering, Siting of Nuclear Power Plants.

Seminars

On 9th May POST held a seminar on Ecosystem Services, chaired by Lord May of Oxford; on 14th May a seminar on Energy and Sewage, chaired by Lord Oxburgh of Liverpool and on 16th July, a seminar on radio spectrum management, chaired by Prof Jim Norton.

On 5th July POST hosted a special seminar for postdoctoral scholars from the USA participating in the 2007 National Institutes of Health, Oxford University and Cambridge University Biosciences Fellowship scheme, with presentations from Dr Evan Harris MP, Dr Ian Gibson MP, the Director and Dr Border.

Staff Fellows and Interns at POST

Dr Martin Griffiths, formerly with the Institute of Physics publications division, joined POST as Physical Sciences adviser on 30th July. Over the summer POST hosted

Marika Reed, a work experience intern from Bristol University.

International Activities

On 24th-25th June Board member Lord Oxburgh and the Director made a site visit to the EU's CASTOR CO₂ absorption pilot facility at the DONG coal-fired power station in Esbjerg, Denmark. Lord Oxburgh went on for discussions in Copenhagen with the Danish environment minister.

On 27th June the Director was the keynote speaker at the Romanian Parliament for a regional parliamentary workshop organised by the Science Division of UNESCO. This was the latest of a series of international parliamentary workshops on enhancing parliamentary capacity in handling S&T issues and was attended by a wide range of parliamentarians from SE European countries.

On 29th and 30th of June Dr Nath and Board member Anne Snelgrove MP gave talks on POST at a conference on 'The Role of POST and MP Pairing Schemes' organised by the Kenyan National Academy of Sciences in Nairobi.



Selected Debates and Parliamentary Questions & Answers



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

Full digests of all Debates, Questions and Answers on topics of scientific interest from 4th June to 26th July 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

Energy

Carbon Dioxide Reduction Target

Debate in the House of Commons on Tuesday 12 June

Colin Challen (Morley and Rothwell): The Government's initiative to launch the draft Climate Change Bill is necessary to provide a clear, credible and long term domestic framework for tackling climate change, whilst at the same time allowing the UK to demonstrate strong international leadership, which is a key to helping achieve multilateral agreements. We have chosen the target of a 60% cut in emissions by 2050 – a reasonably high figure by most other countries' standards. That is the figure in the draft Climate Change Bill although I realise that the Bill refers to a cut of "at least 60%" which originated in the Royal Commission on Environmental Pollution (RCEP) report entitled "Energy – the Changing Climate", published in 2000. The 60% figure was derived from a calculation that suggested that a CO₂ concentration in the atmosphere of 550 parts per million may be an acceptable limit allowing us to contain global warming at a reasonable level, but no country can calculate its own

target for greenhouse gas emission reductions from a greenhouse gas stabilization level without factoring in the share that it must bear of global emission reductions. The formula that the 60% calculation relies on is called contraction and convergence. However, in the light of the Stern report this target will probably result in the world becoming "a very dangerous place". The contraction and convergence formula used by the RCEP seven years ago should be re-run to get a more up-to-date figure, taking account of positive feedbacks identified more recently. These include melting of permafrost resulting in methane release, loss of the albedo effect as the icecap melts with seas absorbing more sunshine, dying rainforests, and sink failures such as acidity levels of the southern ocean reaching dangerous levels.

The Minister for Climate Change and the Environment

(Ian Pearson): Climate change is the greatest long-term challenge facing the human race and it is a top priority for this Government. That is why the draft Climate Change Bill has been published and consulted on and it has received wide support both in the House and in the country at large. The G8 recognised for the first time last

week that a global emissions reduction goal must be agreed, involving all major emitters and taking account of the European goal to halve emissions by 2050. At the United Nations framework convention on climate change (UNFCCC) meeting in Bali, we will need to launch talks immediately on a post-2012 climate change framework in order to conclude it by 2009. Also, for the first time the US has seriously committed to engaging in discussions on a post-2012 international climate change framework under the UNFCCC, and demonstrated its increasing engagement by pledging to host a meeting of major energy consuming and greenhouse gas emitting countries, which will support and add momentum to the UNFCCC process. The G8 leaders also discussed the rapidly growing movement towards the global establishment of emission trading schemes – our preferred way of creating a price for carbon – at national and sub-national level. As the Stern review highlighted, establishing a carbon price signal across countries and sectors will ensure that emissions reductions are delivered in the most cost-effective way.

Energy: White Paper

Debate in the House of Lords on Thursday 12 July

The Minister of State, Foreign and Commonwealth Office & Department for Business, Enterprise and Regulatory Reform (Lord Jones of Birmingham): The Energy White Paper, which we published in May, made it clear that we face two big challenges: first, the need to tackle climate change by cutting greenhouse gas emissions; and, secondly, the need to ensure that we have secure and affordable energy supplies. Greenhouse gas emissions will keep rising as world energy demand is expected to be 50% higher by 2030 than it is today. That demand is likely to be met largely by fossil fuels for some time to come. Greater competition for energy resources and the UK's increasing reliance on imported energy will also have implications for security of supply and we must act now. Over the next few years, energy companies will also need to replace ageing power stations and other infrastructure in the UK. It is vital that we create the right conditions for this investment to ensure that we get timely and increasingly low carbon energy supplies. We must be an active part of the European Union energy and climate change policy that was agreed at the March Spring Council. This included commitments to competitive markets, cuts in greenhouse gas emissions, more renewable energy and a central role for the EU Emissions Trading Scheme as the potential basis for a global carbon market.

Baroness Wilcox: It is unfortunate that the Government are still unable to ensure that anything significant will happen about the critical need to reduce the environmental impact of our energy industry. This White Paper was an opportunity for the Government to give a clear indication of their policies and commitments that will be needed to meet the energy challenge. Instead, we again have a list of possibilities and half-hearted or unclear statements. Indeed the Government have created a great deal of confusion over one of the most controversial aspects of energy policy – whether nuclear power stations that are going to be decommissioned in the near future will be replaced.

Lord Jenkin of Roding: The most encouraging statement that the noble Lord made during the course of his tour d'horizon was that decisions must be made this year. He

nods vigorously. That is absolutely crucial and what we need.

