Spring 2004

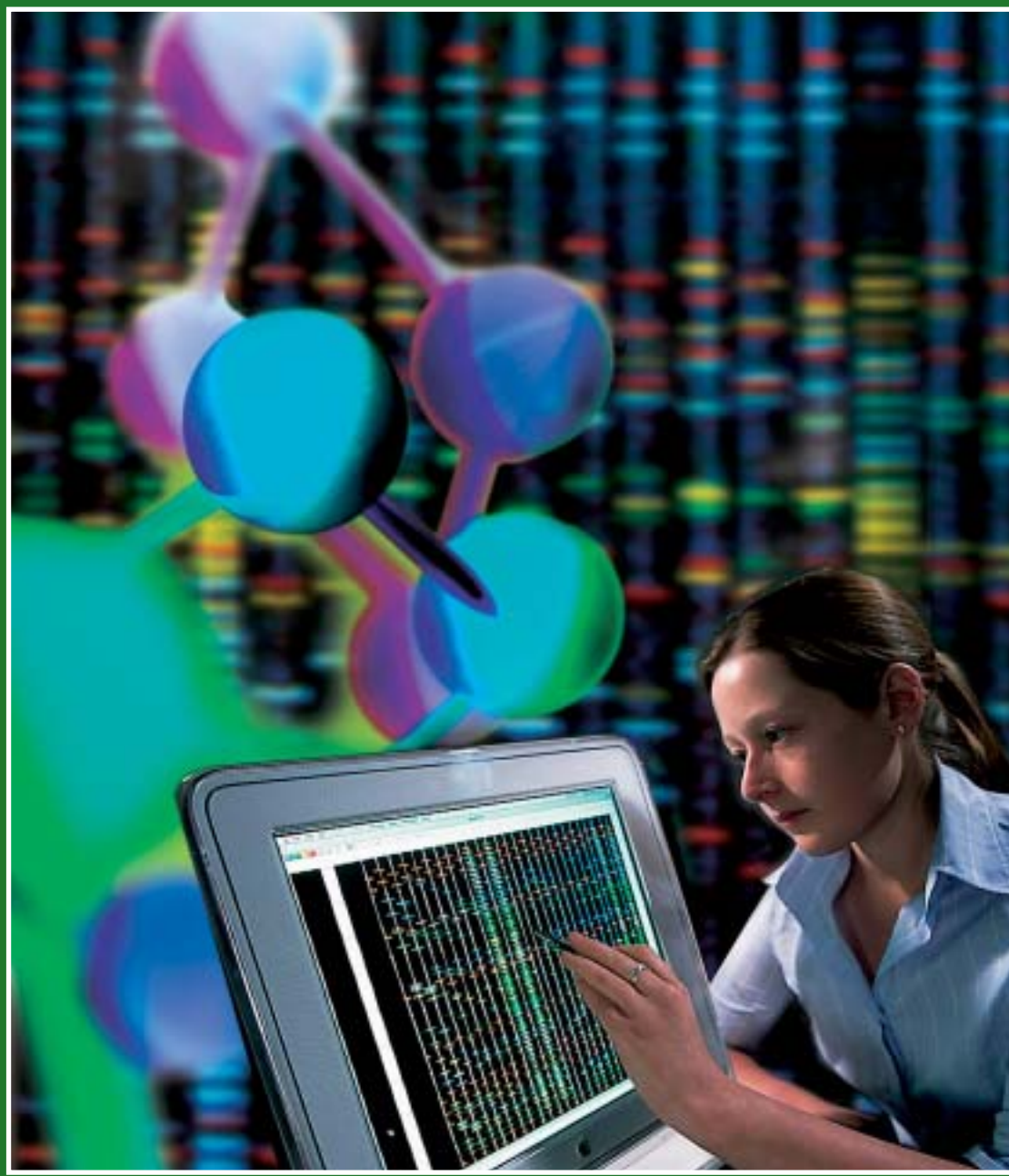
# SCIENCE IN PARLIAMENT

Science Education

The Regulation of Nanotechnology

Designer Babies

The GM Debate



LGC - a Privatisation Success

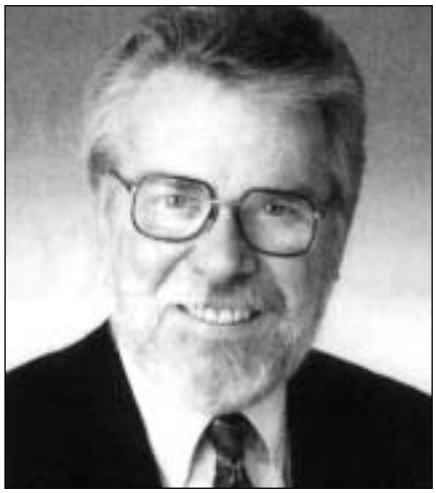
# SCIENCE IN PARLIAMENT

*The Journal of the Parliamentary and Scientific Committee.*

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


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

The Parliamentary and Scientific Committee



In his article "GM: The Politics of Uncertainty" Michael Meacher asks "Do GM crops cause harm to the environment or to human health? And do the benefits of GM foods outweigh the risks?" and concludes; "When the GM benefit is insignificant and the downside risk is enormous, why take the risk?" On the other hand Alan Malcolm vigorously rebuts this conclusion, pointing out that "There are challenges ahead. Some of the answers are not clear, and some of the political ones never will be."

In similar vein Professor George Smith in addressing risks associated with "loose" nanoparticles and nanofibres points out that "in the case of GM products … precautionary work was either forgotten, or left until very late in the development cycle. We must not let this happen again with nanotechnology."

Lord Soulsby points out that "Sixty per cent of ill health in the UK is due to infections, while the magic bullets of antibiotics have lost their power as witnessed by MRSA in hospitals. There is a sea of exotic infections around us whose entry into the UK could occur at any time."

These and other hot topics from Designer Babies and Science Education to rebuilding the UK transport infrastructure are discussed in this issue.

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

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# GM: The Politics of Uncertainty

*The Rt Hon Michael Meacher MP*

From a scientific point of view (as opposed to political), the questions are quite simple. Do GM crops cause harm to the environment or to human health? And do the benefits of GM foods outweigh the risks?

In 1999 the Government set up the Farm-Scale Evaluation trials to answer the environmental question. The report on the trials in 2003 found that GM oilseed rape and GM beet, because of the herbicide used which was part of the package, did indeed cause significant harm to wildlife and the environment. In the case of maize, the report found the reverse: that conventional cultivation caused greater harm than GM cultivation. But there were two reasons for this. First, conventional maize cultivation uses atrazine as the herbicide which is so toxic and damaging to the environment that it has now been banned throughout the EU, so that trials involving a chemical that will not be used in future are no longer valid. Secondly, Bayer told the GM maize farmers to carry out only one spraying with Liberty (glufosinate ammonium), so that the weeds would grow again and the environmental impacts would appear better. But farmers in real life, seeking to maximize yield, would never confine themselves to a single spraying.

The Government repeatedly stated throughout the trials that if GM crops were shown to cause harm to the environment, they would not license them for cultivation in the UK. That has now been conclusively demonstrated in the case of oilseed rape and beet. In the case of maize, if a less toxic chemical weedkiller were substituted for atrazine as is now required, and if the normal two sprayings were used for GM maize crops, it is very likely that the same results would be found for maize as for oilseed rape and beet. The environmental case against GM is therefore clearly made. And that is even before the wider environmental impacts of GM are examined – namely the effects on soil residues and bacteria, transgene flows, and impacts on bird populations – all of which were excluded from the FSE trials because they were so narrowly drawn.

What is the effect of GM on human health? Astonishingly, there have been virtually no clinical tests of the effects of eating GM foods on human beings. Instead, the biotech companies compare any new GM product with its non-GM counterpart in terms of toxins, allergens and nutrients, and if they are broadly similar, they simply assume the GM product to be safe on the basis of the notorious principle of "substantial equivalence". But substantial equivalence has no validity in science whatsoever.

There are very strong reasons why direct and specific health testing of GM foods is needed. First, GM technology is an uncertain and destabilising one, since genes are inserted randomly out of sequence. And genes don't operate in isolation; it is now known how to determine artificially a single function of a gene without triggering other unpredictable and undesired effects. Second, the vectors used are viruses or bacteria which often transfer out of the GMO into other organisms (ie horizontal gene transfer, for example into the human gut, as in Newcastle study 2002). Third, allergic reactions can be quite widespread because the GMO is a novel product (as instanced in the StarLink maize episode in the US in 2000). Fourth, the broad-spectrum herbicides used with GM crops are extremely toxic: glufosinate ammonium is a neurotoxin and a teratogen (ie it harms embryos). And research shows a 10% reconversion rate out of degraded herbicide back to the original toxic form in the human gut. Indeed, more generally, the Medical Research Council has concluded that more knowledge is needed of the effects of GM on metabolism, organ development, immune and endocrine systems, and gut flora.

There are therefore real, serious and unexplored risks from GM both to the environment and human health. Are the benefits then so compelling that it is worth taking these risks? Again, astonishingly, there are in fact no consumer benefits from GM at all, as the biotech companies themselves admit. But would GM, as is often claimed, help to feed the starving masses of the world? The truth is that world poverty and starvation derive from keeping developing countries in a grossly inequitable world trading system, from corrupt or bad governments, from gross maldistribution of land, from spiralling population increases, or from any combination of these. In the absence of controlling these fundamental causes, the role of GM is utterly marginal.

So when the GM benefit is insignificant and the downside risk is enormous, why take the risk?

# GM: The Certainty of Science

*Professor Alan D B Malcolm*

Michael Meacher seems to have learned astonishingly little during his time as a Minister.

Food is a consumer product like no other because we need it, and because "Eating is the only sensual pleasure conducted by consenting adults three times a day in public". Many of the world's great religions have strong food taboos. It is therefore scarcely surprising that hysteria should be so rampant when anyone attempts to "adulterate" our food supply.

But Michael Meacher knows that high fructose corn syrup made from GM maize is chemically and nutritionally identical to that produced from "classical" maize, in just the same way as sugar from cane is the same as sugar from beet. None of these products contains DNA or potentially allergenic proteins. The same can be said of the emulsifier lecithin from GM soya, and many other products that are enjoyed by citizens of many countries.

The insect populations under GM sugar beet in Norfolk, and around cotton plants in China are MORE diverse than before, with a beneficial effect on the bird populations that thrive on them.

This does NOT mean that ALL GM products are safe – only those that have been produced and tested so far. Any new one needs to be individually scrutinised, as happened in the field trials that he was responsible for supervising. Even if a real hazard is identified, this no more damns an entire technology than a minor domestic electrical fault leads to the disconnection of the national grid.

## Where GM is the only option

He knows that there are several products produced using GM technology that are difficult or impossible to make any other way, such as human insulin produced by inserting the human gene into a bacterium, which is grown in culture. The GM-produced insulin has been injected every day into many millions of the population for over a decade – a challenging test.

## Bt Cotton

Building the production of Bt toxin into the plant (instead of spraying bacteria over the crop, as the organic movement has been doing for half a century) can lead to a reduction in the use of noxious pesticides. In China, this has led to a reduction in organophosphate poisoning of peasant farmers. Rachel Carson might actually have been an enthusiast for Bt maize!

Consumers are not indifferent to production methods that may involve consequences, such as rising carbon dioxide levels, aesthetics of wind farms, risk of radioactive leaks or explosions, allergies to pollen from oil seed rape (canola), or objections to the yellow colour of the countryside.

## The Complexity of Food

Food is a complex consumer product. We have more variation in type, size, colour, skin thickness, sweetness and texture of apples in my local supermarket than there are brands of television in my local branch of Dixons. Nutritionally, while not identical, the apples are *substantially equivalent*.

Food is not a consumer product like paper napkins or rolls of film or televisions. With the latter we know that million after million of the objects have been produced in a factory, and made identical to a high degree of precision. On the other hand we accept variability in our fruit and vegetables with varying degrees of goodwill. We know that this week's Brie will not be identical to last week's, but it is substantially equivalent in terms of food safety, nutrition and enjoyment.

We are now all victims of the sloppy and irresponsible use of the term GM. The food that we have been talking about is not modified in any way whatsoever. The plant that gave rise to it undoubtedly has been.

But supposing we did eat the DNA of a modified plant? So what? Michael Meacher acknowledged on television a few months ago that he has been eating tomato seeds for over half a century and yet none of his cells shows any evidence of having been infiltrated by tomato genes.

## Cross-fertilisation

What would happen if some seeds/pollen from these plants escaped and cross fertilised with indigenous plants? Of course the pollen will distribute itself widely – that is what pollen is for. Cross fertilisation is actually very difficult, except with highly similar species. The offspring of most of these crosses will die out in the absence of the original selective pressure. However when the one in a hundred million chance does happen, and an undesirable plant emerges, surely we will do what farmers did for millennia before the industrial revolution, and what I and my friends still do regularly on my allotment. We dig 'em up and either compost or burn them.

## Exactly so

There are challenges ahead. Some of the answers are not clear, and some of the political ones never will be.

Perhaps Michael does know all this, but is merely being economical with the

***The author is Chief Executive of the (independently funded) Institute of Biology, and also a member of the Government's Advisory Committee on Novel Foods and Processes, but is here writing in a personal capacity.***

# Fighting Infection

*The Lord Soulsby of Swaffham Prior*

The Science and Technology Select Committee of the House of Lords has a remit "to examine science and technology". The Science and Technology Committee in the Commons is structured differently and scrutinises the Office of Science and Technology and enquiries are short, topical and political. They seek to make immediate impact and receive good media coverage.

Lords Committees consider matters at length, witnesses receive questions in advance and evidence sessions focus on gaining high quality information. Reports are widely respected, as Lords members often have relevant expertise, and so it was with the sub-committee of the Lords on "Fighting Infection"; five are medically qualified Peers; a veterinarian, one with nursing qualifications, a Patron of the Chronic Diseases Research Foundation, a former member of a Hospital NHS Trust, as well as Peers with experience of research and University administration. Three are Fellows of the Academy of Medical Sciences and two are Fellows of the Royal Society, a powerful array of knowledge. Two technical advisers were appointed to cover scientific and hospital issues.

The Science and Technology Committee works through two sub-committees and ours started with a Seminar, organised by the Academy of Medical Sciences, highlighting the issues to be addressed by the enquiry. The importance of infectious diseases, their detection and prevention had slipped from the main agenda of health concerns in the United Kingdom and world wide. The Surgeon General of the United States stated erroneously to the US Congress in 1969, "It is time to close the book on infectious diseases and to declare the war against pestilence over."

Sixty per cent of ill health in the UK is now due to infectious agents, ranging from the common cold to meningitis, pneumonia, food poisoning and AIDS to mention a few. The "magic bullets" of antibiotics have lost their power as witnessed by the progressive increase in infections unresponsive to antibiotics, such as MRSA in hospitals. There is a sea of exotic infections whose entry into the UK could occur at any time, such as Ebola virus, SARS, malaria, multi-drug resistant TB, West Nile Fever and the avian flu now raging in the Far East. The massive global movement of people, animals and foodstuffs makes surveillance difficult but essential. For example, some 64 million passengers pass through Heathrow Airport every year; each could potentially and inadvertently carry an infectious exotic agent.

The enquiry also received a document from the Chief Medical Officer "Getting Ahead of the Curve". This presented plans for the future of health delivery in several areas and to ensure the House of Lords enquiry was not reiterating what was stated therein, a meeting with Ministry of Health officials confirmed the need for an enquiry into prevention and control of infectious diseases. It was a solid base for the enquiry.

The call for evidence specifically excluded the more social or political issues of MMR vaccination and sexually transmitted infections, though with regard to vaccination, the more of the human herd who are vaccinated, the greater the security against infection. The call for evidence produced an avalanche of responses which form a valuable part of the enquiry; they are available as hard copy, on the web, and included in a CD ROM which accompanies the sub-committee's Report. They provide an important source of information to those interested in infectious disease control and prevention in the UK.

The technical advisers and Committee Clerks, who are remarkable individuals, sift the evidence and are able to address a very wide range of topics and summarise a mass of information with both clarity and superb scholarship

Scheduling oral evidence brings together individuals and organisations with related written submissions. For example, those dealing with vaccine research and development are placed together. Usually two groups of individuals, each of two to four people, are questioned at each session lasting approximately two hours. The sessions are open to the public and often televised. A transcript of evidence is taken and published as part of the overall enquiry. Public attendance varies with much depending on the individuals or groups invited to give evidence. The public are not allowed to intervene and ushers keep an eye on anyone liable to cause disruption.

Invited witnesses receive questions to be asked prior to meeting the sub-

committee. The Chairman also allocates these questions to an appropriate member of the Committee of Enquiry, reflecting their interest and competence, before the witnesses enter. The witnesses are advised that additional questions may be asked, as supplements to their replies, and these usually form the major part of the evidence sessions. Witnesses may also listen to the evidence presented by others during the session. The acoustics are poor in some of the rooms of the Committee Corridor of the House of Lords and it is occasionally necessary for witnesses to be asked to speak up for the benefit of Committee members and transcript recorders.

An important witness, from the Department of Health in our case, was a Minister who was well briefed and responded well to questions; civil servants from the department are seen separately and they too were well briefed.

It is usual for a Committee of Enquiry to visit institutions with an interest in the enquiry topic. We visited Birmingham, where over a three-day period, input was received from a wide range of health professionals representing regional interests rather than those with a London focus. These included hospital-based inspections, environmental health issues, water quality and meat hygiene to mention a few. We had been alerted previously to a decline in the numbers of environmental health inspectors, these being front-line health personnel, though there may be unwillingness to communicate infectious disease matters to this important specialist group. We also heard evidence on safety of bottled water which may accumulate substantial amounts of micro-organisms if stored in a non-refrigerated place. Tap water is probably safer than the carbonated spring water so frequently offered in restaurants.

A visit to the World Health Organisation, Geneva is a "must" for information on the global situation for infectious disease. We were not disappointed and Dr Bruntland the Director-General attended our meetings with the Head of Infectious Diseases, demonstrating power of strong leadership at WHO. In critical health situations WHO depends on the ability of member countries to supply experts to assist in investigation and control. One of our recommendations is that the UK should ensure the ability to respond effectively to requests for assistance from bodies such as WHO. We also visited the WHO centre dealing with the health of immigrants that can pose a major problem to Western countries, such as tuberculosis, especially multi-drug resistant TB, that is an increasing problem, frequently accompanied by HIV infection. Thus three infections, HIV, TB and malaria, constitute important threats to immigrant communities in the UK.

Visits to the Centers for Disease Control in Atlanta, the Institute of Medicine and the National Institutes of Health in Washington DC were particularly important. We were updated with the concerns of health control officers in the USA by Dr Julie Gerberding, Director of CDC, where TB is high on their agenda. Hospital facilities with isolation procedures for TB are much in advance of ours. We were particularly impressed by the Harlem Hospital in New York, where many destitute patients of immigrant origin undergo prolonged and unpleasant treatments for drug resistant TB with enthusiasm and actively recruit others to the programme.

West Nile Virus, transmitted by mosquitoes, is now widespread in the USA with ill health and mortality in horses and humans, which was first noted by veterinarians when increases in crow mortality led to detailed investigation. The virus was also detected in migratory birds in the British Isles but no human cases have been reported – yet! It is well established in horses in the Camargue in France, indicating the importance of collaboration between human and animal health authorities.

In the House of Lords, the Report was taking shape and chapters were being circulated for comment, when the SARS (Severe Acute Respiratory Syndrome) emergency as if on cue became an international problem, in which the Health Protection Agency played a critical role in providing personnel. We have much to learn from this epidemic, especially the origin and spread of SARS, and the needs for surveillance and reporting of infections that arise in China, for example.

Preparation for pandemics requires judgement, especially for vaccine research, and the provision of adequate doses of vaccine. Supplementary vaccines are required from Europe to immunise those susceptible to the influenza pandemic in the USA. The UK vaccine capability is not strong and supplies may be required from overseas in the event of a pandemic.

The Report was agreed by the full sub-committee, approved for publication by the Science and Technology Committee, with inclusion of a topical illustration of hand washing reflecting the title "Fighting Infection". It was sent to the Government and simultaneously launched at a well attended Press Conference in a Committee Room in the House of Lords. Radio and television interviews followed the questioning by science and medical reporters of the major broadsheets and the specialist medical journals and newspapers. Television interviews arranged for the following day were abruptly cancelled as news emerged about the death of a man who had apparently taken his own life – Dr David Kelly.

The Government's response to the Report was relatively quick and supportive. Several new bodies will be set up to deal with existing and emerging infections and an Inspector of Microbiology created to oversee diagnostic facilities. The Health Protection Agency was particularly supportive and a Bill to establish this Agency will come before the House of Lords in 2004. A debate in the Lords, led by the Chairman of the Sub-Committee, which took place on a Monday evening (summarised on pages 38-39), was the final stage of the Report and attracted good support, with the proviso that the Committee may return to a number of issues contained therein at a later date.

## *SCIENCE EDUCATION*

### *MEETING OF THE PARLIAMENTARY AND SCIENTIFIC COMMITTEE ON MONDAY, 27TH OCTOBER 2003*

The science curriculum for schools is being adapted to meet the requirement not only to provide enough well-qualified scientists, engineers and medical professionals for the future, but also to develop a scientifically-literate general population which can intelligently debate a whole range of "science in society" issues. Improved communication through the formation of grass-roots partnerships between schools and the wider scientific world and eLearning, which could well play an increasing part, particularly in higher education, were also considered.

In discussion the following points were made:

In school science there was only one right answer. Examinations mitigated against open-ended questions. Science needed to be taught as a creative subject, but aspects not assessed were not taught. Science needed divergent minds but its teaching attracted convergent minds.

Many experiments were long with periods of dullness and did not fit well with the school time-table. IT simulations could provide an earlier, more realistic experience while an interactive system would safely promote curiosity.

In some ways the educational establishment was weighted against science. Science degrees were expensive and universities were cutting back. There were fewer science teachers and fewer A level students. The single science degree meant that if you were looking for a chemistry teacher you would be choosing from those who at age 19 had chosen to read chemistry. A more pluralistic science degree would provide a wider cohort.

The science education required for teaching could well be very different from that required for research and industry yet the degree content was the same for both. Teaching the evolution of scientific ideas would overcome many of the present shortcomings and dispel the notion that scientists were passionless, neutral and balanced beings. Risk and uncertainty were current concepts which ought to be addressed in the classroom.

# The Curriculum

*John Holman, University of York*

Science has been part of the compulsory core school curriculum since the National Curriculum was introduced from 1989. What is the justification for making science compulsory in all state schools, alongside mathematics and English?

Science in the school curriculum has what Lord Jenkin has called a "dual mandate": to inspire and prepare both the minority of students who will be future science specialists and the majority who will not. This responsibility is echoed by Dr. Ian Gibson, MP, who commented in his select committee's report on science education that "we need to encourage a new generation of young scientists and to ensure that the rest of the population has a sound understanding of scientific principles"[1]. Since the introduction of the National Curriculum for Science there has been an increase in the total number of students taking science at GCSE, the culmination of the compulsory phase of schooling, but perhaps paradoxically, a reduction in the numbers wanting to take the study of science further, at least in the physical sciences. Thus, the number of GCSE science entries rose from 916 000 in 1990 to 1,234, 885 in 2002, but the number of entries for A level chemistry fell from 45,968 in 1990 to 36,648 in 2002.