Health

Health: Sports Medicine

Debate in the House of Lords on Monday 4 June

Lord Addington asked what steps are being taken to make sports medicine more readily available through the National Health Service so as to support healthy living programmes, particularly those aimed at combating obesity through greater physical activity. This is sports and exercise medicine. The basic requirement is to make sure that people know how to exercise and more important, that they receive "repair work" help when something goes wrong. One of the big health scares at the moment is obesity and the fact that we are all getting larger. People, particularly those in the lower economic groups, are not taking exercise. How do we get the help that this group needs? Most people in the higher economic groups have access to the help they need because they can pay for it themselves. The problem comes with those people who may not have as much money or knowledge and are dependent on the NHS. The Government should indicate how they intend to address the fact that we are not helping people to help themselves, especially people who are overweight or who have been inactive, back into exercise. The Government should support those doctors and groups who are trying to make people healthier by making it easier for them to help themselves.

Baroness Royall of Blaisdon expressed the Government's commitment to healthier living by encouraging people to eat more healthily, take more exercise and participate in more sport. The public health is everyone's business and responsibility. Sports and exercise medicine is a preventive medicine and the case for it is a no-brainer. A summary record was presented of the numbers of doctors currently undertaking speciality training in sports and exercise medicine, with 16 in London alone and a few others elsewhere, and the creation of 200 additional specialist medical training posts to include three appointments to sports and exercise medicine. These demonstrate the Government's commitment to strengthening the availability of sports and exercise medicine services throughout the NHS generally although it is not just about complying with the Olympic bid. It is also about supporting people as they make their healthy lifestyle choices.

Water and Sanitation (Developing Countries)

Debate in Westminster Hall on Tuesday 5 June

Mr William Cash (Stone) asked the simple question, why does a child die from water-related disease every 15 seconds? That situation cannot continue. Clean water is life, foul water is death. We now have the technology and the facility, but do we have the political will? One billion people globally lack access to sanitation. Half the world's hospital beds are taken up with people suffering from water-borne diseases. Forty billion working hours are lost each year in Africa to the need to carry water, and 11% more children attend school when sanitation is available. New hospitals will remain full and new schools could remain empty unless water and sanitation are included in the bundle of essential services that are given priority nationally. Water and sanitation are also important to improving the lives and status of women. However,

globally, aid to the sector has fallen and less aid has been focused on the countries that need it the most. The problem is compounded by the fact that renewable freshwater supplies are running low due to a sixfold growth in consumption in the 20th century, and that issue is likely to be exacerbated by climate change. It is estimated that the target for water and sanitation in the millennium development goals will be met in all regions only if donors and developing country Governments double their spending from \$14 billion to \$30 billion per year immediately, with priority given to Africa and south Asia and to the issue of sanitation.

The Secretary of State for International Development (Hilary Benn): We have a world water crisis with 1.1 billion people lacking clean water, 2.6 billion have no access to sanitation and 5000 children die every day because they have no water. That is why we have the millennium development goal for water and sanitation, but sub-Saharan Africa is really lagging behind on water and most of the developing world will miss out on sanitation due to rapid population growth and rising urbanisation. In the end the national Governments concerned will have to get the message from their own electorate, we cannot do it for them. In almost every country there is a national education Ministry and a national health Ministry, but no national Ministry with responsibility for water and sanitation. The issue is dealt with regionally and by local authorities, at a very local level. The part that we play is that of helping those who have the responsibility to get the message and get on with the practical work of providing the water and sanitation required. That is why in every country there needs to be one water and sanitation plan and one national group that co-ordinates action, bringing together Government, civil society, local authorities and donors to see what progress has been made and what the obstacles are and to agree on who will do what. This is overshadowed by the problem as to what the world will do when people start fighting not about national identity and political ideology, but over water? Working to support countries to manage their water resources, such as the Nile basin initiative is very important because of the competing demands for water, especially from agriculture, which accounts for 80% of the world's water consumption.

Drug Classification

Debate in Westminster Hall on Thursday 14 June

Mr Phil Willis (Harrogate and Knaresborough) I am pleased to speak in this packed Chamber to open the debate on the Science and Technology Committee's report, *Drug classification: making a hash of it?* Our report, on the classification of illegal drugs, was part of an over-arching inquiry. Although it stood as a one-off piece, it was also part of a major study that the Committee undertook on scientific advice and risk and evidence-based policy making in Government. We chose to examine drug classification for a variety of reasons, but mainly because the misuse of illegal drugs is a major public health, criminal and societal problem. That was confirmed in the recent Reuter-Stevens report for the UK Drug Policy Commission, which concluded that the United Kingdom has the highest level of dependent drug use and among the highest levels of recreational drug use in Europe. The classification system plays a key role in directing Government resources for tackling illegal drugs. About 75% of the total budget in the area is spent on enforcing drug laws, at the heart of which is the drug classification

system. At the core of our enquiry was a simple question: is the system fit for purpose? We examined in detail the role played by the Government's scientific advisory committee, the Advisory Council on the Misuse of Drugs. Given the highly critical nature of our report, the responses from both the Government and the ACMD were extremely disappointing. The Government rejected more than half of our conclusions and recommendations, and the response from the ACMD was unnecessarily aggressive. We felt that large elements of our report were totally misunderstood and misrepresented.

The Parliamentary Under-Secretary of State for the Home Department (Mr Vernon Coaker) This is an extremely important debate. The Committee is right to hold the Government and the ACMD to justify their policies. That means there will sometimes be passionate disagreement based on a clash of opinion out of which comes better public policy and a better outcome overall. The Minister then provided a detailed and very specific list of some of the differences that the report had already made to the way in which the Government and the ACMD conduct their business in this area. The Government accepts that more is needed than a criminal justice solution to the drugs problem and agrees with the Committee's view that it wanted greater emphasis on harm reduction, treatment and other alternatives. The Government is trying to increase the number of people receiving treatment and to ensure that the treatment is more effective. However alongside that the Government wants a strong law enforcement and criminal justice approach.

Health Services: Research

Question and Written Answer on Wednesday 25 July

Dr Gibson (Norwich N): To ask the Secretary of State for Health when his Department expects to publish the results of its scoping study of the burden of disease that will inform future work on health priorities; how that study has been structured; and who is leading it.

Dawn Primarolo: The Department expects to receive the final report on the scoping study by the end of August. No decision has been taken about its publication.

The study is based on a review of existing datasets and has been commissioned from Dr Stephen Green and Dr Rebecca Miles of Oxford Healthcare Associates.

Information Technology

Public Sector: IT Projects

Debate in the House of Lords on Thursday 21 June

Lord Lucas This Government have much to be proud of in what they have done in the field of Government IT. They have seen through some very successful projects: the DWP payment modernisation system, Consumer Direct, pension credit, Warm Front from Defra and NHS Direct. The Government have also made a number of structural improvements in how IT is dealt with in the Civil Service. The gateway reviews are an excellent innovation. Senior responsible owners, chief information officers and the Office of Government Commerce all speak of a Government who have at least an understanding of what is required to make a successful IT project. So why oh why are we faced with the likes of ID cards, the firearms licensing system, the rural payments system and the current mega NHS project? Why are we faced with failure

and catastrophe on that scale? I have concluded that there are four underlying themes. This Government have a fondness for centralisation, a lack of trust in professionals and others, a tendency to undermine rather than strengthen the Civil Service and a lack of openness. I suspect that these are ineradicable qualities of this Government. I have hope for a future Conservative Government. If I urge the Minister to do one thing, it is to drop the Government's opposition to making gateway reviews public. When there is a real problem, as in the NHS, the Government must do what they did on NATS and call in an outside consultant. The National Audit Office is just too much part of Government to do these things well. It is possible to get these things right but I do not have a lot of hope that this Government will.

Lord Davies of Oldham: In one area I shall disappoint nearly everyone who spoke in the debate which relates to the greater transparency to be achieved from the publication of gateway reviews. The gateway process has helped to achieve more than £2.5 billion in value-for-money savings. In the Government's view, disclosure would seriously undermine the effectiveness of the gateway process, as confidentiality is essential to the whole process. The process is a crucial management tool to improve the success of the Government's projects and programmes. In our view, it is just not in the public interest to put that effectiveness at risk by disclosing the information in the two reports in this case. I recognise that that will disappoint the House. The noble Lord, Lord MacLennan, is always assertive about the necessity for open government. He also raised the issue and I know he will be disappointed by the response. However, a balance has to be struck between the undoubted merits of openness about the Government's actions and areas such as this where there are delicate confidentiality issues involved.

Electronic Warfare

Question and Written Answer on Monday 16 July

Mr Jim Cunningham (Coventry S): To ask the Secretary of State for Foreign and Commonwealth Affairs what discussions he has had with his NATO counterparts on cyber-warfare.

Mr Jim Murphy: This issue has not been raised by NATO Foreign Ministers, but it was discussed by NATO Defence Ministers at their meeting on 14-15 June, who agreed to work to enhance the ability to protect infrastructure systems of critical importance to the Alliance from cyber-attacks. Cyber-defence is also the subject of discussion at official level in NATO.

Science Policy

Science and Heritage (Science and Technology Committee Report)

Debate in the House of Lords Grand Committee on Tuesday 12 June

Baroness Sharp of Guildford rose to move that the Grand Committee report to the House that it has considered the ninth report of the Science and Technology Committee on Science and Heritage in which a sub-committee of the Science and Technology Committee undertook to examine the application of science and technology to the care and conservation of our cultural heritage, an area that does not always receive the highest level of public attention. It is therefore particularly gratifying to note that the

recommendations were so well received and that so many of them are now being implemented. The Department for Culture, Media and Sport stand accused of breaching the Government's own sustainability code which asks all departments to ensure that the natural resources needed for life are unimpaired and remain so for future generations. Conservation gets no mention in the department's strategic objectives or in the public service agreements that it negotiates with its non-departmental public bodies. The other main conclusion refers to the lack of strategic leadership in the sector arising from the fragmentation of the sector by the practice of devolving responsibility to non-departmental public bodies. As a result there is no upward synthesis of needs and concerns. One could argue that the DCMS's strategy is to "divide and conquer" and thereby manage England's heritage in small parcels so that cumulative impacts are lessened or lost in the detail. The suggestion that the Arts and Humanities Research Council and English Heritage take up leadership in this sector had been welcomed and were now in process of fulfilling many of the vitally important duties left unattended by the DCMS.

Lord Davies of Oldham indicated that the committee had done its most successful work in highlighting that the DCMS does not sufficiently appreciate the relationship between the application of science and our heritage. The committee states that DCMS has inadequate resources for heritage protection and that that is a threat to heritage science. The committee has helped to identify areas where the department needs to make progress and develop an understanding of which resources can be employed. The committee has also helped to stimulate the selection of a chief scientific adviser. No assurances about future funding can be given. However the committee indicated that the report was a catalyst for action and had identified important areas of work not previously identified in such a graphic manner.

European Global Navigation Satellite System

Debate in the House of Commons on Monday 2 July

The Minister of State, Department for Transport (Ms Rosie Winterton):

The Government welcome the opportunity for a full discussion on the Galileo programme which is at a turning point. Negotiations with the merged consortium bidding for a public-private partnership concession have been ended. In October, the Transport Council and ECOFIN are likely to be asked to make a decision on the future direction of the programme. The Government intend that the decision should be based on a full assessment of all relevant factors, including the identification of the available options, their costs and risks, and the programme's affordability.

Mr William Cash (Stone) It is not often that the European Scrutiny Committee ends up having one of its proposals for debate taken on the Floor of the House. I wish that happened more often. At the heart of the Government's proposals is a severe question mark over the way in which the process is being conducted. As others have pointed out the abandonment of the PPP element demonstrates the lack of the proposal's viability. However the problem is that no one can actually stop them. The proposal is hopeless, and it is appalling that a clear majority of member states could continue to underline the strategic nature of the Galileo programme. We know the project is not a runner, and we know that there is no way that it can be made into one. The reality is that a huge amount of our taxpayers' money is being subsumed in this absurd

project. It is not a laughing matter if we think of it as money that could otherwise be spent on useful and important projects such as hospitals and schools.