Thus, we see an increase in the numbers of "generalists" – those who are studying science as part of a general education – but a reduction in the number of "specialists" – those who wish to take their study of science further, into A level and higher education. A number of studies have suggested that students find the current curriculum "rushed", "fragmented" and "irrelevant"[2], especially as they approach GCSE at the end of

[1] House of Commons Select Committee Press Release, http://www.parliament.uk/commons/selcom/s&tpnt37.htm

[2] For example, see Osborne J and Collins, S. (2000) *Pupils' and Parents' views of the school science curriculum*, Kings College, London.

compulsory education and begin to think about their options for further study. The challenge for the education system is to provide an appropriate grounding in "scientific literacy" for the generalists, while stimulating and whetting the appetite of young people to take their studies of science further. Meeting this challenge is partly a matter of getting the curriculum structure right, but the quality of science education depends more than anything else on the supply and professional expertise of science teachers.

## Curriculum structure: *21st Century Science*

The shortcomings of the current science curriculum are most apparent at Key Stage 4 (GCSE). At present, about three-quarters of all students take a "double award" science course at GCSE, which is generally accepted as providing a suitable grounding for further study, for example at AS level. Yet among those students will be many who do not wish to take their study of science further, but who nevertheless need a science course that will prepare them to be informed citizens in a democratic society. In October 2000, the Qualifications and Curriculum Authority (QCA) commissioned a study from the University of York Science Education Group to recommend alternative models for Key Stage 4 of the national science curriculum. This study has, with QCA's backing and with funding from the Nuffield Foundation, The Wellcome Trust and the Salters' Institute, resulted in *21st Century Science*. This pilot GCSE course is under development at the University of York and the Nuffield Curriculum Centre and began in 77 pilot schools, with about 8,000 students, in September 2003. If the evaluation of the pilot is positive, this course could provide a model for a more flexible approach to GCSE science.

*21st Century Science* comprises GCSE specifications (syllabuses) supported by books, computer learning, new experiments and activities and a package of training for teachers. It features a Core Science course, studied by every student and designed to develop scientific literacy, together with optional Additional Science courses. Additional Science (General), when taken together with Core Science, offers progression to further study of science at AS level; Additional Science (Applied) offers progression to vocational or pre-vocational courses to prepare for a science-based occupation.

In creating the Core Science course for *21st Century Science*, the development team have addressed the question: "What kind of science do ordinary people need to know, in order to equip them for life in a world dominated by science and science issues – such as the implications of stem cell research, the safety of GM crops and the security of electricity supplies?" The response has been to create a course built on twin foundations. First, it is important to know some basic scientific principles, and we have identified 16 "science explanations" – the big ideas of science, such as the gene theory of inheritance and the nature of chemical change. But we assert that scientifically literate students need not only scientific knowledge, but also an understanding of the way science works – what we describe as the "ideas about science" – the way scientists use data and look for correlations, the way they make and use theories and the way society uses scientific data to make decisions.

For example, one of the nine Core Science modules is called Air Quality. It uses the context of air quality, particularly with reference to the effect of motor vehicle emissions, to introduce "science explanations" on *chemicals and chemical change*, using the simple molecules – CO, $CO_2$, $SO_2$, NO etc – involved in air pollution to introduce the key idea that a chemical change involves rearranging the atoms of one molecule to form another. The Air Quality module also introduces "ideas about science" on data and its *limitations*, in the context of the measurements that air quality scientists make, and *correlation and cause*, in the context of investigations to establish whether a disease such as asthma has a causal link to air pollution by nitrogen oxides.

*21st Century Science* will be externally evaluated before any decision is made to extend its lifetime beyond the two-year pilot, but if it is successful it will show one way of providing a science curriculum that is more appropriate to all young people, whether or not they want to continue their study of science beyond the age of 16.

## Professional development for science teachers

More appropriate curriculum structures will help, but ultimately better science education lies with the teachers themselves: they hold the key to students' motivation and achievement. The kind of changes called for in *21st Century Science* can only be delivered by an appropriately trained and motivated teaching force. This was recognised in Lord Jenkin's report *Science in Schools*[3], which advocated better quality continuing professional development (CPD) as a means to improve the skills and motivation of the profession. This call was taken forward in Sir Gareth Roberts' review which recommended that the Government "improve science teachers' access to, and take up of, subject related CPD, which will benefit their teaching and also act to improve retention"[4].

In December 2002, the DfES and the Wellcome Trust announced proposals for a national network of Science Learning Centres, to take the lead in transforming science education through the professional development of science teachers. The purpose of the Science Learning Centres will be to improve the recruitment, retention and professional skills of science teachers and technicians through a systematic programme of CPD with a science focus. On October 16 2003, the winners of the contracts to establish and run the Science Learning Centres were announced. The National Centre, for the whole of the UK, which will be funded to a total of £25 million from the Wellcome Trust, will be at York and run by the White Rose Consortium of the universities of Leeds, York and Sheffield with Sheffield Hallam. There will be nine Regional Centres for England, funded by the DfES to a total of £26 million.

The Science Learning Centres are now

[3] *Science in Schools:* report of the House of Lords Select Committe on Science and Technology (March 2001).

[4] SET for Success: the supply of people with science, technology, mathematics and engineering skills. The report of Sir Gareth Roberts' Review (April 2002). Recommendation 2.6.

working together, under the chairmanship of Sir Gareth Roberts, to determine a national strategy for science teachers' CPD, in time for the opening of the Regional Centres in October 2004 and the National Centre in 2005. At the heart of this strategy will be the objective of reconnecting teachers with their subject by keeping them up to date with developments at the frontiers and helping them acquire new skills and ideas for inspired teaching. The commitment of over £50 million to this initiative is a mark of the strategic importance of science education to Britain, and represents an unprecedented opportunity to make a lasting difference to its quality.

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*SCIENCE EDUCATION*

# The Importance of School-Scientist Partnerships

*Dr Eric Albone*
*Director, Clifton Scientific Trust*

## The Challenge facing School Science

Science[1] is an intensely human, intensely creative, enterprise. Science dominates our lives and presents society with tremendous opportunities and tremendous challenges. It is exciting and perplexing, disturbing and enlivening. What it is not, is dull.

Yet dull is how school science is seen by many young people. It is a damning indictment that the Commons Science and Technology Committee reported[2] in 2002 that "Many students lose any feelings of enthusiasm they once had for science. All too often they study science because they have to, but neither enjoy nor engage with the subject. And they develop a negative image of science which may last for life".

Similarly, Sir Gareth Roberts[3], in his 2002 Report to HM Treasury highlighted the need to attract the brightest and most creative minds to become scientists and engineers and expressed concern that while the numbers of scientific/technical degrees had been rising, those in physics, mathematics, chemistry and engineering had fallen significantly, a trend which threatened the UK's competitiveness. The Report stressed the need to improve the relevance of the science curriculum to students in order to capture the interest of students (especially girls) and to better enthuse and equip them to study science,

In a different context, the Lords Science and Technology Committee Report Science and Society[4] underlined the crisis of public trust in much scientific information and pointed to the need to develop a culture of dialogue between scientists and the public. It emphasised the importance of science teaching in schools to equip all students for citizenship, and referred to the value of developing partnerships between schools and working scientists.

## Student Engagement

Engaging the enthusiasm of the student is pivotal. The culture of excessive central measurement and assessment in education, undertaken with laudable aims, has in practice not only undermined the professional autonomy of the teacher and inhibited school-based curriculum innovation, but has killed the love for learning in many young people. If students gain no real enthusiasm for what has been learnt, they have gained very little of lasting value however well they may perform in tests.

Student enthusiasm and commitment derive very powerfully from students gaining a personal sense of the real life relevance of their school experience, and of their own participation in and ownership of their learning. Grass roots partnerships between schools and scientists have tremendous potential to bring this about.

Through such partnerships, students can set their classwork in context by encountering at first hand something of the challenge of science as a human activity, where answers are always provisional, where uncertainty abounds, where "there are no answers at the back of the book", and where teamwork and creativity are rewarded. How often is school science thought of as a "creative subject"?

## Peak Experiences in Science?

In the context of music education, John Sloboda[5] has drawn attention to the great importance for student motivation

[1] Science is used throughout in a generic sense to include not only engineering and medicine, but also contexts in which science relates to ethical, economic and other concerns.

[2] HoC Science and Technology Committee *Science Education from 14 to 19* HC 508-1, July 2002

[3] Sir Gareth Roberts' Review to HM Tresury, *SET for Success; The Supply of Poeple with Science, Technology, Engineering and Maths Skills* April 2002

[4] HoL Science and Technology Committee *Science and Society* HL 38, Feb 2000

[5] John Sloboda, Musical Expertise. In Ericsson, K.A. & Smith, J. (eds). Toward a General Theory of Expertise. Cambridge University Press. (1991)

of "peak experiences", deep and rewarding personal experiences which have emotional as well as intellectual content.

Are such quality, motivating, peak experiences possible in Science? Teachers know that they are. School-Scientist Partnerships can contribute greatly here by:

- challenging students to experience their school learning in open-ended, real-life contexts
- encouraging students to think for themselves and to question
- respecting and valuing the students' contributions.

A powerful example of this is provided by the student response to the Japan 2001 Science, Creativity and the Young Mind Workshop which we devised as part of the Japan 2001 Festival. Hosted in Bristol, post-16 students from schools across Britain and Japan lived and worked together for a week in small UK-Japanese teams with expert guidance on open-ended science-related explorations, experiencing at first hand science as more than a compendium of "right answers". Through science they also learnt from each other's way of thinking and of doing things. UK students were selected on "widening participation" criteria and in both countries two thirds of the applications were from young women.

The science achievements in the week were remarkable. Thus, NASA, with whom our Space Science Team were in daily video link exploring hypotheses concerning the origin of the Martian volcanoes could write:

"All felt the excitement of the real life scientific investigation and were amazed at the students' initiative and hard work. The model demonstrates effective collaboration among diverse cultures... More importantly, it demonstrates that, given an exciting challenge and necessary resources, young people will far exceed everyone's expectations!"

But even more telling was the student response. The following quotations are taken from our Evaluation Report.

"When at school, I was learning the science without being able to apply it; now I know what real science is like; I love it!"

"I managed to do a written report and presentation on a subject I knew nothing about with people I did not know, and yet to enjoy myself at the same time. I feel so proud to have taken part. I will never forget it."

"It has changed my attitude a lot. I thought the Japanese were lovely people and I have realised there is so much to learn about the world."

"At the beginning of the week, communication was a problem, but now it has been overcome and everything is exciting."

"It has made me realise how many differences we all have, yet we all have so much in common and can enjoy our differences instead of having conflicts."

We are now working with support from the Embassy of Japan and others to develop continuing UK-Japan School-Scientist Partnerships.

## School-Scientist Partnerships

In July 2002, a survey of all Bristol LEA maintained schools seeking teachers' views showed that although very little was currently in progress, 92% of the 34 schools (from Nursery upwards) who responded felt such links would be of great or significant educational value, and 94% of schools asked to discuss possibilities in their school. Partnerships were seen to be of particular value in motivating pupils and in encouraging them to question. The most valuable mode of partnership would be with scientists working/talking with students in a continuing relationship with the school.

A number of organisations are currently seeking to build bridges between schools and the world of science and technology. One example, the Science and Engineering Ambassadors Scheme, is much to be welcomed in encouraging more scientists and engineers to work with schools; some 3,700 SEAS are now registered nationally. In the future the new Science Learning Centres will be in a position to play an important role in further facilitating such partnerships.

The closest approach to our own work is that of the Teacher Scientist Network in Norfolk. Like us, they stress the importance of working with the teachers to evolve creative partnerships from within the school, rather than delivering schemes to schools.

In building continuing School-Scientist Partnerships, we recognise the diversity of schools and see each partnership as being a unique exploration in what is possible in a particular school situation. Our task is to help the teacher and the scientist to work together to develop their own creativity in ways which fit their circumstances, and to network outcomes so that other teachers and other scientists can share good practice. Training to prepare the teacher and the scientist is of crucial importance.

We are currently developing an innovative Creative Science CPD Course to equip Primary Teachers to work with scientists in creative partnership. We have also developed models for very effective Primary Science Days. The most recent example involved staff from the Bristol Royal Infirmary working with sixty Bristol inner-city primary pupils and their teachers in ways which had an impact on the continuing teaching and learning in their schools.

## Moving Forward

We see a major and largely unexploited opportunity to make a real difference to pupil attitudes to science through the development of a network of grass-roots School-Scientist Partnerships. The following are three key areas in which Government could at little cost greatly raise the profile of such partnerships within schools.

- Give real encouragement to academic scientists to become involved by giving genuine incentive. At present such activities do not count in the Research Assessment Exercise, and academics derive no benefit from becoming involved. Indeed often they are discouraged from taking part.
- Give more encouragement for industrial scientists to become involved, perhaps by instituting an "Investors in Education" award, similar to the "Investors in People" award.
- Give more encouragement to schools to become involved by raising the profile of such activities in OFSTED's inspection criteria, and by giving schools much greater encouragement to be pro-active in this area.

# UK eUniversities Worldwide Limited

*Sir Anthony Cleaver*

UK eUniversities was established at the end of 2001 by the UK Government as a company to make the best of UK higher education available online anywhere in the world. It is not a university itself as students receive degrees from whichever university has developed the course they are studying. As a result, the university is responsible for all academic matters and the degrees awarded are subject to QAA regulation.

UKeU has three main responsibilities. First to develop and make available a top class electronic learning environment, or software platform, capable of dealing with thousands of students across the world. Secondly, UKeU works with universities to ensure that courses are developed to make good use of the platform and that the quality of the electronic aspects is high – UKeU has its own Committee for Academic Quality. Finally, UKeU provides an international sales and marketing capability for the recruitment of students overseas.

The first course became available in March 2003 and is a postgraduate certificate in open and distance learning, developed by the Open University and the University of Cambridge. A further 20 courses are now either under way or open for enrolment in Autumn 2003 or early next year.

While most of the existing courses are postgraduate, UKeU will be providing courses at foundation, undergraduate and postgraduate level, as well as Continuing Professional Development courses. Our focus is in seven main subject areas: business and management; science and technology; health; English language; teacher training; law and environmental studies.

UKeU is also charged with three specific initiatives on behalf of Government - the eChina programme, a collaboration between HEFCE and the Chinese Ministry of Education to provide in-service teacher training in China; the development of courses intended specifically to contribute to the "widening access" agenda in the UK and the establishment of an eLearning research centre, in collaboration with the Universities of Southampton and Manchester.

In its first 21 months UKeU has:

- developed the first version of its learning environment, in partnership with SUN Microsystems who are also a shareholder in the company with significant enhancements leading to the main version in Spring 2004
- established a portfolio of over 20 courses contracted with 18 UK universities and a pipeline which should double this number over the next two years
- established a global service support infrastructure, in partnership with Fujitsu, which provides support 24 hours a day, 7 days a week across the world
- established local market presence through our international business managers in Dubai, Hong Kong, Singapore, Malaysia, Brazil, South Africa, China, South Korea and India
- supported students studying in 36 countries across the world.

Given the challenges faced by science education in our schools, UKeU believes it can provide assistance in a range of areas. For schools, its platform could be used for continuing professional development courses and subject update modules for science teachers. Over time this and its range of science courses will create a national accessible library of science modules and teaching material. This can be supported by online discussion forums for science teachers, while the stock of science teachers could be increased through the use of conversion courses.

At university level, UKeU will provide a range of science courses. Already available are masters degrees in biomedical science, bioinformatics, geographical information systems, computer science, and environmental management, with specific focus on coastal zone management, energy management, renewable energy and environmental toxicology and pollution monitoring. Over time, UKeU could provide the vehicle for quality training and research methods, for new postgraduates, and the opportunity to develop the concept of an electronic "PhD", enabling the supervision of PhD students working remotely from their supervisor.

More generally, the ability to provide science modules at every level available online anywhere, anytime will make it possible for scientists both to remain current in their discipline and also to extend their range of understanding. Anyone interested in learning more could consult the UKeU website at www.ukeu.com or contact Jill Padley on 020 7932 4401 (jpadley@ukeu.com).

*THE REGULATION OF NANOTECHNOLOGY*

*MEETING OF THE PARLIAMENTARY AND SCIENTIFIC COMMITTEE ON MONDAY, 17TH NOVEMBER 2003*

Nanotechnology, the science of the very small scale, covers a wide spectrum of research with great potential of immense benefits. Some applications of nanotechnology are already in widespread use but developments in other areas are a cause for concern.

Consideration was given to how those aspects of nanotechnology which raise ethical, health and safety or social issues could best be regulated so as to promote innovation while still providing the necessary controls.

# Nanotechnology: Friend or Foe?

*Professor George Smith FRS*
*Head, Department of Materials, Oxford University*

Enter the term "nanotechnology" into the Google search engine, and it will find nearly 750,000 matching items. Put in the truncated term "nano", and the total increases to 1.2 million items. Clearly, big things are happening in the world of the very small. So should we be excited or concerned by these new developments (or both)?

## What is nanotechnology?

A working definition is that nanoscience is the study of matter at atomic and molecular scales (typically 0.1 to 100 nanometres) where properties differ significantly from those at larger scale and nanotechnology is the application of this knowledge to make useful materials, structures and devices.

The key point is the new and different phenomena which occur when larger bits of matter are reduced to nanometre scale. It highlights the fact that exciting new technologies are emerging from studies of material at this level, but it also brings into focus the potential risks involved. If the behaviour of matter at this level is different from that in the bulk, and is to some extent unpredictable, then there is every reason for us to be cautious in our approach to this new field.

## Silver and Gold

A case in point is silver which in its bulk form is a very unreactive material. But silver nanoparticles have been found to possess valuable antimicrobial properties, so bandages impregnated with silver nanoparticles help to promote resistance to wound infection while silver particle coatings help to prevent fungal growth on surgical catheters. This is good news; but it is also bad news for on the nanometre scale silver becomes bioactive. There seem to be no toxicological procedures that would predict this from tests that could be carried out on larger lumps of silver.

Another example is gold, normally one of the most inert and unreactive materials on earth. Yet gold nanoparticles are one of the hottest new topics in the field of catalysis. They have been found to promote a wide range of chemical reactions, at temperatures lower than any other commercially available catalyst materials. Again, this is good news from a technological perspective but we are in new and uncharted territory.

There is still no fully satisfactory explanation for the observed behaviour of either of these metals in nanoparticle form, and no sure way to predict how other nanomaterials may behave.

## What can nanotechnology do for us?

At present, the two dominant market sectors for this new technology appear to be ICT (information and communications technology) and medicine, although other niche applications include cosmetics, sun-screens, self-cleaning windows, ultra-strong lightweight materials, low-cost solar power generation, miniature fuel cell technology (for mobile phones and laptops), and environmental pollution monitoring and remediation.

ICT applications include ultra-high density information storage – terabyte range (1000 gigabytes per square inch); ultra-fast conventional computers; novel, ultra-powerful "quantum" computers; ultra-broad-band communications systems; high-

definition, low-energy-consumption flat-screen display technologies and a new generation of fully integrated communications and information systems.

Medical applications include diagnostics – "lab-on-a-chip" technology for rapid identification of pathogens; patient monitoring – real-time sensing of physiological and biochemical parameters; "smart" drug delivery systems – providing swift and timely delivery of just the right amount of a pharmaceutical product to where it is needed in the body; targeted treatment of disease (including tumours) using "designer" nanoparticles which attach themselves selectively to specific sites; aids to independence – biomaterials and bioelectronics to aid physiological response (and possibly even to stimulate brain action).

## What are the risks?

The pseudo-science underlying suggestions of armies of infinitesimal "nanorobots" running riot and destroying the world simply does not stand up to critical scrutiny but there are legitimate reasons for concern about the possible societal implications of almost undetectably small surveillance systems, which could have both civilian and military applications.

At a more mundane level, it is important to emphasise that some aspects of nanotechnology are already with us, and embedded in modern life. For example, the hard disk "read heads" on PCs rely on the quantum-mechanical phenomenon of giant magneto resistance, which arises in copper layers only a few nanometres thick. Also, the world's optical fibre communication systems depend on solid state lasers in which the wavelength of light dimensions is tuned by controlling the nanometre-scale dimensions of "quantum well" structures in semiconductors.

The majority of people are unaware that they are using nanotechnology in this way every day of their lives, to their considerable benefit, and without detectable risk. In these applications, the "nano" components are integrated into larger systems and devices and the risks associated with them appear to be very small.

The potential risks associated with "loose" nanoparticles and nanofibres need to be carefully assessed. There is a shortage of good quality research on the possible toxic effects of such materials. It is clearly important that, if released into the environment, such particles should be pre-treated so as to minimise their chemical activity. Another area of potential concern is the use of carbon nanotubes. These have potentially very important electronic and structural applications. But insertion of carbon nanotubes into the lungs of mice has recently been shown to trigger an aggressive immunological response. The shape and form of these nanotubes is closely similar to that of fine asbestos fibres. It is remarkably difficult to predict the behaviour of such fibres in biological systems. A serious problem is the long incubation times before, eg asbestosis, silicosis, or mesothelioma, develop. This makes screening procedures extremely problematic. Also, the state of our knowledge about how these materials trigger disease at the atomic and molecular level is sadly incomplete. For example, why do different kinds of asbestos fibres behave differently? And why are crystalline silica fibres more dangerous than amorphous, glassy ones? It would appear that both the atomic-scale structure and chemical composition of fibres are important. But we still lack reliable ways to predict in advance whether various types of fibres will be toxic.

## How do we move forward?

Two key areas need to be addressed: R&D, and regulation. If the R&D is done properly, and in a responsible manner, then the need for regulation will be minimised. If not, we could find ourselves with some serious problems. I believe that important lessons can be learned from previous cycles of technological development. In particular, in the case of GM products, there was an almost irresistible desire on the part of public bodies (and especially funding agencies) to climb on the bandwagon of wealth creation. This meant that public interest and public safety-oriented research was neglected. Funds were poured into new gene transfer experiments, but important background work was neglected. Where, for example, was the research funding for studying the risks of horizontal gene transfer between species, or the distances over which bees travel, or pollen drifts in the wind? This precautionary work was either forgotten, or left until very late in the development cycle. We must not let this happen again with nanotechnology.

It is important that the scientists, the regulators and industry should work together to identify and assess the risks of this new technology, and to establish safe operating protocols. This work will be extremely challenging, some of the phenomena observed are entirely new, and therefore the risks are unknown. New protocols will have to be developed to study the interactions of nanoparticles with biological systems at the molecular level. Paradoxically, nanotechnology itself is likely to provide many of the tools and techniques that are needed. Microarrays, containing microscopic quantities of each of many different kinds of organic and biological molecules, may provide the key methodology for high-throughput, highly parallel screening of biological systems, and for identifying where the problems may lie. It is important that such work should receive adequate government funding, and that the results should be fully and openly available to the public. Only in this way can the full benefits of the new technology be realised, without the acrimony and suspicion that has surrounded the GM debate.

## Where to find further information

This is a fast-moving area and the most up to date information is on the Web. Sites of interest include www.nano.gov (the official USA site), www.mnt.org.uk. (the DTI site will be up early in 2004), www.greenpeace.org.uk, www.nano.org.uk (news reports) and www.nanotec.org.uk (progress reports on the current (2003/4) Royal Society / Royal Academy of Engineering study of nanotechnology).

# Regulation & Nanotechnology

*Stephen Falder, member of the Better Regulation Task Force and Chair of the Scientific Research and Regulation sub-group*

## Better Regulation Task Force

The Better Regulation Task Force is an independent committee set up in 1997 to advise the Government on better regulation issues. Our terms of reference are to advise the Government on action to ensure that regulation and its enforcement are proportionate, accountable, consistent, transparent and targeted.

We look at each issue to see how it compares with these five principles of good regulation – which we developed in 1997 and are now common currency across Whitehall. By proportionate we mean policy solutions should be proportionate to the scale of the problem. Accountability means regulations should be well-publicised, accessible, fair and effective and by consistency we mean the same rules and standards should apply to all. Transparency means easy to understand and by targeted we mean the regulations should focus on the problem and minimise the side effects.