Thomas Telford Anniversary

Debate in the House of Commons on Tuesday 3 July

David Mundell (Dumfriesshire, Clydesdale and Tweeddale): I see this debate as a contribution to the celebration of the life and legacy of Thomas Telford, an outstanding man, not just in his lifetime but as one whose work has shaped his profession to this day and many of whose engineering feats are still in use centuries later. His work opened up the highlands with more than 900 miles of new roads, hundreds of bridges, ferry landing piers and dozens of churches. Indeed the work enabled the transportation of goods and people across the whole of Scotland, facilitating many aspects of the industrial revolution. Thomas Telford's achievement was that he rose from being the son of a shepherd on a remote Dumfriesshire hillside to being the most lauded and esteemed civil engineer in the empire. That is just one reason why I would like to see the Government in Westminster and the Scottish Government in Edinburgh do more to promote recognition of the achievements of Telford and people of his ilk, who did so much to shape the modern world in the final centuries of the last millennium.

The Minister of State, Department for Culture, Media and Sport (Margaret Hodge): Scotland has an unparalleled record in producing civil engineers of the finest calibre, and Thomas Telford was clearly one of the most eminent of them all, which is signified by his burial in Westminster Abbey. It is right that those communities whose heritage has been enhanced by the work of Thomas Telford should seek to commemorate the 250th anniversary of his birth in an appropriate manner. I previously also had much interaction with the Institution of Civil Engineers who are co-ordinating events across the country. It is an excellent organisation that does an enormous amount of work in promoting engineering, and particularly in training. We have no specific plans, however, to mark the anniversary of Telford's birth, nor indeed that of William Blake, who was also born in 1757. I wish all those marking the occasion every success in their activities, and I pay tribute to the life and work of Thomas Telford.

Estimates, 2007-08 Department of Trade and Industry

Debate in the House of Commons on Monday 9 July

Mr Phil Willis (Harrogate and Knaresborough): I am concerned that the word "science" does not appear in the title of the new Department. The widely held view in the science community that this is a significant omission was summed up by the president of the Royal Society, Lord Rees who said "we would have preferred the word 'science' to have appeared in the new department's title." There is concern that the Department will be dominated by the university agenda, especially student fees, and that the focus on science and innovation will be diminished. There is also concern about the parliamentary scrutiny of science. Alone among Select Committees, the Science and Technology Committee has a dual role, for departmental and cross-government scrutiny of science, yet it appears that although departmental scrutiny may be accommodated within a DIUS Select Committee, the important scrutiny of science across Government will disappear.

The Minister of State, Department of Innovation, Universities and Skills (Ian Pearson)

Let me put on record the great value that the Government attach to the work of the Science and Technology Committee and the positive and constructive spirit in which its work has been conducted. Whatever arrangements are proposed through the usual channels, I hope that value will be recognised and reflected in future arrangements, and that there will be the opportunity and ability for science to be examined right across Government. I believe that that is important, but I would direct hon Members to the usual channels.

Machinery of Government

Debate in the House of Commons on Wednesday 25 July

The Leader of the House of Commons (Ms Harriet Harman)

moved that with the next session of Parliament, the system of Select Committee scrutiny of the Executive would be updated. Overall responsibility in Government for science and innovation issues was located in the Department of Trade and Industry until the recent machinery of government changes. It now forms a core part of the new Department for Innovation, Universities and Skills (DIUS). There has been great concern in the science community about ensuring the continuance of the work of the Science and Technology Committee, so that science issues, particularly ones that cut across Departments, will continue to be properly scrutinised. Many individuals and Learned Society representatives and others have submitted representations. We therefore propose that the DIUS Committee, instead of being a Committee of 11 members, should have 14 members. If the Committee choose to have a Sub-Committee covering science and technology issues, it will be able to operate that Sub-Committee, in effect, as a successor to the current Science and Technology Committee.

Mrs Theresa May (Maidenhead) I understand that questions to Chairmen of Select Committees will be allowed in the House and there will be more debates on Select Committee reports, but under the new structure questions would not be able to go to the Chairman of the Sub-Committee. If we retained the Science and Technology Committee, the Chairman of that Committee would be able to receive questions. The Sub-Committee is therefore no replacement for a stand-alone specialist Science and Technology Committee.

Dr Brian Iddon (Bolton, South-East) I am with one exception, Dr Turner, Member for Brighton, Kemptown, the longest serving member of the Select Committee on Science and Technology. I am particularly concerned about the amount of resources that the Sub-Committee will have in the light of the current workload amounting to seven to nine reports a year. I doubt that the Sub-Committee could get through two or three reports annually such as the space policy report, or the marine science report. It takes at least nine months to collect evidence and we travel extensively collecting evidence from abroad. In this country we must constantly measure ourselves against the best, which is usually America but also Japan, Germany and France. We have to travel to see what people are doing. Would adequate resources be available to provide sufficient Clerks and secretarial support for the Committee and to allow its members to travel? There are 11 members of the Science and Technology Committee but I guess that there will only be five or six on members on the Sub-Committee. A scientist serving on the main Committee covering DIUS who is also on the Sub-Committee will find that they have a

considerable extra volume of work. The Government are also creating regional committees. We are asking an awful lot of Members by creating this extra workload.

Mr Phil Willis (Harrogate and Knaresborough): I understand that it will be for the new DIUS Committee – not the Government – to establish the Sub-Committee, and it will then be that Committee's job to establish its terms of reference and agree them with the House. It is important that it should be called the Science and Technology Sub-Committee, and it is also important that it have free rein to go wherever it likes across Government wherever science is involved. It should be able to present reports to this House without fear or favour. In order for that to happen it will need adequate resources.

Transport

Exhaust Emissions: EU Action

Question and Written Answer on Thursday 19 July

Dr Kumar (Middlesbrough S & E Cleveland): To ask the Secretary of State for Transport what steps she is taking to ensure that technologies aimed at enabling vehicles to meet European standards for nitrogen oxides and particulate matter emissions are installed and maintained in optimum ways, with particular reference to selective catalytic reduction.

Jim Fitzpatrick: As I mentioned in my answer of 9 July 2007, Official Report, columns 1193-94W, from November 2007 new HGV and bus engines will be required to monitor their emission control systems and to limit engine power in the event of those emission control systems failing to operate. These provisions are essential to

encourage operators to keep the emission control systems properly maintained and working, and so ensure that the intended reductions in emissions of Oxides of Nitrogen (NOX) from current and future standards are actually delivered in operation.

The provisions apply equally to all HGV and bus engines, whether they are using exhaust gas recirculation or selective catalytic reduction, but may be of particular relevance where selective catalytic reduction is being used and the effectiveness of the system could be compromised by a simple omission, on the part of the vehicle operator or driver, to top up the AdBlue reagent.

In the case of engines using selective catalytic reduction (SCR), a level indicator for the AdBlue reagent, incorporating a low level warning, will be required to be displayed on the dashboard near the fuel gauge, and the On Board Diagnostic system will be required to monitor the quality, as well as the presence, of the reagent. On Board Diagnostic systems are also required to monitor for failures which could lead to increased particulate emissions.

Using an SCR equipped vehicle with an empty AdBlue tank would be an offence under regulation 61a of the Road Vehicles (Construction and Use) Regulations 1986, as amended, in that it will lead to excess emissions which could have been avoided by routine maintenance.

*Summaries of further debates on **Museums** (Westminster Hall 6 June); and **Packaging Manufacturing Industry** (Westminster Hall 12 June) can be found on our website www.scienceinparliament.org.uk*

Progress of Legislation before Parliament

A comprehensive list of Public Bills before Parliament, giving up-to-date information on their progress through Parliament, is published regularly when Parliament is sitting in the Weekly Information Bulletin, which can be found at:

<http://www.publications.parliament.uk/pa/cm/cmweb.htm>

Parliamentary and Scientific Committee News

New Members

We are delighted to welcome as new members:

Scientific and Technical Organisation

The Engineering and Technology Board represented by Clare Cox

Associate Member

The Copyright Licensing Agency represented by Mr Kevin Fitzgerald

The Committee's Website

www.scienceinparliament.org.uk

The editorial board of Science in Parliament would like to draw to the attention of members the existence on the website of the members' discussion forum. The forum gives members of the Committee the opportunity to post their views on issues raised at meetings and, on the General Discussion board, on any other matter likely to be of interest to members of the Committee.

Euro-News

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

European Council News

The European Council invited the Council of Ministers to agree swiftly on the first four proposals for Joint Technology Initiatives (JTI), namely Artemis on embedded computer systems, IMI on innovative Medicines, Clean Sky on aeronautics and air transport, and ENIAC on nano-electronics technologies. The leaders also invited the European Commission to present the remaining JTIs identified in the proposals for the Seventh Framework Programme (FP7) as quickly as possible, and recalled the importance of open and transparent management of these issues. The work done so far on the regulation for the European Institute of Technology (EIT) was welcomed and the EU Competitiveness Council was requested to agree on a general approach towards this initiative during its June 2007 meeting which should include provisions for adequate financing, in accordance with Community budgetary procedures. The European Council is confident that its final decision on the matter and that of the European Parliament (EP) will be taken before the end of this year.

Europe's future satellite navigation system, Galileo, stalled recently after the companies involved in the public-private partnership (PPP) charged with financing the initiative were unable to reach agreement on how to apportion the financial risks inherent in the project. In Brussels, the European Council reaffirmed the value of Galileo as a key project of the EU and asked the Competitiveness Council to take a decision on how Galileo should be implemented in Autumn 2007. The Commission has already put forward a number of suggestions on how public money could be used to finance Galileo.

The President of the European Council, German Chancellor Angela Merkel, has previously underlined the importance for competitiveness of securing the protection of intellectual property, and spoke of a forthcoming EU charter bringing in a voluntary code of practice on intellectual property, and promised that the German EU Council Presidency would be unstinting in its efforts to push for both the implementation of the London protocol, and then a Community patent. The initiative should improve the knowledge transfer between research and industry and its contribution to the development of the European research area (ERA).

ITER Fusion for Energy agency opens for business

An agreement on the premises of Fusion for Energy, setting out the conditions for the agency's activities and staff, was signed by the Spanish Minister for Science and Education, Mercedes Cabrera Calvo-Sotelo and Commissioner Potočnik. Based in Barcelona, the new European Joint Undertaking for the International Experimental Thermonuclear Reactor (ITER) and the Development of Fusion Energy, also known as Fusion for Energy, will work with industry and research organisations around Europe to provide the components needed to build ITER. Almost half the parts that make up ITER will come from Europe in the form of "in-kind" contributions.

European Research Council (ERC) has high number of overseas applicants

The ERC has provided further information on the 9167 applications received for the ERC's first round of grants which is much higher than many were expecting. Excellence will be the sole criterion for selection of the first stage applications whose principal investigators (PIs) will be invited to submit full proposals to be funded later this year. The six founding members of the EEC (Belgium, Germany, France, Italy, Luxembourg and the Netherlands) were by far the most active in submitting applications. Some 44.8% of the PIs that submitted proposals are currently living in these countries, while 46.2% of the institutions at which the research would be carried out are in this part of Europe. The ERC pre-allocated most of the starting grants to three broad domains: 15% for social sciences and humanities; 40% for life sciences, including medicine; and 45% for physical, mathematical and engineering sciences. The fields addressed largely mirrored this division (14.9, 37, and 48.1% respectively). The PIs can be of any nationality or current location, but must apply in conjunction with an institution in an EU Member State or associated country, where he or she will be based for at least the period of the grant.

The start of a new science diplomacy with Africa

Africa is tired of hand-outs from the West that take it nowhere, and is instead looking for support to help strengthen its research base so that science can be used to spearhead development. Africa still suffers from brain drain. In South Africa more than 300 specialist nurses leave the country every month. Zambia has seen its pool of doctors diminish four-fold in recent years and 45,000 Egyptian scientists have emigrated over the last 50 years. The result is limited national systems that cannot take up technological opportunities, poor management structures, very basic infrastructure, and a lack of human resources. The problems are exacerbated by a lack of investment, which leads to poor working conditions for researchers, and under-equipped universities that must restrict their teaching to theory. The solution? Increasing the flow of information between Europe and Africa, putting scientists in touch with one another, and promoting best practice would be a start. Offices in Brussels and Addis Ababa could serve as a helpdesk for increasing collaboration between researchers in the two regions. It was proposed that current initiatives should be looked at by MEPs to avoid duplication and if a favourable result is received, it could then be formally proposed at the March 2008 conference.