The formation of the Task Force represented a shift in focus in the Government's approach to regulation, away from deregulation to making regulation work. Not all regulations are bad – some regulations are necessary to protect people and the environment. The Better Regulation task Force is about making regulation better: reducing the burdens and helping the Government to achieve policy objectives in the most effective way.

Task Force members are drawn from across society: private and public sector; trade unions; consumer affairs; economists. We are appointed for our expertise in particular issues rather than who or what we represent. We have a remit that strays across everything that Government does and have published reports on a wide variety of subjects: from Employment Regulations to Housing Benefit and Lone Parents; from Economic Regulators to Regulations and Farming.

The Task Force makes recommendations direct to Government and has had a pretty good success rate. From over 200 recommendations which the Task Force has made since 1997 only a handful have been rejected.

## Scientific research and regulation report

In 2002 the Task Force decided that it should carry out a study into the regulation of scientific research. The UK has a proud history of scientific research and innovation, but the Task Force felt that this was in danger of being undermined in an increasingly risk averse society (witness the GM debate). Regulations are designed to combat that aversion to risk. Scientists need to have the freedom to explore avenues that open up to them, but at the same time they need to understand and acknowledge the concerns of many within society. The Task Force does not believe that scientists should be allowed complete freedom – especially if that freedom breaches moral, ethical or safety concerns. A properly designed regulatory regime will help achieve that balance and the Task Force proposed a regulatory model.

## The 4-stage regulatory model

In its report on scientific research the Task Force proposed a 4-stage model which if followed would bring more transparency into how scientific research is regulated, whilst ensuring adequate controls.

## Stage 1: Pre-research framing

Before any research can take place there is a framing process during which the nature and purpose of a particular piece of research and its parameters are drawn up. For this process to work effectively it must be clear what regulatory structure surrounds the "blue skies" stage – stage 2 – of research. This framing process does not require regulation, but the Government needs to make sure that scientists and researchers can find out easily what regulatory constraints will be on them if they choose a particular course of action. If the research to be carried out raises moral and ethical questions, the regulations controlling these need to be consistent throughout the whole research process.

## Stage 2: Blue skies research

The second stage is what some might call "real research" – the voyage of discovery. Such research is where scientists do not know where they will end up. There may be a number of avenues to be explored, many of which may never result in a final product.

Despite this the scientist must be able to explore all the avenues. Government should not close down

avenues, unless the proposed research is unethical or deemed unsafe for the researcher, the environment or the public in general. Government should set the boundaries through regulation but regulations must be as simple and clear as possible and not be excessively restrictive.

## Stage 3: Research and development

At some stage in a research project there comes a point when the research has to move out of the laboratory and into the wider environment. This may be, for example, field trials for new seeds and plants, clinical trials for new drugs, practical uses for nano particles. At this stage the public will become more involved, and unless briefed adequately, more concerned. Because of the potential greater risk to the public and environment, there is a need for specific regulation, in addition to the containment regulations setting ethical, moral and safety boundaries.

In designing an effective regulatory regime, the Government must consider all the options. It should consider whether regulations could be sunsetted – that is regulations which are time limited. Sunsetting regulations could be very effective where there are significant scientific uncertainties or where technologies are moving very quickly. R & D research fits neatly into this category.

## Stage 4: Product to market

The final stage, providing the field research has been successful, is to bring the product to market. Decisions taken at this stage are not primarily scientific, but ones based on information gathered throughout the life of the research project.

The decisions at this stage are societal, commercial and governmental ones where trade-offs are made at a different series of levels about the risks and benefits to society. It is because such questions lie at the heart of many of the science issues that the public will wish to be involved.

## Nanotechnology

So what has all this got to do with nanotechnology?

It often surprises me that nanotechnology is classed an emerging science. The image to many of nanotechnology is of molecular submarines flowing round a person's blood stream repairing damage and repelling invaders. Yes that may happen – but the reality is now.

There are already products on the market which contain nano particles. Sunscreens contain nano molecules designed to protect us better from the harmful rays of the sun; some fabrics have nano particles that make the fabric liquid repellent. In medicine nanoceramics are already being used as bone replacement agents. In the paint industry nano molecules are used to preserve the integrity of the paint.

At the moment nanotechnology is relatively uninvasive – but the possibilities appear to be endless. It is when people feel that nanotechnology is directly impacting on them and their health, that concerns may be raised. To date few have expressed concerns about the risks of nanotechnology. Indeed they may never be fully voiced if, like embryonic stem cell research, the potential benefits to individuals are identified. But the Government and the scientific community need to be ready to deal with concerns should they be raised.

The Government needs to demonstrate that it has clear policies in place to deal with all stages of nano research in order to ensure the safety of individuals, animals and the environment, whilst permitting research to continue.

## Good communication will be key

The Parliamentary and Scientific Committee's debate is the starting point. The public would welcome more involvement. Given the right information the public is able to make informed decisions. I often wonder whether we give the general public enough credit for the intelligence with which they are able to rationalise difficult issues.

Of course it will not be easy for most to understand nano technology – the field is vast and the potential applications numerous. It is the very breadth of possible applications that makes it difficult to predict where the greatest risks of nanotechnology lie.

## Conclusion

As an area of science we have the opportunity now to shape the debate rather than let it shape our response. The Government has the opportunity to apply the Task Force's model for the regulation of nanotechnology – and the opportunity to lead from the front.

***In discussion the following points were made:***

Despite the best risk assessments there would still be surprises. We don't know what to look for and there is often a significant time lag between cause and effect. There could be good regulations when the risk was understood but the evidence was often epidemiological, which is retrospective and environmental monitoring was concerned with known risks.

It was the duty of the public sector to fund the research for the protection of the public. This was not yet being done for nanoparticles. The Research Councils had briefs which were so narrow that such work fell between them.

Nanoparticles were already present in consumer products, some of which ought to have been regulated. Although a first approach to safety could be that there was a minimal risk when the particles were fixed in the product there were concerns for manufacture and end-of-life dismantling.

With infectious diseases there was an understanding of where the respective bio agents stood in the categories of risk. There was no understanding of where nanoparticles might lie in this hierarchy.

Scientists could deal well with ethical issues. They had done so with stem cell research. The problem with GM crops was that much of the work funded by BBSRC and NERC had focused on wealth creation rather than the protection of the public.

In determining risk priority should be given to areas where nanoparticles were loose, rather than glued down, came into contact with humans or were produced in large quantities.

*DESIGNER BABIES*

*MEETING OF THE PARLIAMENTARY AND SCIENTIFIC COMMITTEE ON MONDAY, 8TH DECEMBER 2003*

Proven scientific techniques already exist which, when applied, have a known consequence on the characteristics of offspring. The areas of application include sex selection, the avoidance of inherited disorders and saviour siblings.

As scientific knowledge advances so the range of attributes which may be bestowed on offspring might widen to include greater intelligence, fitness or other predetermined attribute. Ethical issues would then become more stark as would the impact of such activities on the parent-child relationship.

Lord Winston provided an insight into the methodologies and future potential of research into the predetermination of the characteristics of offspring and the Rt Rev Lord Bishop of Oxford assessed the ethical, moral and religious issues surrounding the subject.

# The Potential of Fertility Treatments

*Professor Lord Winston*

Lord Winston began by giving some background to the research work and fertility treatments currently being practised. With respect to implantation he said that from every 100 apparently healthy embryos transferred to the uterus at the right stage of the cycle only about 18 human babies were born. There was a large attrition rate. An important question to investigate was why the human embryo was so frequently inadequate with respect to implantation, although we now knew that there were a number of inherent problems associated with early development.

The figures just quoted emphasised that it was impracticable to think in terms of taking just one egg in *in vitro* fertilisation treatments. It was not a viable proposition. If you were to begin with 100 eggs, some would not be sufficiently mature to fertilise and of the rest only a proportion would go on to cleave. Of those which clove only about 50% would hatch from the shell and of them just half, or thereabouts, would progress to become babies. Natural cycle IVF was a poor option with little prospect of success. Hence in IVF treatments it was essential to stimulate the ovaries vigorously.

A second important background topic was the human characteristic of a falling pregnancy rate with the increase of the female's age. Only 2% of older women (those in their forties) going through an IVF treatment would successfully complete a pregnancy and give birth to a live baby. Of those that did become pregnant over half would suffer a miscarriage. This increasing difficulty was reflected in natural conception; for women over the age of 40 a pregnancy was surprisingly unusual and complicated. For example, there was a significant rise in chromosome abnormality with the mother's age.

This decrease in fertility with age effect was not peculiar to humans. It was a trait observable in all mammals, but particularly in higher primates.

## The Fertility Treatment

At its basic level the practice was to take a human embryo and remove a single cell. This could be done by "drilling" a hole in the outer layer using acid and sucking out the cell. That cell could then be used for analysis, seeking either abnormal chromosomes or small gene sequences associated with a particular disease. This process could be used on someone who was a carrier or who might be producing a baby with a genetic disorder.

As a technique it was crude and invasive but, as far as he knew, it was safe. Unlike some other IVF procedures it had been studied and used extensively in animals before progressing to use with humans. Nevertheless, its use should only be considered when there was a serious indication that a chromosome or genetic disorder might be passed down the line.

## The Dignity of Life

In debates on these topics arguments were put forward concerning the dignity and respect for the human foetus. In a recent debate in the House of Lords I felt wounded by statements that scientists such as myself working in this area did not confer dignity upon the embryo.

Just two days later a lady came to my clinic. She was suffering with a very serious genetic disorder on her X chromosome which resulted in serious deformities of her lower limbs. She could hardly walk. The gene responsible had not been identified but as the sex of a baby could be detected she asked that a male baby be transferred to her uterus. The danger here was that if that male had the defective chromosome then it was likely to die within the uterus. If it were healthy it would not pass on the disease. There was no way of knowing whether a female would carry the abnormality and pass it on. This lady had weighed up the risks and made her reproductive choice. I mention this episode because of this lady's statement that she wanted her children and grandchildren to have more dignity in life than she had had.

## The Saviour Sibling

The Whittaker case arose because the young child had a disorder. Its bone marrow was not functioning properly and it was likely to die. The child's parents wanted another baby. They also wanted to have the embryo screened to ensure that the new baby had the right genes to produce tissue, in this case bone marrow, which might be then used in a life-saving transplant operation.

The problem here was that a pre-implant diagnosis was being offered to an embryo which could not personally benefit from it. The procedure was not medically neutral. Even although we thought it caused no problems there were concerns about subjecting a baby to an invasive technique when there was no advantage for it. Indeed, it was possible that the new baby could suffer the same problem.

At the time the press reporting was so sentimental that many of the issues were not properly covered. There had been no thorough debate.

## Chromosome Abnormality

Human embryos seen in fertility clinics contained a very high proportion of cells which are mosaic. In a particular example of a normal-looking embryo of eight cells two were found to have chromosome abnormalities. This was representative of a very common situation. Indeed, perhaps 75% of human embryos were chromosomally abnormal in some of their cells. Research suggested that usually the embryo got rid of those defective cells. However, if the embryo did not get rid of defective cells then it was likely to die.

What we didn't know was what were the chances that a particular cell which had been selected being representative of the other cells in the embryo, including those with abnormalities.

> ***"after IVF treatment there was twice the risk of having an abnormal baby"***

So, if we were to consider again the eight cell embryo, if you had happened to select one of the two cells with an abnormality, you were likely to conclude that the embryo was fated to die. In practice, the embryo might well get rid of its abnormal cells and live. This was a major biological problem.

What was needed was a non-invasive technology which looked at the whole embryo; that was the only way to assess the totality of the cluster of cells. There were some techniques which showed promise in this respect.

Work on pre-implant diagnosis had indicated just how frequently abnormalities did occur. Indeed, the process itself may be a cause of some of these abnormalities. Studies with mice had shown that hormone doses did increase chromosome abnormalities in the eggs and that there was an increased likelihood that embryos would be lost. More work with animals was essential.

Another problem was sporadic reporting. For example, we have heard of a study in Western Australia which indicated that after IVF treatment there was twice the risk of having an abnormal baby and another from the USA which showed that after IVF the risk of having a low birthweight baby was 2½ times that of the general population. While these figures were not representative of the global situation, studies from Sweden, America and Australia did contain some alarming statistics. We should be looking much more stringently at why these were occurring.

## The Choices facing Patients

What were the choices facing patients with a genetic abnormality if they did not wish to go through the pre-implantation diagnosis treatment?

They could use contraception and so remain childless.

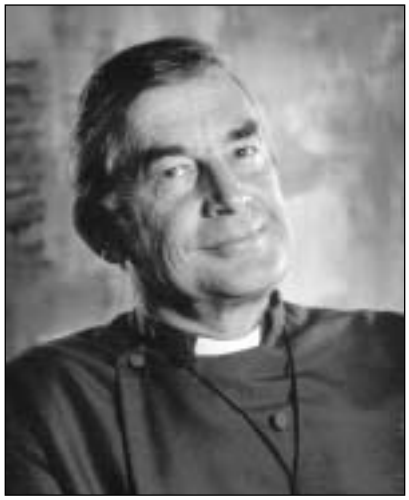
They might attempt adoption but the chances of adopting a baby within the UK were very slight; there have been less than 1,000 adoptions per annum in the UK for some time. Alternatively, they might go overseas but then there are even more unknowns for the adoptive parents to cope with.

They might proceed with a natural pregnancy with a pre-natal diagnosis and a termination of the pregnancy if necessary. Although this was allowable under the law most patients opting for pre-implant diagnostic treatment were going through the procedure because they had an ethical objection to abortion.

Finally, they might await the birth with the option of post-natal gene therapy in those cases where this was possible. This was in many ways unsatisfactory.

## Conclusion

Pre-implant diagnostic techniques, when they are used today in the way that they are, are a totally ethical choice for patients with genetic disorders.



# The Ethical, Moral and Religious Considerations

*The Rt Rev the Lord Bishop of Oxford*

The Lord Bishop said that it was the very essence of being human to interact with nature, it was an essential aspect of our dignity and vocation as human beings.

Nevertheless, there was an accumulated wisdom in nature which it would be foolish to disregard. After all, it had taken some 16 billion years to arrive at where we were now, with 35,000 genes and 3 billion base letters. It was a very complex and highly balanced system which had evolved over those billennia. That accumulated wisdom required a fundamental respect.

So, together with a proper vocation of human beings to interact with and manipulate nature there needed to go a fundamental respect for the accumulated wisdom of nature. That indicated a proper use of the precautionary principle.

## The Early Embryo

One issue which did arise for many people considering the subject of fertility treatments was the moral status of the early embryo. There was a great degree of loss of embryos during IVF treatment while pre-implantation genetic diagnosis did involve an intrusive manipulation of the embryo. It was therefore essential to have some view of the respect due to the embryo.

The Roman Catholic view, shared by many others, was that human life had to be protected absolutely from the moment of conception. In other words, from the first moment of existence a human embryo had to be recognised as having the full rights of a person, among which was the inviolate right of every innocent being to life. That was a view which needed to be taken seriously.

The Christian tradition was not as monolithic as it was sometimes portrayed. There was a text within the Book of Exodus which said that if as a result of a scuffle a pregnant woman lost her baby then, if that baby were unformed (that is, in its very early stages) then the penalty which would accrue to the person who caused that loss was a financial one. However, if the lost baby were formed and in its later stages of development then it was a capital offence.

That distinction had been made in an early Latin translation although it was not included in the current English translations. This text influenced early Christian thinking.

## Aristotle's Legacy

The Christian church was much influenced by Aristotle's view that first there was a "vegetable" soul, then an "animal" soul and finally a human soul. The mail embryo achieved a full human soul after 40 days and, regrettably, the female after 90 days. Although we didn't share that philosophy now, it did recognise a gradualist approach which led to an increasing respect for the evolving embryo.

## The Distinction of Respect

As a result of these two factors the Christian church, at least from the fourth to the nineteenth century, made a sharp distinction in the penalties which accrued for abortion depending upon whether the embryo was formed or unformed.

In 1869 the Pope abolished these distinctions so for the Roman Catholic church today such distinctions no longer applied. Nevertheless, the Western Christian tradition, for most of its existence, did accept that the text from Exodus and Aristotle's views were moral "insights" which indicated that it was legitimate to distinguish between the respect due to an embryo in its early stages and the absolute respect due in the later stages.

Another argument could be based on the very high rate of loss of embryos in the early stages following conception. About two thirds of embryos were lost. If each of these early stage embryos possessed a full human soul then, putting it crudely (for which the Bishop apologised) Heaven would be mainly populated by the souls of people who had never been formed.

A more philosophical argument was that the rights which accrued to what was actualised did not necessarily accrue to what only had potential. An obvious example was that a qualified doctor had certain responsibilities and particular rights, but not all these responsibilities and rights belonged to a medical student training to be a doctor.

There was thus a number of considerations which might lead a person to take a view rather different from the stated Roman Catholic position.

## Gene Therapy

All types of gene therapy were at a very early stage of development. A distinction could be made between a gene therapy which was for the purpose of getting rid of damaged genes or genes which were the cause of serious diseases, and genetic manipulation which was concerned with the enhancement of certain specific qualities.

Certain diseases, such as cystic fibrosis, were dependent on one particular gene. A genetic therapy aimed at allowing a child who might get cystic fibrosis to grow up free of the disease would be wholly beneficial. Most people would say that if developments were to proceed along those lines then that would be entirely moral and thoroughly worthwhile.

## Enhancement

A gene therapy for the enhancement of human qualities was definitely on the ethical agenda even though such therapies were not currently possible, indeed might never be so. There were a number of other considerations. First of all, there was what had been termed the "tyranny of the normal" and, closely associated with that, the horrific possibility that people might choose to have babies according to certain passing fashions. Was this something that we would regard as desirable?

More seriously was the whole question of the relationship between a parent and a child who was born and who grew up as a result of having particular genes in some way chosen for them. All parents tried to give their children advantages through education, persuasion and moral example. But they tried to influence their children while at the same time respecting their free choice. But if parents were to have children which, as a result of the parents' choice, grew up with a particular physical build or a particular set of capacities, what would happen if a child became deeply resentful about the choices that its parents had made on its behalf? It was difficult enough as it was to bring up teenagers. There were more than enough clashes already over parental choice. What would it be like if they were stuck for their entire lives with physical characteristics or mental capacities that they didn't want? Of course, it was highly desirable to have intelligence but you didn't necessarily want a first-class chess playing mind. It was good to have a good physical build, but again you didn't necessarily want to be like a second row forward just because your father loved rugby.

Memory was a mixed blessing. Indeed, much of life was made better by our ability to forget. A person endowed with a truly wonderful memory as a result of genetic manipulation could end up experiencing a very different form of human life.

There were many things to worry about on the parent/child relationship. This was certainly one of the things on his mind during the Select Committee's investigation of stem cell research, particularly when reflecting about cell nuclear replacement. Apart from the fact that it was not yet a scientifically safe procedure (and that in itself was an ethical consideration) if a father were to clone a child what would happen if the child grew up disliking many of the characteristics it saw in its father only to find that they were identical with their father? Could it not lead to self-disgust and self-hatred?

Germline therapy was the manipulation of genes with a view to affecting not just a particular patient, but also all succeeding generations. Apart from the current illegality there were other considerations. It was not just a question of fashion, of what kind of children we, from a personal point of view, would actually want for the future. There would be political considerations of the sort raised by George Orwell and the Brave New World. This might seem unrealistic at the moment but nevertheless it was a consideration and needed to be taken into account. Again, there would be not just the resentment of particular children to particular parents for making them in a particular way, but the resentment of future generations against their forebears.

The question of sex selection had recently been in the news. The HFEA had consulted and come out against sex selection simply on the grounds of balancing the family. Sex selection was technically possible and also legal in certain circumstances. Some genetic disorders were transmitted down either the male or female line. It was legitimate to select the sex of a child on such sound medical grounds.

The HFEA would undoubtedly continue to have difficult choices. It was essential to have the ethical aspects fully discussed before it was faced with a decision.

***In discussion the following points were made:***

There were many procedures being undertaken which related to fertility and the beginning of life. Some were more developed than others and there was a great need for the use of animals to consolidate these to ensure their efficacy.

There was a high frequency of chromosome abnormality even from natural fertility methods. Nature rejected most. The increase in frequency of abnormality with maternal age was higher in humans than in other species.

No culture accorded the aborted foetus the same bereavement rights as a human once born, an indication of differentiation of respect. The law required certainty, which the 14-day criteria gave.

While the attitude of a child brought into the world with the ability to donate tissue to a sibling might be very positive, particularly for blood where the procedure was straightforward, there might be different reactions in the instance of kidney failure.

There was a danger that screening and destroying defective foetuses could engender a culture which devalued the disabled.

As the world population increased so there would be pressures to limit the number of offspring, even in developed countries. Would not parents then want to take every precaution to have a child as free from illness as possible?

# LGC - a privatisation success

*Dr Richard Worswick, Chief Executive, LGC*

LGC's transformation from a government agency to a thriving science-based company is a heartening example of successful privatisation. Over the eight years since the company was formed LGC has grown, both organically and through acquisition, to become Europe's leading independent analytical laboratory. LGC today serves both the public and private sectors, providing advanced chemical and biochemical analysis and diagnostic services across a diverse range of markets. LGC Promochem, formed after the acquisition of Promochem in 2001, is now the market-leading provider of analytical reference standards. Continuous growth has seen staff numbers increase from 270 at the point of privatisation in 1996 to more than 700 today. During this period turnover has increased from £15m to £52m and profits have risen ten-fold.

***Dr Richard Worswick in LGC's Teddington Laboratory***

All this was difficult to envisage when, as an agency of DTI – and known in its pre-privatisation form as the Laboratory of the Government Chemist – LGC was offered for sale by the Government in a competitive sale process. The management buy-out team, backed by the venture capital company, 3i, and the Royal Society of Chemistry, had rapidly to establish credibility for an organisation that had no previous trading record and little experience of operating outside Government.

LGC rose to the challenge by introducing new business and commercial skills while preserving much of the ethos – in particular, quality and integrity – of the public sector. Emphasis was placed on improving customer service and reducing delivery times. To help focus on the new commercial imperatives all staff were given the opportunity to purchase shares in the company and new staff have been given a similar opportunity through share option schemes.

The commercial freedoms offered by privatisation have enabled LGC to invest more in its science and to make some important strategic investments – in new laboratories and equipment and in a small number of carefully targeted acquisitions in the UK and overseas. LGC's recent acquisition of Mikromol in Germany and the opening of its new Italian office reflect LGC's commitment to extending its network of international operations and expanding its European influence.

This commercial and technical success has, in turn, made LGC a much more useful supplier of scientific advice and services to Government. Although LGC today is a private company, its public sector work remains an important part of its activity, accounting for over 65 per cent of LGC's turnover.

LGC serves Government in two ways. First, it provides leading-edge analytical services where issues of public health and safety demand reliable measurements, delivered efficiently and cost-effectively. DNA-based diagnostic services, which include forensic investigations for police forces and medical genetics, are among the company's fastest-growing areas of work. The company also supports the national BSE testing programme and has recently opened laboratories in Edinburgh and Cheshire in anticipation of changes to the Over Thirty Month Scheme. Other services to Government include the genotyping of sheep (using some of the most advanced technology in the world) as part of the National Scrapie Plan to eradicate this disease and the surveillance of food for pesticides and veterinary residues. LGC's contract work for the Food Standards Agency contributes to consumer confidence relating to the provenance of food.

Secondly, LGC works through technical and policy networks to ensure that regulatory decisions are based on sound analytical science, protecting the public while fostering innovation. LGC's scientific locus between regulator and regulated is central to many controversial questions, such as the EU chemicals policy (REACH), GM food and the future of genetics in healthcare. LGC's prominence in providing relevant services gives an unrivalled

basis for the supply of policy advice, furthering UK objectives in international regulatory and standards debates. It also puts LGC in an ideal position to co-ordinate collaborative technical programmes, including a Faraday initiative on high throughput measurements.

## Government Chemist role

LGC's original name – the Laboratory of the Government Chemist – encapsulates a statutory role of some antiquity, tasked with resolving disputes involving analytical science. Initially directed towards revenue protection, the Government Chemist role developed during the twentieth century to cover trade description, but remained essentially responsive. The more enterprising, privatised LGC has helped evolve the role to benefit the development and enforcement of balanced regulation of chemicals.

The principal beneficiary of this change is the chemical industry, which comprises 3,500 companies and accounts for £49,000m pa turnover and some 235,000 jobs in the UK. The Government Chemist is in a unique position to support policy in helping the chemical industry to achieve the twin goals of sustainability and competitiveness. By helping to deliver balanced regulatory enforcement and lightening the burden of regulatory compliance, the Government Chemist benefits UK productivity and competitiveness.

## Securing better analytical science

Analytical science makes a huge – and undervalued – contribution to public health and safety, to innovation and to productivity. LGC is central to Government programmes directed towards raising both the profile and the level of play in analytical science throughout the UK. Several years ago LGC spearheaded the introduction of analytical science into the National Measurement System, through the Valid Analytical Measurement programme. More recently LGC together with the National Physical Laboratory (NPL) and The BioIndustry Association (BIA), has co-ordinated the DTI-funded Measurement for Biotechnology programme (MfB), launched in 2002.

*The most advanced analytical techniques are used for veterinary residue analysis of foods*

The MfB programme works with the biotechnology community to improve the accuracy, reliability and comparability of biomeasurements through the development of method validation tools, reference standards and protocols. As the national measurement institute for chemical and biochemical analysis, one of LGC's primary functions is setting standards for quality and measurement. LGC stands ready to assist in supporting Government's response to 'Bioscience 2015' – the November 2003 report of the Bioscience Innovation & Growth Team, which envisages a major contribution of the bioscience sector towards "improving national health and increasing national wealth". LGC is also working with NPL to create a National Centre for Biometrology, which will be an international centre of excellence focused on improving the reliability of biomeasurements in order to assist the development, exploitation and good regulation of biotechnology.

The provision of public services by the private sector is now accepted across the political divide. LGC's success demonstrates that science (and scientists) can flourish, and the role of a national measurement institute can be enhanced, within a science-based company which is privately owned and which serves both the public and private sectors.

LGC has UK laboratory facilities at its headquarters in Teddington, Middlesex and in Runcorn, Cheshire and has recently opened a new laboratory facility in Scotland. Through its LGC Promochem operations, LGC has offices in the UK, France, Italy, Poland, Spain, Sweden and India, as well as a laboratory and office in Germany.

Dr Richard Worswick, LGC's Chief Executive, recently won the Ernst & Young's 2003 UK Business Products and Services Entrepreneur of the Year award.

For further information on LGC, visit our website: www.lgc.co.uk or contact Deborah Gaskell, Corporate Communications Manager, LGC, Queens Road, Teddington, Middlesex TW11 0LY; tel: 020 8943 7593, email: deborah.gaskell@lgc.co.uk

# Long Term Vision Needed to Keep Britain Moving

*David Jones, Director of Britpave, the transport infrastructure group*

Successive Government under-investment combined with short-term five and ten year plans has resulted in a transport infrastructure that is simply not up to the job. The state of our crumbling transport infrastructure is having direct detrimental impact on the national economy. A survey from the Confederation of British Industry reports that the continual delays and congestion experienced on Britain's roads and railways are dissuading foreign investors from setting up their operations in the country. Meanwhile, market researchers Key Note have found that the congested roads and unreliable public transport is putting off visitors from abroad.

This should come as no surprise as we try to make-do-and-mend with a motorway network that needs continual maintenance roadworks with lanes regularly taken out of action despite there being a long-lasting road building solution. We go against sensible economic reasoning by installing steel motorway barriers that need replacing every time they are hit despite there being a proven barrier solution that lasts for over 50 years without the need for replacement or maintenance. Furthermore in the 21st century we run a rail network based on a 19th century ballast track system – the maintenance costs of which mean that there is no money available for real rail improvements only for patch and mend.

What is needed in Britain is a long-term vision that goes beyond the current short-term, expensive and ultimately flawed quick-fix solutions. Government and the Department of Transport need to have the imagination to examine transport solutions that offer a life-span of at least 40 years before needing any extensive maintenance or replacement. To address this issue, Britpave, the transport infrastructure group, launched in 2003 its "Keeping Britain Moving" campaign. The campaign highlights that many of the current problems lie in the actual fabric and construction of the UK's transport infrastructure and puts forward long-term solutions for motorways, crash barriers, the rail network and airports.

The UK road network carries 95 per cent of all freight traffic. The impact of this on the lifespan of roads is considerable. Typically, one heavy goods vehicle does the same amount of damage to a road as 100,000 cars. The impact of this structural damage means that motorways require constant maintenance with lanes often taken out of action for repair. The solution is to construct the inside lanes, most used by freight traffic, with jointless concrete that is surfaced with easily renewed asphalt. This is a structural solution that can cope with intensive traffic weight without the need for repetitive maintenance.

The same benefits of long-term performance and no undue maintenance results from the installation of concrete crash barriers which, despite their proven ability to prevent cross-over accidents and no need for replacement if hit, have only been installed on limited sections of the motorway network. Since 1995

***Concrete barriers need no ongoing maintenance.***

slipformed concrete barriers have been installed on sections of the M1 and M25. Since their installation there have been no reported cross-over accidents nor any required maintenance or repair despite there being evidence of vehicular impact. Steel barriers, however, are not always able to prevent a vehicle from crossing over into the path of oncoming traffic and need replacing every time they are hit resulting in a significant replacement programme and considerable costs due to roadworks and subsequent congestion. Indeed, on the M25 alone steel barrier repair and replacement has cost over £6 million since September 2001. Furthermore, even if they have not been hit steel barriers are only built to last 15-20 years before replacement. Concrete barriers are built to last a minimum of 50 years.

Steel barriers and wire fences, like their predecessors the rose bushes and thorn tree that were introduced on the first motorways in the 1960s, are no longer adequate to meet the demands placed upon them. This has been realised throughout Continental Europe where steel barriers are being replaced by concrete.

Nowhere are the inadequacies of Britain's transport infrastructure more evident than with the railways. Having once led the world, the rail network is now in crisis. For over 150 years the trains have run on ballasted track. However, this track belongs to another age. Britain's rail network needs to be brought into the 21st century.

Forty years ago, the Japanese had the long-term vision to replace their ballast system with concrete slab track. Forty years on and the impressive safety and punctuality records plus minimum maintenance makes the Japanese rail system the envy of the Britain's beleaguered train operators and passengers. The use of concrete slab track in Japan has maximised the operating efficiency of the rail network by eliminating unplanned maintenance. It also provides significant whole life cost savings. Although the initial outlay is higher, the resultant minimal maintenance and disruption means that this extra cost is recouped within 6-10 years.

Continental Europe is replacing ballast with slab track. However, in the UK slab track has been installed only for the Channel Tunnel and a few isolated lengths. The rest of the UK has to make do and mend.

The proof of concrete's long-term performance and low maintenance is clearly evident at Britain's airports. Faced with 24 hour operations, airports cannot afford to have aprons or runways out of action for unplanned maintenance. For this reason, together with lower whole life costs compared to other pavement construction methods, airports invest in concrete. First trialled at Stansted Airport in the mid-1990s, the favoured method of construction is slipform paving. This enables aprons and taxiways to be laid quickly and economically.

Airport operators and the private companies constructing and operating privately financed road schemes have demonstrated the vision to invest in a transport solution that has a guaranteed long-term performance of 40 plus years and delivers low levels of maintenance. This long-term vision is evident with governments throughout the modern world with the exception of the UK. Here, the lack of long-term vision means we have a transport infrastructure that increasingly looks more Third-world .

A CD-rom "Keeping Britain Moving" outlining long-term solutions for Britain's transport infrastructure is attached to the back cover and available from Britpave, Century House, Telford Avenue, Crowthorne, Berkshire RG45 6YS, tel: 01344 725731, www.britpave.org.uk

***Concrete slabtrack would dramatically reduce rail maintenance.***

***Airports know the value of concrete for round-the-clock operations***


*Professor Colin Pillinger, Lord Sainsbury and the Rt Hon Charles Clarke MP with Beagle2 and admiring onlookers.*

# Science in Schools

*The Rt Hon Alan Johnson MP, Minister of State for Lifelong Learning, Further and Higher Education*

The UK produces some of the best science and scientists in the world. If we want to continue to be successful in the future, the science we teach in schools needs to be relevant and engaging and it needs to prepare students effectively for further study post 16.

Science teaching and learning in schools has two main aims. We need to make sure that young people have sufficient knowledge and skills to pursue further study in science. We also need to make sure that all young people leave school with an understanding of the relevance and importance of science and technology to the world around them. We live in a world where progress in science and technology frequently prompts us to ask ethical questions about how controversial scientific and technological developments should be applied. It is essential that we successfully equip today's young people studying science in schools who may well be making decisions about how we address these difficult issues in the future.

So how do we get more young people engaged in science? Despite explosive media coverage of controversial scientific developments, the Science and Technology Select Committee suggested that school students often perceive science as dull. Like all subjects, science can be hard and intellectually challenging but it is not dull. The challenge we face in schools is to ensure that teachers feel sufficiently confident and inspired to teach science in a way that conveys its relevance and importance to young people.

## Curriculum and teaching

Our vision is to create a curriculum and a style of teaching that reflect the reality of science and its many applications in an informed and objective way. In doing so, not only will we improve the scientific literacy of all students, but we will also

motivate more of them to pursue science beyond 16, and those who go on to study science at university will have a surer foundation.

We know from OfSTED that Initial Teacher Training (ITT) for science teachers is good. However, there is a need to make sure we continue the momentum of this good start throughout every science teacher's career. In October, I announced who would be running the science learning centres, which will provide training and continuing professional development to teachers and technicians. Through access to training at the centres, we aim to make it as easy as possible for all science teachers to keep up with new developments in their field and able to apply these in the classroom. There are also specific aspects of science teacher training that the centres will focus on such as subject specialism for teaching students post 16 and exciting practical work.

## Key Stage 3

The science strand of the Key Stage 3 Strategy has provided a crucial building block for improving teaching and learning in science in schools. We have invested £300 million in the overall strategy already, with a further £200 million in 2003-04 for high quality materials and classroom support to enhance teachers' professional development. The strand for science sets high expectations and challenging targets which provide pupils with a springboard to success at GCSE and beyond. The focus of the science strategy for Key Stage 3 is on teaching styles: encouraging inspiring and creative teaching practices that will enthuse students at a stage where in the past we have seen the interest levels of young people in science drop.

## Key Stage 4

The new Programme of Study for science at Key Stage 4 is the next step. It will be based around practical skills and knowledge and understanding of how science works and how it is applied. The programme of study can lead to three different courses: developing scientific literacy for the 21st Century, enabling students to engage with the world of science as a consumer or citizen; developing a broad understanding of science, enabling progression for more advanced study; or developing practical scientific capability, engaging students in occupations such as health care, manufacturing, agriculture and communications. The changes will come into effect in 2006, and the outcomes of the pilot GCSE, Science in the 21st Century will feed into these changes.

## Partnerships

However, this is not an agenda that schools and teachers should feel they have to take forward alone. Employers, universities and research councils also have a key role to play in demonstrating to young people some of the interesting and inspiring opportunities that studying science can lead to. This could be by encouraging scientists to go into schools through schemes like the Science and Engineering Ambassadors Programme or by giving students opportunities to see and experience science in action in the workplace. Innovative projects that encourage young people to learn through contemporary science, such as the Beagle II education materials and the Genetic Futures event, are the result of successful partnerships between Government, employers, universities, science institutes and research councils. They can have a real impact on young people's enthusiasm for science and I hope that there are many more opportunities to work together to create similar opportunities for young people and their teachers in 2004.

# Science Education

*By Maggie Leggett on behalf of the Biosciences Federation*

School science teachers have been dealing with change over the last 15 years, and will continue to do so. The Government wants larger numbers of young people to go to university, but many academics are unaware of what is happening in schools, and are struggling to adjust to a new type of undergraduate. School teachers, the Government and university tutors all share the same ultimate goal of producing educated people capable of undertaking work. Is there any communication between these three corners of the educational triangle, or are they just working in isolation?

## Should students decide for themselves?

Industry, Government and Universities have expressed concern about the decrease in students opting for science. For many this choice is taken quite early – reducing to single science at GCSE can be the end of scientific aspirations. Are the consequences understood? The view of the Qualifications and Curriculum Authority was that a sensible choice would be made by a 14 year old if provided with all the information. However, discussion with academics, teachers and parents suggests that many 14 year olds would take the path of least resistance, and were most affected by peer pressure. Andrew Kendall, who is currently enjoying a biological science course at King's College London, says he would have taken the subjects he perceived as easiest (not science) if he had been given the option at 14.

Imminent changes by the QCA will concentrate the compulsory science curriculum on "scientific literacy" – enabling young people to understand scientific advances and hazards reported in the media. This is justified by the decision that the majority of pupils do not pursue a scientific career, and therefore do not need to study science in depth. However, students following this route would be ill-prepared for a career in science and are therefore taking the decision to "opt out" of science early.

Wilf Hudson, from the Standards Unit, proposed the attractive option that pupils should have flexibility to pick neglected subjects up later on, although

Pauline Lowrie (Head of Science, Sir John Deane's 6th Form College) points out that school curricula are constrained by timetables. Rebecca Edwards from the QCA describes her preference for non-compulsory science, and a requirement for teachers to "sell" their subject. However, with the current shortage of science teachers and the problems they have outside their subject area, this would be a tall order. Research commissioned by the Wellcome Trust found that most teachers have insufficient opportunity for CPD and staying in touch with current developments. The new centres of excellence for science teachers will need to address these problems as a matter of urgency.

## Do students have the necessary information to make decisions regarding their careers?

Careers advice is a priority for QCA, shortly to be introduced into the national curriculum from Year 7. Currently, careers provision is poor. With the introduction of "Connexions", careers advisors now concentrate on children who are disaffected or who have problems, leaving others with no advice. The benefits of psychometric testing, which are extolled by Angela Lowi (Connexions), costs over £50 and is therefore a minority interest. Pauline Lowrie suggests that children often have little idea what scientists do other than their TV *persona* – hence the current fad for forensics. Although Learned Societies produce careers information, they often lack the resources to develop and distribute it fully as confirmed by a MORI poll, where 44% of students had never received information regarding Higher Education.

## Changing styles of teaching and learning

Over the last 20 years children have been introduced to a far greater range of teaching methods. Pupil-led research by Planet Science suggests that children prefer traditional forms of teaching such as taking notes from the teacher and class discussion and differentiate between methods they enjoy (videos rated high) and those that actually result in learning (videos rated very low). Internet-based research and learning was rated lowest by the 2000 pupils who took part in this survey.

There is still a shock when a student arrives at university however they were taught. Most courses are still taught in large lecture theatres although some universities (eg medicine at Manchester) are moving towards small group problem-based approaches. Student numbers are growing with an increasingly diverse academic background. Some universities provide training in study skills and support and guidance for students. Newcastle University showed that students found academic challenges less problematic than dealing with lifestyle changes, indicating where universities could concentrate their efforts.

## The chemical question

Students enter university with a much greater range of qualifications, and are accepted on biological and biomedical courses without A levels in chemistry and maths. Many believe that a motivated and committed student will overcome deficiencies in the academic background. For example, Laura McRobb, a student at Westminster University studying Biomedical Sciences has entirely Arts based A levels but is enjoying the course and succeeding at Westminster. However, lack of chemistry is still the greatest predictor of failure at the end of the first year in Biological Sciences at Manchester University. The Newcastle study has shown that only 1 in 5 arriving without A level chemistry felt that their chemical knowledge was sufficient. Once again, universities are adapting to the change, providing catch-up courses and other support, but on a reactive rather than proactive basis.

## Assessment

Children are allowed to retake their exams at school. This culture is to be extended so that they can retake as often as they wish, and only "cash in" their grades when they are satisfied. Will this really be a realistic proposition, considering the time and cost implications? Wilf Hudson, from the Standards Unit, extols the virtues of the new system, and comments that he had to retake exams himself. When introduced it will also add to the "culture shock" of a university education, as normally at this level the first mark gained is carried through, and retakes only used to gain entrance to the next year rather than to better marks. Keith Elliott, admissions tutor at Manchester University, feels that students are poorly prepared for this change in culture. Participants also felt that the "bite size" nature of school exam questions led children to think in this way, rather than integrate and apply their knowledge.

## Widening participation or bums on seats?

Louise Archer (London Metropolitan University)[1] has gathered evidence that traditionally under-represented groups are still not going to university, despite recent initiatives. Results of discussion groups with over 200 young people from this background showed that they were not being approached in the right way, since financial and cultural risks of attending university were so much higher, and they lacked role models from their communities. There is very little possibility that any of these school children would even consider HE unless information is portrayed in a way they could trust, even though they recognise the advantages this bestowed. Government and other stakeholders need to rethink their strategies if the aim is to widen participation in addition to increasing numbers.

## The practical issue

Pauline Lowrie asserts (echoed by teachers around the room) that coursework requirements mean that the pupils realised they were being made to "jump through hoops" and resented what they regarded as boring practicals. Further evidence from the Planet Science survey showed that most students want to do more practicals, but these should be more interesting and challenging. Research commissioned by the Wellcome Trust shows that students' experience of school based science practicals is actually very varied, but that teachers feel close assessment of practicals imposes unnecessary rigidity. Save British Science have produced evidence from the Deans of Science in UK universities showing that that fewer than 50% of their students arrive with the necessary practical skills and are graduating with poorer practical skills.

## Links between schools and universities

There must be a benefit to all parties of increasing links between schools and

universities. Local schemes and networks grow rapidly. Peter Robinson who runs Biology4all.com, a website for school and university teachers which incorporates an on-line discussion list and speaker database, speaks enthusiastically about the benefits of this communication forum. The site, which is private and free, enables university academics and school teachers to swap information, learn from each other and set up school talks quickly and easily. Other schemes, such as Researchers in Residence, are spoken of warmly.

## The way forward

The newly formed Biosciences Federation has recently held a meeting to address the above points, and they have declared their intention to make this an annual event. Specific suggestions from their first meeting include:

Building on current networks and links, developing simple methods of two-way contact between schools and universities. This is one of the aims of the Education Committee of The Biosciences Federation.

School biology practicals and coursework need to be overhauled, to present more interesting and stimulating material. Replacement of practicals with IT based alternatives should be discouraged at all levels.

In order to widen participation in HE, marketing campaigns need to target under-represented groups with a greater understanding of their particular problems.

Information should be shared between universities on methods of supporting undergraduates on arrival.

The Government, schools, HE Institutions and learned societies need to work more closely together to provide careers advice.

*Maggie Leggett (mleggett@physoc.org) is Public Affairs Coordinator of the Biosciences Federation. Much of this article is based on a Symposium organised by the Biosciences Federation in October 2003.*

*References:*
*Individual references are available on the Biosciences Federation website, www.bsf.ac.uk.*
*1. Archer, L, Hutchings, M & Ross, A (2003) Higher Education and Social Class: Issues of exclusion and inclusion (London, RoutledgeFalmer)*

# Parliamentary & Scientific Committee News

## New Members

We are pleased to welcome **Gatsby Technical Education Projects** and **WWF-UK** as members of the Committee.

## Peter Robert Simpson

Peter Simpson assumed the duties of Administrative Secretary of the Parliamentary and Scientific Committtee on the retirement on 1 January 2004 of Dr Alan Whitehouse, who had advised, managed and developed the many and diverse activities of the Committee for the previous eight years. Peter is currently working as an Independent Consultant in Geology, Geochemistry, Gemmology, Mineralogy and Petrology with recent overseas projects in China, the Caribbean, Namibia and Canada. He is an Honorary Research Associate of the British Geological Survey where his contributions ranged from research as a NASA Co-Investigator on returned Lunar Samples to directing the Geochemical Baseline Survey of Great Britain and Northern Ireland, including initiation of Hydrogeochemical multielement mapping of stream water and Urban Geochemical Surveys for Environmental Applications.

He is also currently active as a Past Visiting Professor and Academic Visitor at Imperial College of Science Technology and Medicine, in the Department of Earth Sciences and Engineering, where he lectures or supervises 3rd, 4th year and MSc Students on courses such as "Introduction to Exploration and Environmental Geochemistry" and the "Hydrogeology of Contaminated Land". He is a Past Special Professor in the Department of Mineral Resources Engineering, Nottingham University, and Past President of the Association of Exploration Geochemists, where during his Presidency year he helped develop a completely new Scientific Journal for the Association entitled "Geochemistry: Exploration, Environment, Analysis" published in collaboration with the Geological Society of London. He is also currently Chairman of the Editorial Board for "Applied Earth Science", published by Maney on behalf of the Institution of Materials, Minerals and Mining, located at 1 Carlton House Terrace, where he is a Fellow.

Peter is the Company Secretary for "Breast Cancer Understanding and Prevention Limited" which is a private company involved with the authorship, publication and promotion of popular and scientifically researched healthcare books, especially those related to Breast and Prostate Cancer, Osteoporosis and the development of healthy dietary regimes for prevention and recovery. He is the Author of over 100 scientific papers and reports. He has a wife, Professor Jane Plant CBE, a daughter Emma who is an Advertising Management Consultant and a son Tom who is a medical student in Cambridge and London. His hobbies include playing Scottish Country Dance music on a melodeon, which he taught himself.

***Peter Robert Simpson***

# How Designing Better Experiments Can Reduce the Number of Laboratory Animals Used in Biomedical Research

*Dr Michael F W Festing, FRAME*

Animal research in the UK is tightly regulated under the Animals (Scientific Procedures) Act 1986. The system involves licences, detailed discussion of every project, and unannounced visits by Home Office inspectors as outlined by Lord Sainsbury in the Autumn 2003 edition. Yet there is still room to reduce the number of animals used in biomedical research by better design of experiments and using statistical methods more effectively. It would also improve the quality of the research saving both money and scientific resources.

A well designed experiment usually involves a comparison of several groups of animals given different experimental treatments. The aim is to identify the effect of the treatments on the animals. The good experiment should: ensure that the *only* difference between groups is due to the treatmentl; be *powerful* enough to detect any biologically important effects; be simple enough to minimise the risk of making mistakes; lend itself to statistical analysis and be economical with animals and scientific resources.

The power of an experiment depends largely on having uniform animals (ie of similar age, weight and genetic composition) and on the number used. This number has, until recently, been a matter of tradition and guess-work. Groups of about eight animals per treatment are common but when many treatments are involved this seriously over-estimates the number needed.

## Group size

There are better methods for determining group size. According to the Resource Equation method the total number of animals, for measurement outcomes, should be the number of treatment groups plus 10 to 20 additional animals, rounded to equal numbers per group. Where there are more than 20 groups, each group should contain two animals. The Power Analysis method depends on the variability of the animals, the magnitude of the treatment response and the chance of reaching a wrong conclusion. Both methods reduce the guess-work.

## Too many animals used

Experiments often use too many animals. A small survey of 27 UK scientific papers found that the number of animals used per experiment ranged from five Rhesus monkeys to 288 mice. The latter experiment involved 144 mice of each of two strains. The aim was to see if the strains differed in blood levels of three pharmacological preparations at six times of the day. It involved 36 groups of eight mice per group. However, it is unwise to do such a large experiment without having an idea of the outcome. Blood levels were not measurable for two of the pharmacological treatments. A pilot study using, say, the three pharmacological treatments, two times, two strains and two mice per group (24 mice) would doubtless have shown that the two pharmacological treatments gave undetectable blood levels. A second experiment could then have been done to see if the mouse strains differed using the single measurable pharmacological treatment, say at three times of day, using four mice per group or a total of 24 mice. This strategy would have used 48 mice, saving 240 mice or freeing resources for more experiments, thereby speeding research. Moreover it would have been more likely to reach a correct conclusion.