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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SCI
Society for General Microbiology
UFAW

Animal Health and Welfare, Veterinary Research

ABPI
Academy of Medical Sciences
British Veterinary Association
Cefas
The Nutrition Society
PHARMAQ Ltd
UFAW

Astronomy and Space Science

Natural History Museum
STFC

Atmospheric Sciences, Climate and Weather

Natural Environment Research Council
Newcastle University
STFC

Biotechnology

BBSRC
Biochemical Society
Biosciences Federation
Campden & Chorleywood Food Research Association
Eli Lilly & Company
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LGC
National Physical Laboratory
Newcastle University
Royal Society of Chemistry
SCI
Society for General Microbiology

Brain Research

ABPI
Eli Lilly & Company
Merck Sharp & Dohme
Newcastle University

Cancer Research

ABPI
Eli Lilly & Company
Newcastle University

Catalysis

Institution of Chemical Engineers
Royal Society of Chemistry

Chemistry

CCLRC
Institution of Chemical Engineers
LGC
London Metropolitan Polymer Centre
Newcastle University
Royal Institution
Royal Society of Chemistry
SCI

Colloid Science

London Metropolitan Polymer Centre
Royal Society of Chemistry

Construction and Building

Institution of Civil Engineers
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Education, Training and Skills

ABPI
Academy of Medical Sciences
Biosciences Federation
British Association for the Advancement of Science

British Ecological Society
British Nutrition Foundation
British Pharmacological Society
British Society for Antimicrobial Chemotherapy
CABI
Campden & Chorleywood Food Research Association
Clifton Scientific Trust
Economic and Social Research Council
Engineering and Physical Sciences Research Council
Institute of Biology
Institute of Physics
Institution of Chemical Engineers
Institution of Engineering and Technology
LGC
London Metropolitan Polymer Centre
NESTA
Natural History Museum
Newcastle University
Royal Institution
The Royal Society
Royal Statistical Society
SEMTA

Energy

Institution of Chemical Engineers
Institution of Civil Engineers
Institution of Engineering and Technology
Newcastle University
SCI
STFC

Engineering

Engineering and Physical Sciences Research Council
Institution of Chemical Engineers
Institution of Civil Engineers
Institution of Engineering and Technology
London Metropolitan Polymer Centre
Royal Academy of Engineering
SCI
SEMTA
STFC

Fisheries Research

AMSI
Cefas
Freshwater Biological Association

Food and Food Technology

Biosciences Federation
British Nutrition Foundation
CABI

Campden & Chorleywood Food Research Association
Institute of Biology
Institution of Chemical Engineers
LGC
Newcastle University
The Nutrition Society
Royal Society of Chemistry
SCI
Society for General Microbiology

Forensics

LGC
Royal Society of Chemistry

Genetics

ABPI
BBSRC
HFEA
LGC
Natural History Museum
Newcastle University

Geology and Geoscience

AMSI
Institution of Civil Engineers
Natural Environment Research Council
Natural History Museum

Hazard and Risk Mitigation

Health Protection Agency
Institution of Chemical Engineers

Health

ABPI
Academy of Medical Sciences
Biochemical Society
Biosciences Federation
British Nutrition Foundation
British Pharmacological Society
British Society for Antimicrobial Chemotherapy
Economic and Social Research Council
Eli Lilly & Company
Health Protection Agency
HFEA
Institute of Biology
Institute of Physics and Engineering in Medicine
LGC
Medical Research Council
Newcastle University
The Nutrition Society
Royal Institution
Royal Society of Chemistry
Society for General Microbiology

Heart Research

ABPI

Hydrocarbons and Petroleum

Natural History Museum
Newcastle University
Royal Society of Chemistry

Industrial Policy and Research

AIRTO
Economic and Social Research Council
Institution of Civil Engineers
Royal Academy of Engineering
SCI
STFC

Information Services

AIRTO
CABI

IT, Internet, Telecommunications, Computing and Electronics

CABI
Engineering and Physical Sciences Research Council
Institution of Engineering and Technology
Newcastle University
STFC

Intellectual Property

ABPI
The Chartered Institute of Patent Attorneys
NESTA
Newcastle University

Large-Scale Research Facilities

Campden & Chorleywood Food Research Association
London Metropolitan Polymer Centre
Natural History Museum
STFC

Lasers

STFC

Manufacturing

ABPI
AMSI
Engineering and Physical Sciences Research Council
London Metropolitan Polymer Centre
SCI

Materials

London Metropolitan Polymer Centre
National Physical Laboratory
STFC

Medical and Biomedical Research

ABPI
Academy of Medical Sciences
Biochemical Society
Biosciences Federation
British Pharmacological Society
British Society for Antimicrobial Chemotherapy
Eli Lilly & Company
HFEA
Medical Research Council

Newcastle University
UFAW

Motor Vehicles

London Metropolitan Polymer Centre
SEMTA

Oceanography

AMSI
Cefas
Natural Environment Research Council

Oil

Institution of Chemical Engineers
LGC

Particle Physics

STFC

Patents

The Chartered Institute of Patent Attorneys
NESTA

Pharmaceuticals

ABPI
British Pharmacological Society
British Society for Antimicrobial Chemotherapy
Eli Lilly & Company
Institution of Chemical Engineers
LGC
Merck Sharp & Dohme
PHARMAQ Ltd
Royal Society of Chemistry
SCI

Physical Sciences

Cavendish Laboratory
Engineering and Physical Sciences Research Council
London Metropolitan Polymer Centre
National Physical Laboratory

Physics

Cavendish Laboratory
Institute of Physics
National Physical Laboratory

Pollution and Waste

ABPI
AMSI
CABI
Cefas
Institution of Chemical Engineers
Institution of Civil Engineers
London Metropolitan Polymer Centre
Natural Environment Research Council
Newcastle University

Psychology

British Psychological Society

Public Policy

Biosciences Federation
British Nutrition Foundation
British Society for Antimicrobial