Faulty design in other respects and incorrect statistical methods rendered the conclusions reached by these authors unsafe.

Other experiments involving 88 rats, 102 rats and 64 mice could each have been done with about half these numbers. In each case the authors used simple but inappropriate statistical methods to try to analyse the data from complex experiments with many treatment groups. Several other papers had design errors or failed adequately to explain their methods, so it was impossible to judge whether they had been done correctly. In eleven cases it was not even clear how many animals had been used.

## The inbred strain

Fourteen papers used rats but only one used an inbred strain. These strains are like clones of genetically identical individuals and have been available for many years. Their uniformity leads to more powerful experiments and they have several other useful characteristics. Their use is often essential and crucial yet, although at least eighteen Nobel prizes have been awarded for research necessitating the use of these strains, many research workers seem to be unaware of their valuable properties.

## Scientists Failing

All papers discussed here were peer reviewed, implying that far too many scientists are failing in their understanding of experimental design and statistics. Fortunately the major funding organisations are now aware of the problem and the Medical Research Council, working through Centre for Best Practice for Animals in Research, has recently set up a working party of stakeholders to consider what needs to be done.

# Entrepreneurship in the UK: Changing the Culture through Collaboration

*Neil Mundy, Director Innovation and Integration, One NorthEast*

How can entrepreneurship be fostered in start-ups, when many of the UK's smaller businesses are still struggling to compete? How can senior executives best manage and encourage entrepreneurial people within larger firms? What initiatives and policies can help the public and private sectors to share ideas about stimulating a more innovative culture inside an organisation?

Speakers and delegates discussed these questions and more at the Cambridge-MIT Institute's (CMI) annual Summit on Entrepreneurship in the UK last November, which was hosted by One NorthEast in Newcastle. As Director of One NorthEast's "Strategy for Success", I was delighted that we could work with CMI on this event. As was highlighted in the Government's recently published Lambert Review, increasing entrepreneurship and competitiveness in this country is dependent on building the next generation of collaboration and partnership between industry, academia and the public sector.

If understanding and communication is not always apparent within the business world, then think of the greater barriers that often exist between academia and industry. Collaboration, improved communication and understanding between these sectors are the only ways to boost entrepreneurship and the commercialisation of new ideas. Lita Nelsen, Director of CMI's highly acclaimed technology transfer training programme, PRAXIS, spoke at the Summit of the need for a culture change: technology transfer needs to become pervasive. It also needs to be recognised as global, which is precisely why international collaborations such as CMI are useful in providing a model for partnerships.

Entrepreneurship is multi-faceted. All too often, we think of it solely in terms of start-ups and small firms with academics seeking to commercialise discoveries. Through stronger links with academia, businesses need to be able to approach universities and ask for help in meeting some of their technology and skills needs.

Larger companies have a vital part to play in terms of UK entrepreneurship. "Intrapreneurship" – maintaining the entrepreneurial spirit in larger companies – has been essential to the success of North East world-class companies such as SAGE and Northern Rock Plc

As Douglas Robertson, Director of Business Development at Newcastle University, pointed out to Summit delegates, technology transfer is a "long-term game – long-term return and long-term investment." Although we have a strong venture capital base, we have a poorly formed early stage technology investment environment. It will take time and energy to change this landscape and create an entrepreneurial culture in the UK.

So where do we start? I firmly believe that both One NorthEast and CMI are encouraging some of the entrepreneurial reforms needed to further economic development in the UK. The North East Region has devised a "Strategy for Success", through which we aim to accelerate change in the region from its traditional industrial heritage to one based on competitiveness and high-technology industry. The regional strategy has identified five areas of strength: new and renewable energy, nanotechnology and micro-systems, process industries, life sciences and digital technology and media. To boost entrepreneurship in these areas and to bridge the business-academia gap, we have set up five Centres of Excellence around these areas to identify technologies that have commercial potential, communicate market needs to the research community and effect spin-offs of new companies or technology transfer to existing companies. To support this the region is also dedicating energy and resources to creating an investment culture through NStar.

CMI and the North East's collaboration goes further than the Summit. The CMI "Connections" programme aimed at developing the entrepreneurial capabilities and intentions of undergraduates has twice been held in the North East, and One NorthEast has sent cohorts of CMI sponsored representatives to the Entrepreneurship Development Programme in MIT in Boston.

In the North East, we attach the highest priority to working internationally, including learning from international best practice. Entrepreneurship in the UK provided an international perspective to the entrepreneurship debate through the Cambridge / MIT partnership, a national perspective through CMI's National Competitiveness Network of universities, and a direct regional perspective through One NorthEast. I hope that such collaborations will continue to grow.

For further information see
www.onenortheast.co.uk
www.cambridge-mit.org

*RESPONSE TO BOOK REVIEW*

*By Susan A. New PhD and Roger M. Francis MB FRCP*

# Understanding, Preventing and Overcoming Osteoporosis

*By Professor Jane Plant CBE and Gill Tidey*
*Virgin Books Ltd, 2003, £16.99, ISBN 1-85227-077-2*

Jane's first book 'Your Life in Your Hands' (2000, revised 2003) describes recovery from breast cancer by changing to a diet based on that of rural China where breast cancer rates were 1 in 100,000 compared to 1 in 10 in the West. The osteoporosis book was written in response to the non-dairy message in that book and our cookbook 'The Plant Programme' and to such questions as 'Where will I get my calcium from?' or 'Won't I get osteoporosis?' Our aim is to empower people by translating mainstream scientific literature to make it accessible and to do so with a healthy scepticism of science funded by any vested interest groups.

Our osteoporosis book is based on more than 450 references, mainly from peer-reviewed sources and includes seven dietary and eight lifestyle factors so we are always suspicious when someone seizes on the non-dairy message. In the case of the lead reviewer of our book, Susan A New, her university website indicates that her PhD was funded by a 'Nutritional Consultative Panel UK dairy industry scholarship'. It also notes New's consistent track record in raising significant research income. Moreover in 2001 she was awarded the Silver Medal of the (UK) Nutrition Society where a senior officer recently confirmed their funding was from publications, grants and fees for membership which includes mainly representatives of the food, feed and pharmaceutical industries.

R M Kradjian, head of the breast surgery division, Seton Medical Centre, California, who discourages all use of dairy produce in his book 'Save Yourself from Breast Cancer' draws attention to the problem of science funded by vested interest. He states 'The issue is clear. Much of our highly varied, desired and profitable food supply has been found to be dangerous. The people who furnish this food and who are enriched by its sale do not want you to know this. They have generously contributed to scientists who have supported and are willing to continue to support, their products.'

In their review New and Francis fail to refer to any of the work we include by distinguished researchers from the University of California that shows that the higher the proportion of acid generating animal protein in the diet, the higher the risk (up to 200 times) of hip fracture. They conveniently ignore our recommendation of oily fish or ultra pure cod liver oil as a source of vitamin D. They also state 'Lee's putative claims' on the beneficial effects of natural progesterone (which we recommend to replace HRT) on bone density are based on observational studies unpublished in peer-reviewed journals. In fact Lee's book is based mainly on the 'Journal of the American Medical Association' and other peer-reviewed journals or medical textbooks. They also claim that our ten Golden Guidelines 'mirror those given by the UK Food Standards Agency (FSA)'. Perhaps they could indicate any FSA recommendation for organically grown food certified by the Soil Association [Golden Guideline 1] or removal of dairy produce from the diet [Golden Guideline 2] or any of our Golden Guidelines? They indicate emphasis on 'alkali-forming foods, i.e. fruit and vegetables' to balance acid-generating foods is 'premature', even though alkali-forming foods are essential to balance acid-generating food - mainly animal protein (epecially cheese), according to distinguished German nutritional researchers (see 'Hard Cheese', New Scientist). Others authorities are quoted below:

Dr Colin T Campbell of Cornell University USA:
The association between the intake of animal protein and fracture rates appears to be as strong as the association between cigarette smoking and lung cancer.

Dr. John McDougall MD:
The calcium-losing effects of protein in the human body is not an area of controversy in scientific circles. The myth that osteoporosis is caused by calcium deficiency was created to sell dairy products and calcium supplements. American women are among the biggest consumers of calcium in the world, and they still have one of the highest levels of osteoporosis in the world. The primary cause of osteoporosis is the high-protein diet most Americans consume today. 'Eating a high-protein diet is like pouring acid rain on your bones'.

John Robbins:
The [US] National Dairy Council has spent tens of millions of dollars to make us think that osteoporosis can be prevented by drinking more milk and eating more dairy products. But the only research that even begins to suggest that the consumption of dairy products might be helpful has been paid for by the National Dairy Council itself.

The University of Surrey highlights its excellence in dancing. Our question is 'Whose tune is Susan A. New dancing to?'

References cited from 'Understanding, Preventing and Overcoming Osteoporosis'

Jane Plant and Gill Tidey

The full text of the response is available from:
BParker@virgin-books.co.uk

# Exploring the Brain

*Report by Robert Freer*

The Parliamentary and Scientific Committee visited the Institute of Cognitive Neuroscience, University College London, on 6th November 2003.

The scientific exploration and understanding of the brain is one of the most challenging new research projects in medicine today. How does our brain work? What is thought, what is memory and what is the process of thinking? Thirty years ago we knew little more about the working of the brain than was known in the twelfth century. The Institute of Cognitive Neuroscience (ICN) was founded in 1996 as part of University College London (UCL) to study and to try to understand some of the problems arising from the activity of the brain. The Institute brings together the previous neurological work in different departments of UCL and is the focus for human neuroscience research within UCL. ICN has seven groups of researchers studying the functional and neural organisation of human cognition with grants totalling £7.6 million.

The group was welcomed by Professor Tim Shallice FRS, Director of the Institute, and one of the pioneers of cognitive neuropsychology, who described the range of work being undertaken by the different departments at ICN, and the value of bringing together in one Institute research workers that were formerly in separate schools working in relative isolation from each other. The ICN provides an environment that encourages interaction between teams using different methodological approaches, which is likely to prove particularly productive when tackling specific research topics.

ICN research workers use methods for the non-invasive measurement of brain activity such as scalp-recorded electrical potentials (EEG) and functional magnetic resonance imaging (fMRI), behavioural studies of patients who have suffered neurological illness or development difficulties principally of genetic origin, and transcranial magnetic stimulation (TMS), with which it is possible to temporarily disrupt the function of circumscribed brain regions in healthy individuals.

The introduction was followed by two interactive sessions, one on the brain and mind in autism and schizophrenia and the other on attention in the normal and damaged human brain. These were presented by Professor Uta Frith FBA, the leader of the Development Disorders Group, and Professor Chris Frith and by Professor Jon Driver, leader of the Attention Group and of the Functional Imaging Laboratory.

The Development Disorders Group studies brain processes involved in autism and development dyslexia. Phonological processing problems and common cortical processing disorders were identified in Italian, French and English which were qualitatively identical even though the nature of the writing system is very different in the three languages. fMRI studies in autistic adults indicated that mentalising problems were found to be reflected in weaker connectivity in the brain's mentalising system

The Attention Group is exploring and making significant discoveries in the three related themes of modulation of early sensory processing by selective attention, crossmodal links in spatial attention, and the neurological deficits in attention following frontal-parietal damage

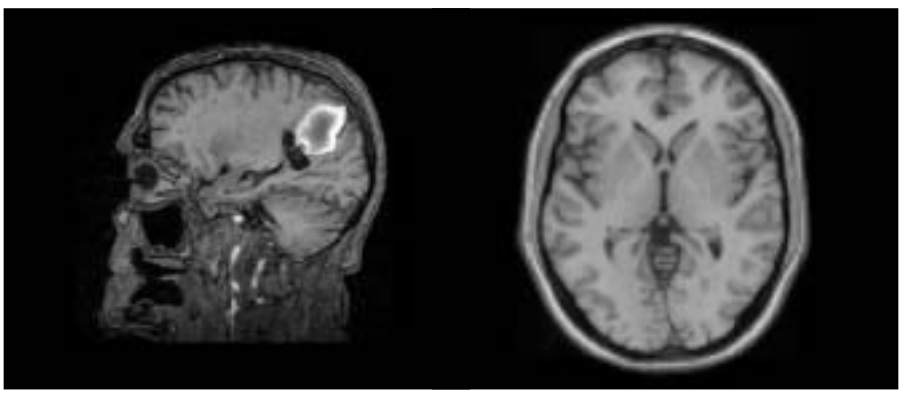
The third presentation was by Professor Brian Butterworth FBA on Dyscaculia: the hidden epidemic. Professor Butterworth is the leader of the Numeracy and Literacy Group which has shown the existence of a cortical system that responds to abstract numerosity-number independently of modality, and have shown the independence in the brain of different types of alphanumeric operation.

A buffet lunch was much enjoyed with the company of several research scientists with poster displays of the techniques and work of the other main ICN groups. These included the Cognitive Electrophysiology Group (leader Professor Rugg FRSE), the Executive Functions Group (leaders Professor Shallice FRS and Dr P Burgess), the Motor Control Group (leader Dr Haggard) and the Space and Memory Group (leaders Professor J O'Keefe FRS and Dr N Burgess).

The display of work on Memory and Ageing seemed to attract a particular interest from members.

After lunch the party visited the Brain Imaging Laboratory to see the magnetic resonance imaging equipment and were shown pictures of the brain in a healthy condition and with various disorders recognised by certain behavioural problems.

Members of the group thanked Professor Shallice for the opportunity to visit the ICN and to see this fascinating work at the new frontier of medical research.



***Left: T1 weighted MRI scan showing a sagittal slice through the brain of an individual who has suffered a right parietal haemorrhage causing neglect.***
***Right: T1 weighted MRI scan showing an axial slice through normal brain***

# House of Commons Select Committee on Science and Technology

*Under the Standing Orders, the Committee's terms of reference are to examine "the expenditure, policy and administration of the Office of Science and Technology and its associated public bodies". The Committee was nominated on 12 November 2001.*

*The Chairman is Dr Ian Gibson (Lab, Norwich North). Other members of the Committee are Paul Farrelly (Lab, Newcastle-under-Lyme), Dr Evan Harris (Lib Dem, Oxford West and Abingdon), Mr Tom Harris (Lab, Glasgow Cathcart), Dr Brian Iddon (Lab, Bolton South East), Mr Robert Key (Con, Salisbury), Mr Tony McWalter (Lab/Co-op, Hemel Hempstead), Dr Andrew Murrison (Con, Westbury), Geraldine Smith (Lab, Morecambe and Lunesdale), Bob Spink (Con, Castle Point) and Dr Desmond Turner (Lab, Brighton Kemptown).*

## Oral Evidence

**Office of Science and Technology (OST)**

The Committee took evidence from Lord Sainsbury of Turville, Parliamentary Under-Secretary of State for Science and Innovation; Professor Sir David King, Chief Scientific Adviser to the Government; and Dr John Taylor, Director General of the Research Councils, on Monday 10 November.

**Colin Blakemore: introductory session**

The Committee took evidence from Colin Blakemore, Chief Executive, MRC on Monday 8 December.

## Current Inquiries

**Government Support for Nanotechnology**

In response to the announcement by Lord Sainsbury of Government funding for nanotechnology of £90m over six years, the Committee announced its inquiry into Government support for nanotechnology on 2 July 2003. It is looking at the action the Government has taken to support developing nanotechnologies and to promote relevant research in the public and private sectors. Oral evidence sessions were held on 20 October, 27 October, 3 November, 15 December and 26 January.

**The Use of Science in UK International Development Policy**

The Committee announced on 21 July 2003 that it would examine the extent to which research, technology and innovation are informing Government international development policy and practice, and what the impact of Government policy has been in building a relevant science base in developing countries. It will also examine whether expertise in the UK science base is being utilised effectively in the implementation of this policy and what the implications are for the maintenance of a science, technology and engineering capacity in the UK which is of relevance to development policies. Oral evidence sessions commenced in January 2004.

**Human Reproductive Technologies and the Law**

In the light of recent court cases that have challenged the HFE Act and the Human Fertilisation and Embryology Authority's right to regulate on a number of issues, the Committee announced an inquiry into human reproductive technologies and the law on 24 October 2003. It will examine the regulation of, amongst other topics, the use of embryo research for therapeutic purposes, the use of preimplantation genetic diagnosis and issues of consent relating to frozen embryos. In view of the sensitivity of these issues and the strong personal views held by many people, the Committee plans to consult widely, including an open "e-consultation". This process will be used to inform the inquiry's terms of reference and the Committee's oral evidence sessions. The "e-consultation" was launched in January and the terms of reference will be decided at Easter 2004.

**EU Chemicals Policy**

On 29 October 2003, the European Commission published its proposals for EU chemicals legislation. In response, the Science and Technology Committee announced a short inquiry into the implications of these proposals. In particular it will try to establish, given that the principles of the legislation will remain in place: what, in order of priority, needs to be amended in the legislation; and what the implications would be if these amendments were not made. Oral evidence sessions began in January 2004.

**Scientific Publications**

On 10 December 2003, the Committee announced an inquiry into scientific publications, looking at access to journals within the scientific community, with particular reference to pricing and availability. It will be asking what measures are being taken in Government, the publishing industry and academic institutions to ensure that researchers, teachers and students have access to the publications they need in order to carry out their work effectively. The inquiry will also examine the impact that the current trend towards e-publishing may have on the integrity of journals and the scientific process. Oral evidence sessions are due to begin in March.

**BBSRC**

The Committee took evidence from the Biotechnology and Biological Sciences Research Council (BBSRC) on Monday 1 December. This was a scrutiny session on BBSRC's work, strategy and expenditure plans, as part of the Committee's ongoing programme of scrutiny of the Research Councils. A Report is expected in Febuary.

## Reports

**Light Pollution and Astronomy**

The Committee's Seventh Report of Session 2002-03, Light

Pollution and Astronomy, HC 747, was published on Monday 6 October 2003. The Report examines the growth of light pollution in the UK and the effect it has had on professional and amateur astronomy. Members of the Committee held press conferences at various locations to launch the publication.

**The Scientific Response to Terrorism**

The Science and Technology Committee published its Eighth Report of Session 2002-03, The Scientific Response to Terrorism, HC 415I, on Thursday 6 November 2003. The Report examines the extent to which the UK response to terrorist attacks using chemical, biological, radiological or nuclear agents was underpinned by science and technology, what contribution science and technology could make in combating terrorism and what issues needed to be faced by the research community to ensure that their activities did not unwittingly assist terrorists' activities.

**The Work of the Engineering and Physical Sciences Research Council**

The Science and Technology Committee published its Ninth Report of Session 2002-03, The Work of the Engineering and Physical Sciences Research Council, HC 936, on Monday 3 November 2003. The Report examines the work, strategy and expenditure plans of EPSRC, as part of the Committee's ongoing programme of scrutiny of the Research Councils.

## Government Responses

The Committee published the Government Response to the Committee's Fifth Report, The Work of the Natural Environment Research Council, as its Seventh Special Report of Session 2002-03, HC 1161, on Wednesday 29 October 2003.

The Committee published the Government Response to the Committee's Sixth Report, UK Science and Europe: Value for Money?, as its Eighth Special Report of Session 2002-03, HC 1162, on Friday 31 October 2003.

The Committee published the Government Response to the Committee's Seventh Report of Session 2002-03, Light Pollution and Astronomy, as its First Special Report of Session 2003-04, HC747, on Thursday 18 December 2003. The Report and Government Response were debated in Westminster Hall on Thursday 12 Febuary.

## Further Information

Further information about the work of the Committee or its current inquires can be obtained from the Clerk of the Committee, Mr Chris Shaw, the Assistant Clerk, Mrs Emily Commander, or from the Committee Assistant, Ms 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.

All recent publications (from May 1997 onwards), terms of reference for all inquiries, press notices and the uncorrected transcripts of evidence sessions are available on the internet http://www.parliament.uk/parliamentary_committees/science_and_technology_com.cfm

# House of Lords Science and Technology Select Committee

*The members of the Committee (appointed 3 December 2003) are Baroness Finlay of Llandaff, Lord Lewis of Newnham, Lord Mitchell, Lord Oxburgh (Chairman), Lord Paul, Baroness Perry of Southwark, Baroness Platt of Writtle, Baroness Sharp of Guildford, Lord Soulsby of Swaffham Prior, Lord Sutherland of Houndwood, Lord Turnberg, Baroness Walmsley, Lord Winston, and Lord Young of Graffham.*

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

## Science and International Agreements

Lord Mitchell is chairing Sub-Committee I's inquiry "Science and International Agreements", which is exploring the processes whereby scientific advice and other scientific input is incorporated into international agreements.

Oral evidence has so far been heard on a wide range of agreements, including those on climate change, whaling, trade and GMOs, the marine environment and the Antarctic. In January three members of the Sub-Committee and the Clerk visited the UK's Rothera Research Station in the Antarctic – a full report, with photographs, will appear in the next edition. The Committee will also be visiting UN bodies in Geneva, and possibly the European Commission and others in Brussels.

Oral evidence sessions are expected to conclude by early March, with the Committee to hear from learned societies, FCO and ministers. Rebecca Neal (nealr@parliament.uk) is Clerk of the Sub-Committee.

## The Practicalities of Renewable Energy

Sub-Committee II, chaired by Lord Oxburgh, is investigating what practical steps are needed to move

towards renewable energy sources at the rate proposed in the Government's recent Energy White Paper.

In October 2003 Members of the Sub-Committee visited Denmark, where renewable sources make a major contribution to the energy supply. The fascinating trip took in discussions with government officials and academics, with visits to biomass and biogas combined heat and power stations and solar power installations.

The highlight was a trip to the world's largest offshore windfarm, Horns Rev, in the North Sea, which is operated by Elsam. It comprises eighty wind turbines, each over 100 metres tall, 15 km from the coast. Despite choppy sea conditions, which affected some Members worse than others after our breakfast of Danish pastries, the Sub-Committee was most impressed. The conditions helped to emphasise the very real problems that would be faced when maintenance was required. Elsam also demonstrated an alternative method of seeing to repairs, by abseiling an engineer from a helicopter down to a turbine.

The Sub-Committee hosted a one-day seminar in December, at which most of the inquiry's main issues were covered in the course of a lively and useful debate. Oral evidence sessions began in January, and will continue until Easter. The Clerk of the Sub-Committee is Christopher Johnson (johnsonc@parliament.uk).

### Fighting Infection – Government Response and Debate

The Government published its response to the Committee's report 'Fighting Infection' in November 2003 as a Command Paper (available from the Department of Health website http://www.doh.gov.uk/infectioncontrol/). The Report was then debated in the House of Lords on 8 December.

The debate on the Health Protection Agency Bill in the House of Lords on 5 January also drew on the Fighting Infection report, which made several recommendations regarding the new Agency.

### Follow-up to "Chips for Everything"

Following comments received on the Government's response to the Committee's Report 'Chips for Everything', a follow-up Report was published in January. The new Report draws attention to the development of a managed network for system-on-chip design. The Committee looks to the Government to ensure that there is a clear leader, an expert in the field, to take responsibility for establishing the network and driving it forward, as well as being responsible for its day-to-day running.

### Select Committee visits

At time of writing, the Committee was planning to visit the new headquarters of the Met Office in Exeter, and the Eden Project in Cornwall, in February 2004. Visits to the UK Atomic Energy Authority site at Culham to hear about nuclear fusion research, and to CABI Bioscience's genetic resources collection at Egham, are also in the pipeline.