Chemotherapy
Economic and Social Research Council
HFEA
NESTA
Prospect

Public Understanding of Science

Academy of Medical Sciences
Biochemical Society
British Association for the Advancement of Science
British Society for Antimicrobial Chemotherapy
Clifton Scientific Trust
Engineering and Physical Sciences Research Council
HFEA
Institute of Biology
Institute of Physics
Institution of Chemical Engineers
Institution of Engineering and Technology
Medical Research Council
Natural History Museum
NESTA
Prospect
Royal Academy of Engineering
Royal Institution
The Royal Society
Royal Society of Chemistry

Quality Management

Campden & Chorleywood Food Research Association
LGC

Radiation Hazards

Cefas
Health Protection Agency

Retail

Marks and Spencer

Science Policy

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

Seed Protection

CABI

Sensors and Transducers

AMSI
STFC

SSSIs

Natural England
Royal Botanic Gardens Kew

Statistics

Royal Statistical Society

Surface Science

STFC

Sustainability

Biosciences Federation
British Ecological Society
CABI
Cefas
Institute of Biology
Institution of Chemical Engineers
Institution of Civil Engineers
London Metropolitan Polymer Centre
Natural England
Newcastle University
SCI

Technology Transfer

CABI
Campden & Chorleywood Food Research Association
LGC
London Metropolitan Polymer Centre
NESTA
National Physical Laboratory
STFC

Tropical Medicine

Health Protection Agency
Society for General Microbiology

Viruses

ABPI
Health Protection Agency
Society for General Microbiology

Water

AMSI
Campden & Chorleywood Food Research Association
Cefas
Freshwater Biological Association
Institution of Chemical Engineers
Institution of Civil Engineers
LGC
Royal Society of Chemistry
SCI
Society for General Microbiology

Wildlife

Biosciences Federation
British Ecological Society
Institute of Biology
Natural England
Natural History Museum
UFAW

Association of the British Pharmaceutical Industry



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

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

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

Association of Marine Scientific Industries



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

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

The Academy of Medical Sciences



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The 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



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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



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

BIOSCIENCES FEDERATION

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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



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

British Association for the Advancement of Science - the BA



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 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



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 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



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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

Today's science, tomorrow's medicines

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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

The British Psychological Society

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

British Society for Antimicrobial Chemotherapy

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E-mail: tguest@bsac.org.uk
Website: www.bsac.org.uk

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

British Veterinary Association



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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, particularly government

BVA carries out three main functions which are:

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



www.cabi.org

CABI

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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



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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,
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http://www.phy.cam.ac.uk

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

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

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

High Energy Physics: LEP, SPS & future LHC experiments. Detector development. Particle physics theory.

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



Cefas

Centre for Environment, Fisheries & Aquaculture Science

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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
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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

CLIFTON SCIENTIFIC
Trust

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

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

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

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

Clifton Scientific Trust Ltd is registered charity 1086933

Economic and Social Research Council



**Contact: Lesley Lilley, Senior Policy
Manager, Knowledge Transfer,
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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: Dr Karin Briner,
Managing Director,**
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E-mail: k.briner@lilly.com
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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

EPSRC

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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



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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



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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 issues 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



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Website: www.hfea.gov.uk

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

Institute of Biology



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

IOP Institute of Physics

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Website: www.iop.org

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

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

Institute of Physics and Engineering in Medicine



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

IChemE

Institution of Chemical Engineers

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

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Institution of Civil Engineers



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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



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

LGC



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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



Sir John Cass Department of Art, Media & Design

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

Marks & Spencer Plc

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Main Business Activities

Retailer – Clothing, Food, Home and Financial Services

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

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

Medical Research Council



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



Merck Sharp & Dohme Research Laboratories

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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: Nicholas Bojas
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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



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

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

Natural England



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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



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

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

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

Natural History Museum



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



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

The Nutrition Society



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

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

Principal activities include:

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

PHARMAQ

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Website: www.pharmaq.no

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

Prospect



Contact: Sue Ferns,
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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 Academy
of Engineering

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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.

Kew
PLANTS PEOPLE
POSSIBILITIES



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.

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Email: s.owens@kew.org
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SAVING THE WORLD'S PLANTS FOR LIFE

The Royal Institution



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E-mail: ri@ri.ac.uk Website: www.righ.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 Society



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

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

RSC Advancing the Chemical Sciences

The Royal Society of Chemistry

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The Royal Society of Chemistry
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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.

The Royal Statistical Society



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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 Science Council



Contact: Diana Garnham,
Chief Executive
32-36 Loman Street
Southwark
London SE1 0EH
Tel: 020 7922 7888
Fax: 020 7922 7879
Email: enquiries@sciencecouncil.org

The Science Council was established by Royal Charter in 2003 with the objects to advance science and its applications for public benefit. It is a membership organisation for learned and professional bodies across science and its applications and works with them to represent this sector to government and others. The Science Council promotes the profession of scientist through the Chartered Scientist designation and the development of codes of practice; it promotes awareness of the contribution of professional scientists to science and society and advances science education and increased understanding of the benefits of science. The Science Council provides a forum for discussion and exchange of views and works to foster collaboration between member organisations and the wider science, technology, engineering, mathematics and medical communities to enable inter-disciplinary contributions to science policy and the application of science.



Technology Skills For Productivity & Performance

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Website: www.semata.org.uk

SEMATA (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



Science & Technology
Facilities Council

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

society for general Microbiology

Contact: Public Affairs Administrator
Marlborough House, Basingstoke Road,
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Tel: 0118 988 1843 **Fax:** 0118 988 5656
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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
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Website: www.soci.org

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

Society of Cosmetic Scientists



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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



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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.

Links to online publications in Science, Engineering and Technology that are likely to be of interest to readers of Science in Parliament

1. The United Kingdom Research Council Newsletter: <http://www.rcuk.ac.uk/news/bulletin>
2. RCUK Dispatch which is a fortnightly round up of research stories and major funding announcements, and events from all of the United Kingdom Research Councils: <http://www.rcuk.ac.uk/news/dispatch>

N.B. Editors of online publications in Science, Engineering and Technology are invited to contact the Editor of Science in Parliament with a view to the mutual exchange and publication of links. Please note that back numbers of Science in Parliament that are more than one year old are currently freely available online from the website. Current issues are available to Members of the Parliamentary and Scientific Committee or by subscription:
<http://www.scienceinparliament.org.uk>

Science Diary

The Parliamentary and Scientific Committee

Contact: Annabel Lloyd
020 7222 7085:
lloyd@pandsccte.demon.co.uk
www.scienceinparliament.org.uk

Monday 22 October 17.30

Global Population Growth – Is It Sustainable?