### Further Information

Further information about the work of the Select Committee can be obtained from Christopher Johnson (johnsonc@parliament.uk) who took over as Clerk of both the Select Committee and Sub-Committee II in November 2003. A free weekly notice of business of all House of Lords Select Committees is available from Geoff Newsome, 020 7219 6678. The Committee's email address is hlscience@parliament.uk

# Progress of Legislation before Parliament

### Government Bills

**Energy Bill:** introduced into the House of Lords 27.11.03; Second Reading 11.12.03; Committee stage started 15.1.04

**Health Protection Agency Bill:** introduced into the House of Lords 27.11.03; Second Reading 5.1.04

**Human Tissue Bill:** introduced into the House of Commons 3.12.03; Second Reading 15.1.04; Committee stage started 27.1.04

**Patents Bill:** introduced into the House of Lords 15.1.04; Second Reading 26.1.04

### Private Members' Bills

**Air Traffic Emissions Reduction Bill:** introduced into the House of Lords by Lord Beaumont of Whitley 10.12.03; Second Reading 16.1.04

**Genetically Modified Organisms Bill:** introduced into the House of Commons by Gregory Barker MP under the Ballot 7.1.04; provisional date for Second Reading 26.3.04

# House of Commons Library Science and Environment Section
## Research Papers

*The following are summaries of papers produced for Members of Parliament.*
*Information and copies of papers can be obtained from Amina Hossain at the House of Commons Library on 020 7219 6788 or through www.parliament.uk/commons/lib/research/rpintro.htm*

### The Water Bill

**Research Paper 03/67**

The Water Bill received Royal Assent on 20 November 2003. It is the culmination of extensive consultation on the Government's part on the issues of water abstraction, regulation and competition.

The Bill includes provision for all abstraction licences to be issued on a time-limited basis and, from 2012, to be revoked without compensation if they cause serious environmental damage. The Director of the Office of Water Services is replaced by a Water Services Regulation Authority and competition is introduced for businesses that use more than 50 megalitres of water a year. The Bill also includes miscellaneous changes to various pieces of legislation relating to water, including fluoridation.

This paper deals with the Bill as introduced in the Commons 11 July 2003 and Section IV comments on amendments introduced in the Lords. The Bill extends to England and Wales only, except for some clauses dealing with flood defence and reservoirs which also extend to Scotland.

### Forthcoming publication:

**The Human Tissue Bill** **Bill 9 of 2003-04**

The issue of organ retention was most prominent during the Alder Hey investigation where it became widely known that organs were routinely kept in hospitals after bodies had been returned to families. The biggest concern was the lack of consent and the failure of doctors to communicate with families.

The Government consulted on what should be done with regard to regulating the removal, use and disposal of human tissue. The consultation went wider than the immediate concerns of Alder Hey, considering also issues such as non-consensual DNA analysis, fetal tissue, stem cells and cell lines.

The Human Tissue Bill was introduced to the House of Commons on December 2003 and was debated on Second Reading on 15 January 2004. The Bill seeks to establish a Human Tissue Authority supported by two Inspectorates. The Bill sets out the main principles of consent with regard to human tissue and creates offences for non-consensual removal and use.

The Bill extends mainly to England and Wales but has some provisions for both Scotland and Northern Ireland.

# Parliamentary Office of Science and Technology

### Security of electricity supplies

*September 2003* ***POSTnote 203***

Modern societies are vulnerable to unreliable electricity supplies. The recent power failures in London, storm damage to UK electricity networks in 2002, as well as widespread blackouts in North America and other parts of Europe, all highlight the impact of disruptions to electricity networks. Electricity generation capacity shortfalls are another potential threat to electricity supplies. This briefing outlines the main issues linked to maintaining electricity supplies. It also reviews the role of Government in ensuring the security of supply in electricity markets.

### Reform of mental health legislation

*October 2003* ***POSTnote 204***

In 2002, the Government published a draft Bill setting out proposed changes to the current Mental Health Act 1983. While the need to reform current legislation is widely accepted, the proposed changes have been criticised by health professionals, service providers, users and carers alike. The Government is currently consulting about the changes. This briefing analyses issues concerning overlap with other legislation and examines alternative ways forward for mental health policy and the provision of services.

### Childhood obesity

*September 2003* ***POSTnote 205***

Obesity is a growing problem in the UK and elsewhere and is currently the subject of a Commons Health Committee inquiry. The most recent (2001) estimates for England suggest that some 8.5% of 6 year olds and 15% of 15 year olds are obese. This is a concern because obesity is an important risk factor for mortality and a range of chronic diseases in adult life. This note builds on POST report 199 – Improving Children's Diet and describes recent trends in obesity,

examines possible causes and analyses policy responses.

## Smoking in public places

*October 2003* ***POSTnote 206***

The Chief Medical Officer has called on the Government to consider introducing legislation to ban smoking in all enclosed public places. Several other countries have already introduced such laws. This briefing considers the evidence that passive smoking causes disease; describes government policy on the subject and discusses options for reducing exposure of staff and customers in public places to tobacco smoke.

## The environmental costs of aviation

*November 2003* ***POSTnote 207***

The Government's policies for the future of UK air transport were set out in a White Paper in late 2003. This also put forward initial proposals for making the aviation industry and its users pay for their environmental costs. This briefing examines the basis for the Government's cost estimates and how these could be used in policy decisions related to airport expansion and environmental regulation for aviation.

There is also report E-11 on POST's web site which provides a more detailed analysis of valuing the global warming impacts of aviation.

## The nuclear energy option in the UK

*December 2003* ***POSTnote 208***

The Government's recent White Paper on energy policy did not endorse a programme of new nuclear power stations at present, but declared that "at some point in the future new nuclear build might be necessary if we are to meet our carbon targets." Thus, its policy on nuclear energy is "to keep the option open". Parliamentary interest in this topic is high. This briefing analyses some of the issues associated with keeping the option open that the Government and industry might need to resolve. It does not examine whether there is a need to keep the option open nor indeed the precise means for doing this. Rather, it focuses on options for new reactors, the economics of nuclear energy, the knowledge base for nuclear technology, and issues related to waste management, licensing and security.

## Modern methods of house building

*December 2003* ***POSTnote 209***

A recent Treasury report argued that a UK housing shortage is having widespread economic and social consequences. The Government estimates that by 2016 there will be 3 million new UK households. It recently published the Sustainable Communities Plan outlining a major new house building programme to help meet this growth. It is encouraging modern methods of construction (MMC), which it says can achieve "a step change in the construction industry to produce the quantity and quality of housing we need". MMC primarily involves the manufacture of homes in factories, with potential benefits such as faster construction, fewer housing defects, and reductions in energy use and waste. This note describes the variety of MMC used by UK house builders and assesses the main costs and benefits. It then discusses issues including industry capacity and the quality of housing built using MMC.

## HIV/AIDS in developing countries

*December 2003* ***POSTnote 210***

HIV/AIDS is an increasing problem in developing countries. Bodies such as the World Health Organisation (WHO) and the Joint United Nations Programme on HIV/AIDS (UNAIDS) deliver a range of education, prevention and treatment initiatives, but the epidemic continues to grow. This note describes the scale of the epidemic, outlines recent policy initiatives and analyses the effectiveness of current programmes

## GM crops in the UK

*January 2004* ***POSTnote 211***

The Government is expected to set out its policy on genetically modified (GM) crops in early 2004. To inform this it has commissioned a scientific review, a costs and benefits study and a public debate, each of which has now reported its findings. Its policy will also be informed by the results of the farm-scale evaluations (FSEs) of GM crops. Since 1998 the EU has had a moratorium on GM crops and products. This led the US and others to file a case against the EU with the World Trade Organisation (WTO). This briefing summaries the results of these strands, describes recent international developments, and analyses the main options for the future of GM crops in the UK.

## POST Board membership

Following the resignation of Margaret Moran MP from POST's Board, the House of Commons Information Committee has selected Mr Neil Gerrard MP to be one of its two nominations to the Board.

## Current Inquiries

The areas in which POST is currently working include: Transparency in animal research, Climate change and business, Environmental policy and innovation, Building scientific capacity in developing countries, Marine nature conservation, IT in the NHS, Nuclear security study and Nuclear power in Iran.

## Staff, Fellows and Interns at POST

Dr Josephine (Jofey) Craig was appointed assistant adviser (medicine and biological sciences), in October 2003 following the resignation of Dr Jacqui Russell. Dr Sarah Pearce (adviser, physics, IT and telecoms) left in December 2003. Her replacement is being recruited.

Sophy Bristow (intern), from Imperial College, is working on business responses to climate change; Johannes Vogel (visiting fellow from the Natural History Museum) is working on marine nature conservation and Franziska Matthies (fellow, from the Tyndall Centre) is looking at climate change and health.

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

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

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

# Debates and Selected Parliamentary Questions & Answers

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

*A full digest of all Debates, Questions and Answers on topics of scientific interest from 6th October to 18th December 2003 from both Houses of Parliament appears on pages 44 to 51.*

## Science Policy

### Forensic Science Service

*Debate in Westminster Hall on Wednesday 5 November*

**Mr Lindsay Hoyle** (Chorley) reminded Members of the Home Secretary's announcement that he wished the Forensic Science Service to change its status to one of a public-private partnership.

He continued by saying that he was concerned about how privatisation would affect a highly skilled workforce that had always been at the leading edge in solving crime. While science had progressed and new DNA techniques had become available, the FSS throughout the country had always been at the forefront.

The reason given for the proposed change of status had been that for the FSS to remain competitive radical change was needed to allow it to make the best use of rapidly advancing science and technology. It was alleged that if the FSS were to remain a trading fund it faced a sustained and accelerated loss of market share.

How would competition improve the service to police? Would the FSS be sold *en bloc* or would it be split up? If the latter, there were many questions concerning sharing data, training scientists, retaining expertise in seldom required specialist subjects and would not the only winner be the criminal?

He asked for an update on R&D work. If the labs needed investment why not take it from the profits currently being made? He also asked for an assurance from the Minister that the DNA database would remain in the public sector. During this speech **Mr David Taylor** (NW Leicestershire) interjected to say that the logic behind such privatisation could be extended to privatising scene-of-crime investigations and even to the CID itself.

**Mr Paul Goggins,** the Parliamentary Under-Secretary of State for the Home Department, said that the FSS had a well earned world-class reputation. The best value approach adopted by police forces was already leading to the development of a competitive market for forensic sciences. Both LGC and Forensic Alliance were working successfully with police forces and accounting for some 10% of market share.

There were no plans to split the FSS into smaller regional companies. The purpose of the public-private partnership was to ensure that the FSS continued to have access to new developments in forensic technology. That required access to development capital, a key issue which the creation of the PPP would address. The FSS would require capital investment significantly exceeding its profits for it to remain a leading-edge organisation. Investment was critical to growth at a time when new technologies were providing so many opportunities. If it remained in the public sector it would not be able to attract anywhere near the amounts of capital investment needed.

*Mr Colin Burgon MP (Elmet), Mr David Borrow MP (S Ribble), Mr Jon Trickett MP (Hemsworth), Mr David Heath MP (Somerton & Frome) and Mr Julian Brazier MP (Canterbury) also spoke in the debate.*

### Waste Management

*Question and Written Answer on Tuesday 11 November*

**Mr Lidington** (Aylesbury): To ask the Secretary of State for Environment, Food and Rural Affairs if she will make it her policy to place anaerobic digestion on an equal level with composting in the Government's waste hierarchy.

**Margaret Beckett:** The Government have agreed that anaerobic digestion should be treated as a contributor to both composting and energy recovery within the Municipal Waste Best Value Indicators. A consultation document seeking views on the options for bringing anaerobic digestion into the composting category of best value and for determining the method for allocating the proportions of treated waste that count towards composting and energy recovery was issued on 15 October. It can be viewed on the Defra website at www.defra.gov.uk/corporate/ consult /anaerobic-digestion.

### Scientific Careers

*Question and Written Answer on Wednesday 12 November*

**Dr Kumar** (Middlesbrough S & E Cleveland): To ask the Secretary of State for Education and Skills what is being done to promote scientific careers to school students; and what involvement professional bodies have in such information and promotion schemes.

**Alan Johnson:** Our strategy for science, engineering and technology was set out in "Investing in Innovation" published in July 2002 in response to the recommendations made in Sir Gareth Roberts' report "SET for Success". Our response to Baroness Greenfield's report "SET Fair" outlines our strategy to tackle under-representation of women in science. Both of these included looking at the promotion of science careers. We are working closely with colleagues at the DTI and the Promoting SET for Women Unit to take forward the recommendations in those reports.

We believe that a good way of promoting science, including careers, in schools is by introducing current scientific developments into the classroom. As well as making science both exciting and relevant this will give young people an understanding of the role of science in society. We are working with a range of bodies, including professional bodies, to achieve this. We have consulted on the programme of study for science at Key Stage 4, following a review by the QCA. The new programme of study will set out a core for science, suitable for all learners, to increase flexibility of qualifications at Key Stage 4. From September 2003, a new science GCSE, "Science in the 21st Century" will be piloted in 50 schools. It aims to provide a sound and stimulating science education that will engage all students with contemporary science issues; and to increase the number of young people studying science subjects post-16. Connexions Personal Advisers provide independent advice to students on all careers, including scientific careers.

The Science and Engineering Ambassadors' scheme (SEAs) launched jointly by this Department and the DTI in January 2002, aims to show young people the links between what they learn at school and the world of work. Ambassadors work with young people across the key stages and give them an understanding of the opportunities that a science, engineering or technology based career can offer.

## Science and Politics

*Debate in the House of Lords on Tuesday 9 December*

Editor's note: It is fitting that my last task as Editor of this Journal was to summarise this debate on science and politics. It is the very essence of what the Parliamentary and Scientific Committee is all about.

**Baroness Greenfield** addressed the mechanisms to improve communication between scientists and politicians with a view to better public understanding of scientific policies. She said that there was still insufficient dialogue between politicians and scientists and a lack of understanding of their respective agendas. The public remained confused about where the role of the scientist ended and where the politician's began. The public were not comforted by the efforts of scientists and politicians to handle crises. For example, the report of Lord Phillips into the BSE crisis had drawn out three major themes: decisions were apparently made for political expediency; decisions were made in secret; and false assurances of certainty were given where certainty did not exist.

In the dialogue, politicians sought a simple answer from the experts, worked to a time-scale dictated by their limited tenure of office and were under an understandable pressure from their electorate for an immediate decision. Scientists expected politicians to solve the problems of society, tended to take a long-term view and were used to issues not being proved categorically, on any subject there being differing opinions, interpretations and need for further experimentation. Also, scientists were specialists and saw themselves as accountable to other colleagues working in a narrow area. Politicians had to be generalists answerable to the public.

In addition to these fundamental differences in agenda and mindset there was the problem of actual opportunity for dialogue. Although there had recently been some impressive moves there was still the central issue of how to integrate science more fully into the mainstream of society, and hence into the politician's mindset and policy toolkit.

Such was the interest in the debate that each of the contributors was limited to just five minutes. The following points were made:

There were a number of organisations working to create a dialogue between politicians and scientists. The Parliamentary and Scientific Committee, POST and learned institutions were amongst them. The need was not to invent new institutions but to revitalise existing ones. Neither science nor politics spoke with a single voice. On every science issue there were competing claims not just on the science but also on ethics, the environment, ecology, finance and social considerations. Parliamentarians were invariably short of time and required short, easily digested briefs.

One of the key features which had shaped modern western culture was science and technology. We needed to recapture the celebration of science on its own terms; it should be admired in the same way as great art or sporting success. In an age when people generally were questioning authority and when science and technology continued to challenge society's ethical and moral boundaries it was essential to win the hearts and minds of the public.

Polls repeatedly showed that the public supported science but were uncomfortable with the pace of advance. The way they learnt about science was primarily through the media where miracle cure and scare stores hit the headlines. There were unrealistic expectations and concern about unintended consequences. The teaching of science over many decades had contributed to the problem rather than helping to solve it. It was important to recognise the dual purpose of science education of both furthering specific scientific study and also enhancing society's wider scientific literacy. The long-term solution lay in the schools.

It was difficult for politicians and scientists to know how to handle powerful lobbying groups which could without responsibility hype up a cause. These groups had much trust amongst the public. An example was the anti-GM lobby where a well-organised minority pressure group had put out convincing propaganda. Politicians faced with emotional arguments had turned too often and too strongly to the precautionary principle.

Hard decisions had to be made. The Government consulted and proposed policy, but then it had to persuade the public to accept it. Whenever scientists, politicians and patients came together on a platform to promote some aspect of medical research, invariably it was the patient, however unused to public speaking, who was the most powerful advocate. Scientists should seek out the most needy potential beneficiaries of scientific advances to help with selling scientific policy.

It was the public which, through taxes, supported science. So scientists were essentially servants of society, not of the Government. Science could set the stage, but it had no special role in decision-making and it should retain an

independence from Government. It should also be wary of the increasing commercial concerns driving science.

Risk was well understood by non-scientists. In the retail trade, for example, fashion was fickle and new products could not be tested to death. However, the more you knew the better able you were to assess the risk. It was suggested that research evidence should be graded and that scientific guidance could be categorised from A where there was strong supporting evidence, through C where the jury was out to E where there was strong evidence to reject something. A verbal risk scale could be "one per street", "one per town" or "one per country": not unlike the logarithmic Richter scale.

**Lord Sainsbury of Turville,** the Minister for Science, said that where politicians put their money illustrated their values. The increased science funding demonstrated how seriously the Government took the subject. Scientists often worked with a great deal of uncertainty and could not give instant answers. Politicians had to make decisions in response to current and urgent problems. Neither had a monopoly of wisdom, objectivity or foresight.

The public wanted to know that issues such as ethical, health and environmental impacts had been properly considered by scientists, regulatory and ethical experts and by representatives of the public. Existing channels of communication had to be made more effective. There were 64 MPs with a first degree in science, a proportion rather better than in the general public.

Government had to have access to relevant scientific advice and had to be seen to use it effectively, especially when there was a range of opinion. OST now had a rolling programme to review the quality of advice given to Departments and how they made use of that advice. It was essential that there were forums outside Parliament to engage the public in debate. We should not wait for concerns to become deeply rooted with polarised positions. People could judge risk very well; they encountered it in their daily lives. Their approach to risk was strongly influenced by their values and beliefs, and whether acceptance was a personal choice. The public did consider carefully the benefits and risks of technological developments and problems arose when they perceived that the benefits did not outweigh the risks. A further consideration was whether a Government could do anything about the matter.

Science should not be treated simply on a democratic basis. It was wrong to decide whether a technology in itself was good or bad. It was up to the Government to assess ethical, health, safety and environment considerations but, once those regulatory aspects had been taken into account, it should be left to individuals to make up their own minds as to whether they wanted to accept a particular technology.

*Baroness Jay of Paddington, Lord Jenkin of Roding, Lord Taverne, the Lord Bishop of Chester, Lord Haskel, Lord Chan, Lord Waldegrave of North Hill, Lord May of Oxford, Lord Stone of Blackheath, Baroness Greengross, Lord Winston, Baroness Finlay of Llandaff, Lord Oxburgh, Lord Turnberg, Lord Chorley, the Earl of Northesk, the Earl of Erroll, Lord Mitchell, Baroness Sharp of Guildford and Baroness Miller of Hendon also spoke in the debate.*

# Health

## Obesity

*Debate in the House of Lords on Monday 6 October*

**Baroness Finlay of Llandaff** called obesity a global public health epidemic where knowledge was ahead of policy. It was not just a health issue but concerned farming and food production, food and drink marketing, transport, sport, education, employment and social security. Currently more than one in five people in the UK were obese.

Obesity shortened life by, on average, nine years, but in the Afro-Caribbean population it seemed to foreshorten life by up to 20 years.

Obesity was linked to hypertension, heart disease, breast, colon and other cancers, osteoarthritis, diabetes, blindness and other conditions. It was more prevalent in the lower socio-economic groups and could account, through low self-esteem, for a large hidden morbidity in depression, failed social interaction and relationship breakdown.

When ill, obese people were at greater risk. Being heavy they were more difficult to care for, wounds healed poorly after surgery and, if critically ill, venous access and artificial ventilation were much more difficult. The NHS was already struggling. Could it cope with the increased burden from obesity-induced illness?

Many children were eating themselves to an early death, grazing on high-sugar, high-fat, high-salt snacks and carbonated drinks. They also took very little exercise. Fad diets abounded. Food labelling was so precise it failed to be comprehensible; the system needed simplification.

The consumption of fats and sugars was increasing steadily. Children were targeted through TV advertising, collectable toys and so forth, completely undermining any healthy eating campaign.

Many school playing fields had been sold off, yet children needed activities like swimming, athletics, dance and ball or contact sports. These and safe, car-free routes to school would increase exercise. The country could not afford the increasing sickness absence – 18 million days in 1998 – from obesity-related problems.

**Lord Warner** said that the Government took the issue very seriously. Indeed, the Chief Medical Officer had described obesity as a veritable time bomb. Obesity was increasing in children. It was responsible for 6% of all deaths, compared with 10% from smoking.

The Government was tackling the problem of obesity in terms of both prevention and management. Prevention was the best long-term approach, especially when dealing with children. Action focused on improving the overall balance of diet and increasing physical activity.

Opportunities for some people to develop a healthy lifestyle

might be influenced by their environments, for example, having access to affordable fruit and vegetables and to pleasant open spaces.

A priority area for the Government's work with industry was to reduce salt levels in processed food. Discussion on fat and sugar in food would follow. The industry was being encouraged to act more responsibly when providing food to children.

A range of actions had already been implemented in schools, aimed at encouraging a healthy diet and increased physical activity. National nutritional guidelines for school meals were being developed.

Lord Warner concluded by noting that the National Institute for Clinical Excellence, in conjunction with the Health Development Agency, was developing guidance on the prevention and management of obesity.

*Lord McColl of Dulwich, Lord Shutt of Greetland, Lord Chan, Baroness Rendell of Babergh, Lord Moynihan, the Countess of Mar, Baroness Greengross, Lord Rea, Lord Clement-Jones and Lord Skelmersdale also took part in the debate.*

## Deep Vein Thrombosis

*Question and Written Answer on Tuesday 4 November*

**Mr Kidney** (Stafford): To ask the Secretary of State for Transport what funding the Government have contributed to the World Health Organisation's research into deep vein thrombosis; and what progress has been made in the research.

**Mr McNulty:** To date, the Government have contributed approximately £400,000 to the WHO research project. We expect our total contribution to be in excess of £1.1 million. Epidemiological studies are being carried out in the Netherlands: two at the Leiden University Medical Centre and one at the Amsterdam Medical Centre. Clinical and physiopathological studies are being carried out in the UK.

At the Leiden centre, work is well advanced on the cohort study among business travellers, following a successful pilot study of the employees of an international company in Switzerland. The proposed methodology for the case-control study among frequent travellers was also piloted. However, for technical reasons an alternative methodology has been proposed, which I understand the Scientific Executive Committee responsible for the research protocols has approved in principle. At the Amsterdam centre, following extensive planning and preparation, the first test of the travel and non-travel immobility study will start shortly. This will comprise an eight-hour flight before, during and after which blood samples from volunteer passengers will be drawn for examination. Further tests will be carried out on the same volunteers to assess their clinical response to eight hours immobility, without travel, and eight hours engaged in normal activities.

The other stream of the research, examining the effects of hypobaria and hypoxia on the risk of deep vein thrombosis, is already under way under the auspices of Leicester University. Hypobaric chamber tests are being carried out at the aviation medical facilities at RAF Henlow to examine the effects of reduced atmospheric pressure on the cardio-vascular systems of volunteers seated for eight hours.

The World Health Organisation is due to publish the results of the research at the end of 2004 or early 2005.

## Antibiotics

*Question and Written Answer on Wednesday 12 November*

**Gregory Barker** (Bexhill & Battle): To ask the Secretary of State for Environment, Food and Rural Affairs if she will make a statement on the use of antibiotics in imported meats.

**Mr Bradshaw:** Residues of antibiotics, other veterinary medicines and banned substances in meats imported from third countries are controlled at two levels. Firstly, the European Commission requires all third countries wishing to export food products to the EU to submit annual residue monitoring plans. These must demonstrate that the third country understands that exports to Member States should not contain substances banned in the EU, or authorised veterinary medicines in excess of the EC Maximum Residue Limit. These arrangements replicate the obligations placed on Member States to ensure that any residues of veterinary medicinal products in foodstuffs produced in the EU are at a level safe for consumers. The European Commission's Food and Veterinary Office also carries out missions to third countries to inspect and audit the arrangements they have in place to meet this requirement. Secondly, imports into the UK are randomly sampled at Border Inspection Posts and, to a lesser extent, at retail outlets. These samples are tested for a range of residues, including antibiotics. Any positives are considered for their consumer safety implications by toxicologists and the importing country's authorities are asked to investigate. Results of all the tests are reported on the Veterinary Medicines Directorate's website and in their quarterly newsletter.

## Fighting Infection

*Debate on the report of the Science and Technology Committee on Fighting Infection (HL Paper 138) in the House of Lords on Monday 8 December*

**Lord Soulsby of Swaffham Prior** said that 60% of all ill health was due to infectious diseases. Antibiotics had lost their magic so that exotic diseases were now a threat in the UK. The establishment of the Health Protection Agency as a co-ordinating body to bring together the many facets of healthcare promised to be an important development. There were twenty-four recommendations in the report and the Government's response had been timely and comprehensive. The Infectious Disease Panel had been set up, a new inspector of microbiology had been established in the DoH and £12 million had been earmarked to tackle hospital-associated infection such as MRSA.

However, one recommendation was that there should be effective collaboration and communication between all organisations involved in infectious disease services, but the Government had not made it clear whether it intended to map out the responsibilities of those organisations.

Vaccination was a major and effective approach for the prevention and control of infectious diseases yet the UK's capabilities for vaccination production had declined. The

country was dependent on overseas suppliers who would be under pressure to give priority to the needs of their own country in the event of a major global epidemic. International collaboration was very important. HPA and DoH staff should be available for secondment. Both organisations should be involved in international infectious disease control.

The HPA corporate plan was ambitious. There was much to be done to draw together the expertise of a wide range of health, scientific and related staff. It must have the resources to develop to enable it to respond swiftly in a co-ordinated manner to new and existing threats from infectious disease.

**Lord Oxburgh** noted that the combination of good hygiene, clean water, good sanitation and antibiotics had virtually eliminated most of the serious infections from the developed world. Hence, when it came to training nurses and doctors infection had had rather a low priority. The situation was changing rapidly and urgent action was required to avoid serious outbreaks.

**Lord Warner,** the Parliamentary Under-Secretary of State, Department of Health, said that the UK was internationally respected for its work on infectious disease surveillance, that the UK traditionally had a much stronger public health system than many other nations but that the present system fell short of what was necessary. That was the starting position.

For the first time the DoH had in place a strategy for tackling infectious diseases. We were now much more aware of the risks, of the role played by animals and birds and of the problems arising from easier international transport. The Infectious Disease Panel had been set up; new funding of £12 million would help NHS pharmacists monitor and control the use of antibiotics; there had been an extension of the mandatory national surveillance of healthcare associated infections and there were soon to be action plans for TB and Hepatitis C.

The HPA integrated into one organisation expertise which had been previously dispersed to give a coherence to the major areas of health protection, bringing together local, regional and national responses to emerging threats. A new audit of deaths from healthcare-associated infections was to be established and a proportion of such deaths would be investigated.

The Chief Medical Officer was proposing seven action areas where change was required: active surveillance and investigation; reduction of infection risk from the use of catheters, tubes and other devices; reduction of reservoirs of infection; high standards of hygiene; management and organisation; and research and development. Some of the issues would be debated again when the Health Protection Agency Bill was debated in the New Year.

*Lord Haskel, Baroness Finlay of Llandaff, Baroness Masham of Ilton, Lord Addington and Lord Skelmersdale also spoke in the debate.*

# Animal Health and Welfare

## Animals in Scientific Procedures

*Debate in the House of Lords on Friday 17 October on the Report of the Select Committee on Animals in Scientific Procedures (HL Paper 150)*

**Lord Smith of Clifton** said that one strength of the Select Committee had derived from lay people without vested interest coming to conclusions on a complex issue of great public importance. In many ways the Government's response was negative, complacent and displayed no sense of urgency.

The first recommendation he highlighted called for a severe culling of the bureaucracy involved in licence applications and amendments: applications extending to many hundreds of pages were not uncommon. This was unnecessary, time-consuming and, more importantly, was frequently deleterious to the welfare of animals. This matter "would be revisited" said the response.

Local ethical review committees should have delegated powers to approve routine or minor amendments to licences. The response was that this would need primary legislation and "would not be justified". These ethical review committees should have a lay member in order to reassure the public. This recommendation had been flatly rejected on the grounds that some establishments had "found it difficult to identify and recruit lay members".

One of the most important recommendations had been the establishment of a centre for the 3Rs: the reduction, refinement and replacement of the use of animals. It would give a focus to the development of the 3Rs and also show an earnest intention to often sceptical animal welfare groups. That suggestion had at least found some favour.

Also of great importance was the ease of access by the public to information. Anonymous project licences describing the projected benefits of the research and harm to the animals should be made public. In addition, serious effort should be made to provide better figures on animal suffering. While agreeing in principle the Government stated that the difficulty "should not be underestimated".

While the Home Office Inspectorate did a good job invigilating laboratories it did display an over-bureaucratic mind-set which was too defensive of the *status quo*.

**Lord Winston** said that there was a huge need for animal research. There was a massive investment in the Genome Project but in terms of human welfare and the prospects for human life the most important scientific issue was that of animal research. The key aspect was that the use of the intact animal gave a dynamic assessment of what the gene actually did in a way that no other experiment could.

The essence of science was that experiments needed to adapt to emerging data. When animals were involved the experimenter had to go through the entire rigmarole again to get an amendment approved. We really did need to be able to react to unexpected findings.

To embed in the public mind the vital role of animal research

he suggested that every packet of pills crossing the counter of every pharmacy should have a statement "These drugs were made possible only by the use of animals in research".

**Lord Soulsby of Swaffham Prior** said that UK regulation governing the use of animals in experiments was rigorous, but it should not be rigid. It lacked adaptation to developments in animal sentience, our better understanding of how animals behave and how we should provide for them in experimental situations.

**Lord Sainsbury of Turville,** the Parliamentary Under-Secretary of State, Department of Trade and Industry, said that the subject of animal experimentation raised difficult and sensitive issues. The Government response involved not just the Home Office but also the DTI, the Department of Health, DEFRA, the Department for Education and Skills, the Department for Work and Pensions and the MoD. All the important recommendations were being taken forward and the complex issues were being dealt with.

It was the Government's view that it was morally acceptable for humans to use animals in research but morally wrong to cause them unnecessary or avoidable suffering. A great value of the report was the clearly stated arguments as to why animal experimentation was so necessary. There was a huge job to be done on openness and information on the regulatory process so that people understood what was being done.

The recommendation for a UK Centre for the 3Rs was being considered in terms of the need for general scientific research on the one hand and toxicology testing on the other. There were plans to publish summaries of project licences on the Home Office website, but developing a shorter application form and licence was easier said than done.

*Baroness Warnock, Lord Taverne, Lord Plant of Highfield, Lord Lucas, Lord Beaumont of Whitley, Baroness Eccles of Moulton, Lord Hunt of Chesterton, the Earl of Onslow and Lord Hodgson of Astley Abbotts also spoke in the debate.*

## TB in Cattle

*Debate in the House of Lords on Thursday 30 October*

**Baroness Byford** said that bovine TB was a serious disease out of control. In 1979 just 72 herds in the UK had TB reactors but in 2002 4,047 herds were under restriction at some time during the year. Incidence was increasing at around 25% year on year.

She then reviewed the spread of the disease across the country and the compensation figures which had risen from £3.4 million in 1998-99 to over £60 million in 2002. She then underlined the contamination effect of the wildlife source, mentioning badgers in particular.

She continued by asking the Minister some practical questions. First, in the TB hotspots were tests made on wildlife at the same time as on cattle? Secondly, were tests on all road casualties of badger and deer in TB areas routinely made? Thirdly, should not an overall strategy embracing cattle and wildlife risk be routine? Fourthly, what studies were under way to identify bovine TB in wild and farmed animals, notably deer? Fifthly, what was the Minister's view of the decision in Scotland to order whole-herd slaughter when TB was confirmed? What progress had been made with new tests which would differentiate between cattle that were reactors and those which were diseased?

Was the introduction of lay TB testers due to a shortage of veterinarians available or the increasing number of cattle awaiting test? How reliable was the tuberculin skin test?

She concluded by saying that action needed to be taken to eradicate TB for its uncontrolled spread would have a great impact on animal health and welfare, on farmers' livelihoods and on the wider rural economy.

**Baroness Farrington of Ribbleton** said that the Government had a wide-ranging programme in place to tackle the complex problem of bovine TB.

The current five-point plan consisted of protecting public health, research into how the disease was spread, testing and controls, vaccine-related research, and the randomised badger culling trial. A review of the TB strategy had been announced earlier in the year.

Pasteurisation of milk alongside the ongoing cattle testing programme and inspection at slaughterhouses had minimised the public health risk.

The data for both 2002 and 2001 on infected herds could not be compared with earlier years as TB testing was largely suspended during the foot and mouth outbreak. The resulting backlog of overdue tests (27,000 tests at the end of 2001) had now been reduced to below the figure existing at the outbreak of foot and mouth disease. Now all herds with a TB test overdue by more than three months would be placed under movement restrictions.

The gamma-interferon test was undergoing a field evaluation as a supplement to the tuberculin test in affected herds. However, the identification and delivery of an effective vaccine against bovine TB for either cattle or wildlife remained a long-term goal.

The badger-culling trial was intended to establish whether culling badgers was an effective or sustainable bovine TB control mechanism. It would also provide a wide range of epidemiological data on the disease.

Vaccine-related research and the badger-culling trial were just part of the research programme. Other aspects were the pathogenesis of the disease, risk factors in cattle herd breakdowns and the risks to cattle from wildlife. The best hope of controlling and eventually eradicating this complex disease lay in the results of the research programme.

*Lord Plumb, Lord Williamson of Horton, Lord Livsey of Talgarth and the Duke of Montrose also took part in the debate.*

## Bovine Tuberculosis: Findings of Independent Scientific Group

*Question and Written Answer on Tuesday 4 November*

**Lord Gregson** asked Her Majesty's Government: When they will update the House on the findings of the Independent Scientific Group on Cattle Tuberculosis.

**Lord Whitty:** The Independent Scientific Group on Cattle TB (ISG) was appointed by Ministers in 1998 to design and

oversee a large-scale field trial, the Randomised Badger Culling Trial (RBCT), aimed at evaluating badger culling as a means to reduce the incidence of cattle TB. The trial involves three experimental treatments: (i) proactive culling, which aims to reduce badger densities to very low levels across entire trial areas, (ii) reactive culling, which seeks to remove only those badgers geographically close to recent cattle TB outbreaks on particular premises, and (iii) no culling (survey only).

The culling of badgers in reactive treatment areas of the RBCT will be suspended from today. The decision to suspend the culling of badgers in these areas has been taken on the basis of recent scientific findings from the ISG.

The ISG has advised Ministers that its interim analysis of trial data so far indicates that there was a 27 per cent increase in the number of cases of bovine TB (breakdowns) occurring in reactive culling areas compared to the related survey-only areas where no badger culling took place.

We have decided to suspend operations immediately because of the risk that a further three months of culling would cause additional TB breakdowns.

The results that have not emerged from the reactive culling part of the trial will be published as soon as possible in a peer reviewed scientific journal. Data on herd breakdowns from the reactive trial areas will continue to be collected and subjected to further analysis with the more detailed results being submitted for publication in a peer reviewed journal at a later date.

On the advice of the ISG, operations will continue in proactive areas because the data for these areas does not yet yield a statistically significant result. The survey-only (control) areas will also continue to be monitored.

The Government's policy on bovine TB is based on scientific advice and these findings will be taken into account in the development of the forthcoming TB strategy.

### Bovine Tuberculosis

*Question and Written Answer on Wednesday 19 November*

**Mr Hayes** (S Holland and The Deepings): To ask the Secretary of State for Environment, Food and Rural Affairs what (a) strategy has been implemented and (b) funds have been committed to (i) identifying and (ii) eradicating bovine tuberculosis.

**Mr. Bradshaw:** In 2002–03 we spent nearly £74 million on the bovine tuberculosis (TB) Five Point Plan, based on:

Protecting human health;
Cattle testing and controls;
Development of a TB vaccine;
Research into how TB is spread; and
A badger culling trial

We are keen to improve diagnosis of the disease in both cattle and badgers and have commissioned the Veterinary Laboratories Agency to carry out two research projects, at a total estimated cost of over £950,000.

The current TB programme is under review and we expect to consult on proposals for a new TB strategy for Great Britain, and on short-term policy options for TB control, around the end of the year. In developing the strategy we will need to consider whether eradication of the disease is a realistic goal within the 10 year period over which the strategy will apply, and on the most appropriate ways of achieving it.

## Energy

### Offshore Oil and Gas

*Debate in Westminster Hall on Tuesday 14 October*

**Mr Bob Blizzard** (Waveney) said that vast reserves of oil and gas remained and many remained to be discovered. The UK was the fourth largest oil producer in the world. The industry supported 265,000 jobs and had generated £190 billion tax revenues since the sixties. Yet the industry was at a crossroads. In the past few years there had been little new exploration and only four wells had been drilled. If we did not explore we could not find and so not benefit.

There were complaints from companies which wished to explore about unreasonable charges demanded by the majors which owned the infrastructure.

There were similar problems associated with access to seismic data. In the interests of the UK there needed to be a national archive of seismic information open to all.

Licences were being retained by operators who were not doing anything with them. Licences for non-active areas should be relinquished to allow others to explore the area.

The problem was not that oil and gas were running out but that time was running out.

**Mr Stephen Timms,** the Minister for Energy, E-Commerce and Postal Services, said that the two main objectives were to ensure that the oil and gas resources in the UK continental shelf were fully and effectively exploited, and that the UK should maintain its position as a centre for expertise for the oil and gas sector.

The scale of the recent Buzzard discovery was evidence that huge quantities of oil and gas could still be produced from under the North Sea, potentially greater amounts than had already been extracted. The Government was keen to attract new players into the North Sea; the successful discovery at Annabel was evidence of what could be done. In all, some 15 North American companies were undertaking strategic assessments of the UK's continental shelf.

The offshore infrastructure was a most valuable asset; it provided the basis for continued exploitation. The Government was seeking greater transparency in the deals that were done. UK companies had recently agreed to allow the DTI to publish exploration data after four years.

New approaches and new technologies were allowing operators to increase recovery from fields far beyond the levels originally predicted.

Finally, the Governments of the UK and Norway had just signed up to principles which would underpin future cross-

boundary oil and gas co-operation. This was key to unlocking the remaining reserves within the median corridor.

*Mr Frank Doran MP (Aberdeen Central) also took part in the debate.*

## Biofuels

*Debate in Westminster Hall on Wednesday 15 October*

**Mrs Gillian Shephard** (SW Norfolk) made a case for the Government to increase its support for a sustainable biofuels policy on economical and environmental grounds, and for fuel security. The recent duty reduction of 20p a litre for biofuels, although welcome, was not enough to stimulate the industry. The public wanted access to environmentally friendly fuels without the expense of switching to hybrid vehicles. The reduction in $CO_2$ emissions from conventionally produced bioethanol could be greater than 60%.

The UK needed a long-term strategy for creating and exploiting opportunities for non-food crops, including starch and oils. What was being done? Five Departments were involved in the issue but no one Department was in charge.

The country had a Government which rightly preached its commitment to the environment and to their European and international obligations. In the one policy area of biofuels it had the chance to demonstrate all those commitments.

**Mr Ben Bradshaw,** the Parliamentary Under-Secretary of State for Environment, Food and Rural Affairs, said that biofuels should be promoted and encouraged. They could provide significant life-cycle reductions in $CO_2$ emissions compared with conventional fossil fuels.

Environmental issues were not the only consideration. Establishing new markets for agricultural produce and increasing rural job opportunities were also important. Support was required to kick-start the industry. Options included further duty cuts, enhanced capital grants, enhanced capital allowances and mandatory blending. As the Minister began his review of the research being carried out Mr Deputy Speaker called "Order". Time had run out and the next debate was due.

*Mr Paddy Tipping MP (Sherwood), Mr Keith Simpson MP (Mid-Norfolk), Dr Alan Whitehead MP (Southampton Test), Mr Norman Lamb MP (N Norfolk), Mr Anthony D Wright MP (Great Yarmouth), Mr Richard Bacon MP (S Norfolk) and Mr John Hayes MP (S Holland and The Deepings) also spoke in the debate.*

## Biofuels

*Question and Written Answer on Monday 20 October*

**Lord Carter** asked Her Majesty's Government: What view they have formed of the potential ability of British agriculture to produce biodiesel and bioethanol from current crops and technology.

**Lord Whitty:** Biofuels offer an opportunity for diversification of agricultural activities and the development of new markets. Traditional technologies for producing biodiesel and bioethanol use crops including oilseed rape, suger beet and potatoes, which are well known to farmers and use the same crop management drivers as for food crops.

In order to produce a significant percentage of the UK's fuel requirements, a large amount of land would need to be dedicated to biofuel crops. To meet the 5.75 per cent reference target for use of biofuels in the EU Biofuels Directive, if entirely provided from virgin crops ie excluding recycled oil or forestry by-products etc, would require up to 1 million hectares of land: about 10 per cent of available land. For UK farmers to produce fuel crops on this scale, the market return to the farmer would need to be sufficient to motivate diversion from production for established food and animal feed markets.

## Energy Consumption

*Question and Written Answer on Thursday 18 December*

**Mr Bellingham** (NW Norfolk): To ask the Secretary of State for Environment, Food and Rural Affairs if she will make a statement on the development of new technologies to help reduce the demand for energy consumption.

**Mr Bradshaw:** The Energy White Paper recognised the need to promote innovation to find new ways to save energy in the future. We agreed with the Chief Scientific Adviser's Energy Research Report that energy efficiency should be a priority area for investment in research and development and an inter-departmental high-level group, on which the Energy Saving Trust and The Carbon Trust are also represented, is co-ordinating work in this field.

The Carbon Trust has established the Low Carbon Innovation Programme, launched in 2002, which aims to accelerate the development of new and emerging low carbon and energy efficient technologies in the UK and provides funding across the low carbon innovation process – research, demonstration and development – by investing in projects and leveraging in further funding.

# Biotechnology

## Gene Transfer

*Question and Written Answer on Thursday 6 November*

**Joan Ruddock** (Lewisham Deptford): To ask the Secretary of State for Health what published research involving humans he has assessed which examines the potential for horizontal gene transfer from GM bacteria to gut bacteria; how many people were involved in the experiments; what evidence of gene transfer was identified; and what research he has commissioned on this subject.

**Miss Melanie Johnson:** The Department of Health has not commissioned any research that looks at horizontal gene transfer from genetically modified (GM) bacteria to gut bacteria. The Food Standards Agency (FSA) however has published research on the use of human volunteers to examine the potential for horizontal gene transfer from GM food to gut bacteria. Seven people were involved in the study. No intact DNA was shown to be transferred to intestinal tract

bacteria. The current state of knowledge regarding gene transfer was reviewed in the GM science review. This concluded that "transgenic DNA is no different from other DNA consumed as part of the normal diet and it will have a similar fate". The science review is available in the Library.

Applications to use oral GM bacteria are assessed on a case by case basis by either the Health and Safety Executive (under the Contained Use Regulations), or by the Department for Environment, Food and Rural Affairs Advisory Committee on Releases to the Environment (under the Deliberate Release Regulations). Each application involving the use of GM bacteria is comprehensively evaluated with regard to safety, including gene transfer.

## GM Science Review

*Debate in the House of Commons on Tuesday 11 November*

**Joan Ruddock** (Lewisham Deptford) said that the GM debate was all too often characterised as scientists who understood the issues on one side and on the other non-governmental organisations and the public who were ignorant and unjustifiably alarmed. The Prime Minister had repeatedly said that the issue would be decided on the basis of sound science, but sound science was not the only criterion on which to decide about GM.

The review demonstrated that in areas from human health to the environment, scientific knowledge on the potential impacts of GM foods and crops was limited and uncertain; harmful and irreversible effects might occur.

She asked about the potential for horizontal gene transfer from GM food to gut bacteria, on studies on the fates of transgenic and natural DNA and on the invasiveness of GM herbicide-tolerant and other GM crops inside arable systems.

It was not possible, she said, to follow through in such a short debate the fascinating and well-written 250-page science report.

**Mr Robert Key** (Salisbury) said that just because scientists said that things were hard to predict or that there were areas of uncertainty that did not nullify scientific progress. The way media and pressure groups had portrayed the studies produced by the Government did not do justice to those studies. The planting of GM crops throughout the world exceeded twice the area of the UK.

The strategy unit economic review concluded that there were many potential benefits for genetic modification. GM crops could deliver direct health benefits and the overall balance of costs and benefits would depend upon public attitudes.

He concluded by saying that there was no evidence of health or environmental risk. There was a good argument, based on the scientific evidence, for moving forward with the responsible, case-by-case introduction of GM crops to the UK.

**Mr Michael Meacher** (Oldham W & Royton) said that the science review was an excellent, pretty balanced wide-ranging report. It did admit that there was no test of the health impacts on humans of eating GM foods, that the environmental testing was limited and the long-term cumulative impacts on the environment were not tested, and that no co-existence framework existed; it would be irresponsible to proceed to the commercialisation of GM crops until there was one.

**Dr Ian Gibson** (Norwich N) said that the concept of sound science was problematic as experiments usually gave rise to various interpretations. Science could not give the ultimate answer, but only part of the answer. It had been very difficult to talk to the public. Not many members of the public who had taken part in the debate could be considered "ordinary"; most came from polarised organisations and positions.

**Mr Elliot Morley,** the Minister for the Environment, said that the erosion of public trust and confidence was part of the problem faced by new technologies. The report had concluded that there was no scientific case for ruling out all GM crops, nor should they have blanket approval. The Government's precautionary approach was to regulate each GM crop case by case. There were gaps in our knowledge. Although never complete what mattered was whether we had sufficient knowledge and understanding of the risks to make informed decisions.

On DNA transfer, the science review had concluded that the experiments to investigate the transfer of transgenic DNA from GM plants to bacteria had generated consistently negative results with but one exception, which had to be examined. Studies carried out to date had been unable to detect evidence for horizontal gene flow between GM plants and bacteria in soil. Because of the interest in the subject there would surely be further debates on detail in the future.

*Mr Simon Thomas MP (Ceredigion), Dr Phyllis Starkey MP (Milton Keynes SW), Mr Alan Simpson MP (Nottingham S), Mr Andrew George MP (St Ives) and Mr John Whittingdale MP (Maldon and E Chelmsford) also spoke in the debate.*

## Genetically Modified Food

*Question and Written Answer on Monday 17 November*

**Alan Simpson** (Nottingham S): To ask the Secretary of State for Health (1) what techniques are available for identifying unintended changes in GM foods at the molecular level; and what research he has published on this subject;

(2) how unintended changes in GM foods approved in Europe are evaluated; and what research he has commissioned on this subject.