Professor Malcolm Potts, University of California, Berkeley
Dr Therese Hesketh, Institute of Child Health, UCL
The Earl of Selborne FRS

Tuesday 13 November 08.30

Breakfast Briefing

Potential for Concentrated Solar Power and Creation of a HVDC Grid

Dr Gerry Wolff, Co-ordinator TREC-UK
Neil Crumpton, Friends of the Earth

Monday 26 November 17.30

How can Science help to prevent Natural Disasters becoming Economic and Human Catastrophes?

Professor Stephen Sparks FRS, Director, Centre for Environmental and Geophysical Flows, Bristol University
Professor Christopher Rapley CBE, Director, Science Museum
Professor John Dewey FRS, University of California, Davis, and University College, Oxford

Wednesday 5 December

Annual Lunch at the Savoy Hotel

Sir David King FRS

Tuesday 11 December 10.00

Visit to V&A Museum Conservation Department

Tuesday 22 January 17.30

New Diseases and Renewed Threats

Professor Hugh Pennington FRSE, President, MRSA Action UK
Professor Nigel Minton, University of Nottingham
Professor Andrew McMichael FRS, Weatherall Institute of Molecular Medicine, University of Oxford

Tuesday 26 February 17.30

Discussion Meeting – subject and speakers to be confirmed

The Royal Institution

The Royal Institution's lecture theatre will reopen in autumn 2007, but the rest of the Ri will remain under refurbishment until summer 2008. See www.rigb.org or telephone 020 7409 2992 for full details and to book tickets.

Friday 26 October 20.00

Why can't a man be more like a woman?

Dr Jane Mellanby

Friday 2 November 20.00

Can chemical warfare be ethical?

Prof Alistair Hay

Wednesday 7 November 19.00

An evening with Adam Hart-Davis

Baroness Susan Greenfield and Dr Adam Hart-Davis

Friday 9 November 20.00

Scar Wars

Prof Mark Ferguson

Tuesday 13 November 19.00

The Faraday factor: why is he so famous?

Prof Frank James

Wednesday 14 November 19.00

Boosting your brainpower: the science and ethics of cognitive enhancement

Prof Robin Gill, Prof John Harris and Prof Barbara Sahakian

Friday 16 November 20.00

What is the brain for?

Prof Geoffrey Raisman

Tuesday 20 November 19.00

From brains to black holes: what the future holds

Baroness Susan Greenfield and Lord Martin Rees

Wednesday 21 November 18.30

The unusual world of tiling patterns and quasi-crystals

Prof Sir Roger Penrose

Thursday 22 November 18.30

Medical research through thick and thin

Prof David Carling, Matthew Sanders and Dr Michael Snowden

Friday 23 November 20.00

Space exploration: the next 50 years

Prof Monica Grady

Friday 30 November 20.00

Machines that learn

Prof Christopher Bishop

5, 8, 11, 13, 15 December 17.00

The Royal Institution Christmas

Lectures

Back from the brink: the science of survival

Dr Hugh Montgomery

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 a whole breadth of science, engineering and technology. All events are free to attend and open to all.

Wednesday 24 October 18.30

Thinking like a vegetable: how plants decide what to do

Professor Ottoline Leyser FRS

Monday 29 October 18.30

Climate change on the living Earth

Professor James Lovelock FRS

Wednesday 7 November 18.30

The uses of infinity: a philosopher looks at emergent phenomena in physics

Dr Jeremy Butterfield

Monday 12 & Tuesday 13 November (all day)

Photosynthetic and atmospheric evolution

Wednesday 14 November 18.30

Washing dirty lab coats on the page and the stage

Professor Carl Djerassi

Wednesday 28 November 18.30

Nature and nurture in brain function: clues from synesthesia and phantom limbs

Professor V S Ramachandran FRS

Monday 3 December 18.30

Touchdown on Titan

Professor John Zarnecki

Monday 3 & Tuesday 4 December (all day)

Titan: atmosphere and space

Wednesday 5 December 18.30

Decoding consciousness

Dr Geraint Rees

Please see www.royalsoc.ac.uk/events for the full events programme, further details of the above events and webcasts of past events.

The Royal Academy of Engineering

3 Carlton House Terrace, London SW1Y 5DG

www.raeng.org.uk/events or
events@raeng.org.uk
020 7766 0600

Royal Society of Edinburgh

22-26 George Street, Edinburgh EH2 2PQ.

Tel: 0131 240 5000 Fax: 0131 240 5024

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

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

Thursday 1 November 17.30

The Science of Improvement: Why Scotland Needs its Public Intellectuals

Professor Duncan Rice FRSE, Principal and Vice-Chancellor, University of Aberdeen

Thursday 29 & Friday 30 November

Inflammation and Inflammatory Disease

Full day Conference

Monday 3 December 17.30

Cellular Clocks in Humans

Professor Ole D Laerum CorrFRSE, President, Norwegian Academy

Monday 4 February 17.30

Security, Insecurity, Paranoia and Quantum Mechanics

Professor Stephen Barnett FRS FRSE, Professor of Quantum Optics, Department of Physics, University of Strathclyde

The Physiological Society

Contact: Liz Bell
e-mail: ebell@physoc.org
Tel: 020 7269 5711

Monday 19 November 13.00-16.00

Cystic fibrosis: latest advances in medical research and implications for patients and their families

Kohn Centre, The Royal Society
6-9 Carlton House Terrace
London SW1Y 5AG.



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100 years of living science

In 2007 Imperial College London celebrates the Centenary of its founding charter, which combined three renowned 19th century institutions.

Over the last 100 years the College has become one of the world's leading science-based universities, responsible for discoveries including penicillin and holography, and innovations such as the maglev train and robotic surgery.

Today we strive to create an environment that encourages our students and researchers to become the next generation of pioneers and innovators.

Visit our website to find out more about our history, the Centenary fundraising campaign and how you can be involved.

Read Sir Richard Sykes on the importance of university science — page 18.