**Miss Melanie Johnson:** Each genetically modified (GM) food approved to date in Europe has been assessed on a case by case basis. A comparison is made between the GM food and its non-GM counterpart and the assessment focuses on any differences between the two. This includes a detailed analysis of the inserted gene and the protein produced, and any differences observed in the overall composition of the food.

There are a number of techniques, which could potentially be used for identifying unintended effects in GM foods at the molecular level. These include two-dimensional protein gel electrophoresis, protein microarrays, nuclear magnetic resonance and gas and liquid chromatography mass spectrometry.

The Food Standards Agency funds two research programmes, which underpin the safety assessment of GM foods. One of the programmes is exploring the potential use of the above techniques for detecting unintended changes at the molecular level. The programme started in September 2001 and will finish in 2004.

# UK Parliament - Digest of Parliamentary Debates, Questions and Answers

## 6th October - 18th December 2003

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

**Denotes selected Debates and Questions and Answers of particular interest which are reproduced on pages 35 to 43.*

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# Euro-News

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

## Stem Cell Research

A controversial vote in the European Parliament on whether the EU should fund research using tissue from human embryos has resulted in a victory for those in favour of allowing the practice.

MEPs ultimately rejected all amendments aimed at imposing stricter conditions on the use of embryonic stem cells so that the final vote on the Commission's original proposals was carried by 300 in favour to 210 against.

However, MEPs did conclude that research using adult stem cells should be given priority for EU funding, and that research using newly acquired embryonic stem cells should only be funded if it could be demonstrated that other forms of stem cell were not suitable. The European Parliament requested that, in the interests of transparency, the Commission produce an annual list of projects which employed the use of embryonic stem cells funded under the EU Research Framework 6 Programme .

The final decision on whether the EU will fund such research rests with the Council of Ministers.

## An Alternative Reference Year for Kyoto

The European Parliament adopted a legislative resolution on a monitoring mechanism for greenhouse gas emissions, allowing Member States to choose between either 1995 or 1990 as the reference year for the measurement of progress in relation to reducing greenhouse gases, a decision which is particularly advantageous for Finland and France.

However, the European Commission, although now accepting the compromise, was very much opposed to this solution as it raised many technical and political problems and it would place the Community in an uncomfortable position regarding other signatory states to the Kyoto protocol, as this protocol provides for mutual surveillance on the basis of reliable data.

## Emissions from Ships

While agreeing with the Commission paper on an EU strategy to reduce atmospheric emissions from seagoing ships MEPs want it to go even further and include polycyclic aromatics and heavy metals among the emissions to be covered by the strategy. They also say that the Commission's overall objective should be extended so that it also aims explicitly to reduce ships' emissions of greenhouse gases and their contribution to global warming.

## Ban on Growth Hormones

Following a scientific risk assessment, the European Parliament and the European Council adopted a Directive prohibiting the use of growth promoting hormones.

The new legislation complies with a ruling by the World Trade Organisation appellate body condemning a previous EU Directive that banned the use of certain growth hormones. The WTO claimed that the scientific material used by the EU to justify enforcing the ban did not sufficiently evaluate the risk associated with meat consumption and advised further risk assessment.

Since the ban applied to meat imports containing hormones from third countries and EU Member States alike, the world's trading powers clashed, resulting in the US and Canada imposing sanctions on European products.

The new legislation incorporates a reviewed assessment of the scientific information available, as well as new evidence on the risk to human health of hormone residues in meat products.

## ITER

The signs are that the location to be put forward by the EU to host the international thermo nuclear experimental reactor (ITER) may have to be decided by a vote. This follows the failure by Europe's research ministers to reach a consensus on whether a French or a Spanish location should constitute the EU's bid.

The European bid will be up against bids from Japan and Canada, two of the other partners in a project which will cost around €10 billion and create roughly 10,000 new jobs. One aspect on which all parties do agree is that ITER is more likely to come to Europe if only one bid is submitted, but an independent study on all aspects of the two sites was unable to recommend one site over the other.

## Patenting Computer Implemented Inventions

While voting in favour of a legislative resolution on the patentability of pure computer programmes, MEPs insisted that a computer implemented invention should not be regarded as making a technical contribution merely because it involved the use of a computer, a network or other programmable apparatus. Inventions involving computer programmes which implement business, mathematical or other methods and did not produce any technical effects beyond the normal physical interaction between a programme and a computer, network or other programmable apparatus should not be patentable.

## China to join the Galileo Programme

The EU has reached an agreement with China to allow it to participate in the Galileo programme.

The agreement itself provides for co-operative activities in the fields of science and technology, industrial manufacture, and service and market development, as well as standardisation and certification issues. It also provides for a significant financial contribution from China by granting it a stakeholding in the Galileo joint undertaking.

# European Union - Digest

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

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University of East Anglia
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PPARC

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UMIST
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PPARC

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British Society for Antimicrobial Chemotherapy
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UMIST

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## Academy of Medical Sciences

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The Academy of Medical Sciences is an independent interdisciplinary body representing the medical science community and those involved in healthcare. Its 700 Fellows include clinical academics, non-clinical scientists, veterinary scientists, dentists, nurses and the professions allied to medicine. The Academy's prime purpose is to promote the translation of medical science into clinical practice for patient benefit. It provides authoritative advice and comments on a multitude of public policy issues that involve the biomedical disciplines.

## AIRTO

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

## Association of Medical Research Charities

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

## Aston University


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Aston is a leading technological university with excellence in teaching and research in its chosen fields. All of its research is of direct relevance to industry and commerce and it has a strong record of research collaboration. The latest research assessment exercise shows that more than 85% of Aston's academics are rated as undertaking research of national and international standing.

## 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 Science Budget of the Office of Science and Technology. It supports staff in universities and research institutes throughout the UK, and funds basic and strategic science in: agri-food, animal sciences, biomolecular sciences, biochemistry and cell biology, engineering and biological systems, genes and developmental biology, and plant and microbial sciences.

## British Association for the Advancement of Science - the BA


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The BA is the UK's nationwide, open membership organisation dedicated to connecting people with science, so that science and its applications become accessible to all. The BA aims to promote openness about science in society and to engage and inspire people directly with science and technology and their implications.

Established in 1831, the BA organises major initiatives across the UK, including the annual BA Festival of Science, National Science Week, programmes of regional and local events, and an extensive programme for young people in schools and colleges.

## British Ecological Society


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

## British Pharmacological Society

Advancing molecules into medicines.

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The British Pharmacological Society's 2,500 members are trained to study drug action from the laboratory bench to the patient's bed-side. Our members come from academia, industry, hospitals and regulatory authorities and government bodies. Our aim is to improve the quality of life by developing new medicines to treat and prevent the diseases and conditions which affect millions of people and animals. Inquiries about drugs and how they work are welcome.

## The British Psychological Society

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**Fax: 020 7419 6922**
**Email: anapad@bps.org.uk**
**Website: www.bps.org.uk**

The British Psychological Society is an organisation of over 34,000 members governed by Royal Charter. It maintains the Register of Chartered Psychologists, publishes books, 10 primary science Journals and organises conferences. Requests for information about psychology and psychologists from parliamentarians are welcome.

## British Society for Antimicrobial Chemotherapy

**Contact: Tracey Guest, Executive Officer**

**British Society for Antimicrobial Chemotherapy**
**11 The Wharf, 16 Bridge Street,**
**Birmingham B1 2JS.**
**Tel: 0121 633 0410**
**Fax: 0121 643 9497**
**E-mail: tguest@bsac.org.uk**
**Website: www.bsac.org.uk**

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

## British Veterinary Association


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

***BVA's chief interests are:***

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

***BVA carries out three main functions which are:***

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

## Building Research Establishment Ltd


**Contact: Dr Jeremy Hodge**
**BRE, Garston, Watford WD25 9XX.**
**Tel: 01923 664000 Fax: 01923 664010**
**E-mail: enquiries@bre.co.uk**
**Website: www.bre.co.uk**

BRE is the UK's leading centre of expertise on buildings and construction, and the prevention and control of fire and other risks. BRE is owned by the Foundation for the Built Environment, an independent charitable organisation with a mission to champion excellence and innovation in the built environment.

Expertise includes:

- Design standards
- Construction
- Material properties
- Whole life performance
- Benchmarking
- Testing and Certification
- Energy usage
- Environment
- Fire
- Security
- Natural hazards
- Expert witness

## CABI Bioscience


**Contact: Dr David Dent, Managing Director**

**CABI Bioscience, Bakeham Lane, Egham, Surrey TW20 9TY.**

**Tel: 01491 829080 Fax: 01491 829100**

**E-mail: bioscience.egham@cabi.org**
**Website: www.cabi-bioscience.org**

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

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

## Campden & Chorleywood Food Research Association

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

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

## Cavendish Laboratory


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

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

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

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

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

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

## Chartered Institute of Patent Agents

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

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

## Clifton Scientific Trust


**Contact: Dr Eric Albone**
**Clifton Scientific Trust**
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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
- seeing science as creative, questioning, human
- bringing school science added meaning and motivation
- locally, nationally, internationally (currently between Britain and Japan)

Clifton Scientific Trust Ltd is registered charity 1086933

## Council for the Central Laboratory of the Research Councils


**Contact: Natalie Bealing**
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**CCLRC Daresbury Laboratory**
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**E-mail: enquiries@cclrc.ac.uk**
**Website: http://www.cclrc.ac.uk/**

CCLRC is the UK's strategic agency for scientific research facilities. It supports leading-edge science and technology by providing world-class, large-scale facilities, which are used annually by more than 12,000 researchers worldwide. These advanced technologial capabilities, backed by a pool of expertise and skills across a broad range of disciplines, are exploited by universities and industry alike. The annual budget of CCLRC is some £130 million

## University of East Anglia


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

## Economic and Social Research Council


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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 contrbuting to the economic competitiveness of the United Kingdom, the effectiveness of public services and policy, and quality of life. The ESRC is independent, established by Royal Charter in 1965, and funded mainly by government.

## Engineering and Physical Sciences Research Council


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EPSRC invests more than £500 million a year in research and postgraduate training in the physical sciences and engineering, to help the nation handle the next generation of technological change. The areas covered range from mathematics to materials science, and information technology to structural engineering.
We also actively promote public engagement with science and engineering, and we collaborate with a wide range of organisations in this area.

## English Nature

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

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

## Environment Agency

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**Website: www.environment-agency.gov.uk**

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

## Freshwater Biological Association

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**Chief Executive.**
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**Cumbria LA22 0LP.**
**Tel: 015394 42468 Fax: 015394 46914**
**E-mail: info@fba.org.uk**
**Website: www.fba.org.uk**

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

## Fund for the Replacement of Animals in Medical Experiments

**Contact: Professor Robert Combes,**
**Scientific Director**
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**Nottingham NG1 4EE**
**Tel: 0115 958 4740 Fax: 0115 950 3570**
**E-mail: bob@frame.org.uk**
**Website: www.frame.org.uk**
**Registered Charity No.: 259464**

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

## Institute of Biology

**Contact: Prof Alan Malcolm, Chief Executive**
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The biological sciences have truly come of age with the new millennium and the Institute of Biology is the professional body to represent biology and biologists to all. A source of independent advice to Government, a supporter of education, a measure of excellence and a disseminator of information - the Institute of Biology is the Voice of British Biology.

## The Institute of Mathematics and its Applications

**Contact: Lisa Wright, Personal Assistant to Executive Director**
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**Website: www.ima.org.uk**

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

## Institute of Physics

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

The Institute of Physics is an international learned society, publisher and professional body. It represents the physics community to government, legislators and policy-makers. Key activities include:
Scientific publishing and electronic dissemination of physics
Setting professional standards, awarding professional qualifications, validating higher education courses
Promotion of physics through conferences, education, policy advice and public debate
Support for physics in schools, colleges and universities

## Institute of Physics and Engineering in Medicine

**Contact: Robert Neilson, General Secretary**
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**York, YO24 1ES**
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**Website: www.ipem.org.uk**

IPEM is a registered, incorporated charity for the advancement, in the public interest, of physics and engineering applied to medicine and biology. It accredits medical physicists, clinical engineers and clinical technologists through its membership register, organises training and CPD for them, and provides opportunities for the dissemination of knowledge through publications and scientific meetings.

## IChemE

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

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***heart of the process***

## Institution of Civil Engineers

**Contact: Neal Weston,**
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ICE aims to be a leader in shaping the engineering profession. With over 70,000 members, ICE acts as a knowledge exchange for all aspects of civil engineering. As a Learned Society, the Institution provides expertise, in the form of reports and comment, on a wide range of subjects from energy generation and supply, to sustainability and the environment.

## King's College London

**Contact: Caroline Quest**
**Director of Knowledge Transfer**
**King's College London**
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**Website: http://www.kcl.ac.uk**

King's is a multifaculty university with excellence in education, humanities and law, a diversity of provision in health and life sciences and a distinguished tradition in natural sciences and engineering. The College encompasses the international standing of the Institute of Psychiatry and brings together three world famous names - Guy's, King's and St Thomas' - in the UK's largest medical and dental schools.

## LGC

**Queens Road, Teddington**
**Middlesex, TW11 0LY**
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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 is the UK's leading independent analytical laboratory providing chemical and DNA-based analysis, diagnostic services, reference standards, R&D, method development, consultancy and training to both the public and private sectors. LGC operates in a diverse range of markets including foods, pharmaceuticals, biotechnology, environment, chemicals and petroleum.

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

LGC is based in Teddington, Middlesex, with other UK operations in Runcorn and Hatfield, and facilities in France, Germany, Italy, Poland, Spain, Sweden and India.

## University of Leeds

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**Tel: 0113 3436028**
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**Website: http://www.leeds.ac.uk/rsu**

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

## London Metropolitan Polymer Centre

**Contact: Alison Green,**
**London Metropolitan University**
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**Tel: 020 7133 2189**
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**Website: www.polymers.org.uk**

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

## University of Manchester Institute of Science and Technology

**Contact: Colin Cooper**
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**Website: www.umist.ac.uk**

Manchester's UMIST is the 6th top research university in the UK. Winner of 3 Queen's Prizes for Higher Education, 2 Queen's Awards for Export Achievement and 2 Prince of Wales' Awards for Innovation, UMIST has an international reputation. Centres of excellence include Environment, Life Sciences, IT, Telecommunications, Management, Manufacturing, Materials and Energy. UMIST VENTURES Ltd is the commercial arm of UMIST.

## Marks & Spencer Plc

**Contact:**
**David S Gregory**
**Michael House**
**Baker Street**
**London**
**W1U 8EP.**

**Tel: 020 7268 8247**
**E-mail: david.gregory@marks-and-spencer.com**

**Main Business Activities**

Retailer - Clothing, Food, Financial Services and Home.
544 stores in 29 countries worldwide.
Employing 67,133 people.

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

## Medical Research Council

**Contact: Elizabeth Mitchell**
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**E-mail:**
**elizabeth.mitchell@headoffice.mrc.ac.uk**
**Website: www.mrc.ac.uk**

The Medical Research Council (MRC) is funded by the people of the UK through taxes. 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 user needs as well as high scientific quality. The MRC has funded the work which led to some of the most significant discoveries and achievements in medicine in the UK.

## Merck Sharp & Dohme Research Laboratories

**Contact: Dr Ruth M McKernan**
**Director**

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**www.msd-nrc.co.uk**

Drug discovery for brain diseases.

## National Physical Laboratory

**Contact: Isabelle Boscaro Clarke**
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**Website: www.npl.co.uk**

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

## National Radiological Protection Board

**Contact: Dr Michael Clark,**
**NRPB Scientific Spokesman**
**Chilton, Didcot, Oxfordshire OX11 ORQ.**
**Tel: 01235 822737 Fax: 01235 822746**
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**Website: www.nrpb.org**

To advance by research the acquisition of knowledge about the protection of mankind from radiation hazards.
To provide advice to the government on the acceptability to the UK of standards recommended or proposed by international bodies, and on their application.
To provide information and advice to those with responsibilities in the UK in relation to the protection from radiation hazards, either of the community as a whole, or particular groups. The Board was established under provisions of the Radiological Protection Act 1970.

## Natural Environment Research Council

**Contact: Sheila Anderson,**
**Head of Communications**
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**Tel: 01793 411646 Fax: 01793 411510**
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The UK's Natural Environment Research Council funds and carries out impartial scientific research in the sciences of the environment. NERC trains the next generation of independent environmental scientists.

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

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

## University of Newcastle upon Tyne

**Contact: Dr Douglas Robertson**
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The University of Newcastle is a member of the Russell Group of research-intensive Universities. The University has undergone a major restructuring and expansion since 2002, with increases in undergraduate, postgraduate and international student numbers, as well as sustained growth in research income. The University has a well balanced portfolio of research funding across all sponsor groups and has one of the highest levels of research projects funded by UK Government Departments.

## OSIL

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**Petersfield, Hampshire GU32 3ET**
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OSIL specialises in the provision of high quality products and services for the marine, freshwater and meteorological measurement community. These include supply of laboratory/field instruments, service and calibration, sampling equipment, seawater calibration standards, oceanographic survey, data collection and interpretation. Our expertise ranges from inshore and coastal waters to full ocean depths. OSIL maintains close links with academic scientific centres.

## Particle Physics and Astronomy Research Council

**Contact: Dr Catherine Ewart,**
**Head of Corporate Affairs**
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The PPARC is the UK's strategic science investment agency that directs and funds research in national and international programmes in fundamental physics.

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

## Prospect

**Contact: Jenny Thurston,**
**Deputy General Secretary**
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Prospect is an independent, thriving and forward-looking trade union with more than 105,000 members. We represent scientists, technologists and other professions in the civil service, research councils and private sector.

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

## Queen Mary, University of London

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

## RIO TINTO

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

## The Royal Academy of Engineering

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**Director of Communications**
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**Website: www.raeng.co.uk**

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

## Royal Astronomical Society

**Royal Astronomical Society**
**Burlington House, Piccadilly,**
**London W1J 0BQ**
**Tel: 020 7734 4582**
**Website: www.ras.org.uk**

**Contact: Dr Jacqueline Mitton**
**(Press Officer)**
**Tel: 01223 564914**
**Fax: 01223 572892**
**e-mail: jmitton@dial.pipex.com**

The Royal Astronomical Society is a learned society founded in 1820. It exists to encourage and promote astronomy and geophysics. Expertise of members covers most aspects of astronomy, astrophysics, space science, solar physics, studies of the upper atmosphere, planetary science and geophysics.

## Royal Botanic Gardens, Kew

**Contact: Prof. Simon J. Owens**
**Keeper of the Herbarium**
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ALL LIFE DEPENDS ON PLANTS

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 eductional organisation devoted to increasing knowledge and public understanding of plant and fungai 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.

## Royal College of Veterinary Surgeons

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**E-mail: a.samuelson@rcvs.org.uk**
**Website: www.rcvs.org.uk**

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

## The Royal Institution

**Contact: Dr Gail Cardew**
**Head of Programmes**
**The Royal Institution**
**21 Albemarle Street, London W1S 4BS**
**Tel: 020 7409 2992 Fax: 020 7670 2920**
**E-mail: ri@ri.ac.uk Website: www.rigb.org**

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

## The Royal Society

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

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

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

## The Royal Society of Chemistry

**Contact: Dr Stephen Benn**
**Parliamentary Affairs**
**The Royal Society of Chemistry**
**Burlington House, Piccadilly, London W1V 0BN**
**Tel: 020 7437 8656 Fax: 020 7734 1227**
**E-Mail: benns@rsc.org**
**Website: http://www.rsc.org**
**http://www.chemsoc.org**

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

## The Royal Statistical Society

**Contact: Janet Lindley**
**12 Errol Sreet, London EC1Y 8LX.**
**Tel: 020 7614 3933**
**Fax: 020 7614 3905**
**E-mail: j.lindley@rss.org.uk**
**Website: www.rss.org.uk**

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

## The Science Council

**Contact: Dr Sarah Ball, Director**
**The Science Council**
**76 Portland Place**
**London W1B 1NT**
**Tel: 020 7470 4830 Fax: 020 7470 4937**
**E-mail: enquiries@sciencecouncil.org**
**Website: www.sciencecouncil.org**

The Science Council has a membership of over 20 professional institutions and learned societies covering the breadth of science and mathematics. Its purpose is to provide an independent, collective voice for science and scientists and to maintain standards across all scientific disciplines. There are specialist groups for policy issues relevant to science in education, environment, health and society. In 2003 the Science Council was granted a Royal Charter and launched the Chartered Scientist (CSci) designation in 2004.

## SEMTA

Technology Skills For Productivity & Performance

**Contact: Nicolas Heslop**
**Public Affairs Manager**
**SEMTA, 22 Old Queen Street,**
**London SW1H 9HP**
**Tel: 020 7222 0464 Fax: 020 7222 3004**
**E-Mail: nheslop@semta.org.uk**
**Website: www.semta.org.uk**

SEMTA (Science, Engineering and Manufacturing Technologies Alliance) is the Sector Skills Council for the science, engineering and manufacturing technology sectors. We have become one of the first fully-licensed SSCs.

Our **Mission** is 'to ensure that our sector has the knowledge and skills required to meet the challenges faced by the workforce of the future.'

Our sectors account for a significant proportion of the UK economy. There are about two million people employed in about 100,000 establishments in the core Science, Engineering and Technology sectors, currently contributes over £74 billion per annum – about ten per cent – of total UK GDP.

## Society for general Microbiology

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

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

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

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

## Society of Chemical Industry

SCI
where science meets business

**Contact: Mr Richard Denyer,**
**General Secretary and Chief Executive**
**SCI, International Headquarters**
**14-15 Belgrave Square, London SW1X 8PS**
**Tel: 020 7598 1500 Fax: 020 7598 1545**
**E-mail: secretariat@soci.org**
**Website: www.soci.org**

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

## University of Surrey

UniS
University of Surrey

**Contact: Pauline Elliott**
**University of Surrey, Guildford,**
**Surrey, GU2 7XH**
**Tel: 01483 689905**
**Fax: 01483 683948**
**E-mail: information@surrey.ac.uk**
**Website: http://www.surrey.ac.uk/**

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

## Sypol Limited

Sypol

**Contact: Lawrence Waterman**
**Sypol Limited**
**Elsinore House**
**Buckingham Street**
**Aylesbury**
**Bucks HP20 2NQ**
**Tel 01296 415715**
**Fax: 01296 397106**
**E-mail: lawrence.waterman@sypol.com**
**Website: www.sypol.com**

Sypol is the UK's leading health, safety and environmental (HSE) consultancy. Established in 1979, it offers training and advisory services to organisations in the public and private sectors to help meet their statutory obligations in ways that complement their overall business aims.
Sypol's focus is on providing efficient, practical and cost-effective ways of dealing with HSE issues and operates at all levels - from briefing main boards on corporate governance; through development of management systems; to guidance on handling hazardous substances and asbestos.

## Universities Federation for Animal Welfare

UFAW
Established 1926

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

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

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

**SCIENCE IN PARLIAMENT**

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# Science Diary

## The Parliamentary and Scientific Committee

Contact: Annabel Lloyd
020 7222 7085

*www.pandsctte.demon.co.uk*

*Thursday 18 March 10.15-14.00*
Science Week Seminar
**The Government's Use of Science**
Grand Committee Room, Westminster Hall

*Monday 26 April 17.30*
**The EU Chemicals Directive**
Boothroyd Room, Portcullis House

*Monday 17 May 17.30*
**Annual General Meeting**

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## The Royal Institution

21 Albemarle Street, London W1S 4BS

For further information visit www.rigb.org or telephone 020 7409 2992

Events held at the Royal Institution
Unless otherwise stated tickets £8 (£5 concs)

*Tuesday 2 March 19.30*
**P... P... P... Protect the Penguins**
Dr Peter Barham

*Wednesday 3 March 19.30*
**Vicious Viruses: how they happen, and how we can stop them**
Prof John Oxford

*Wednesday 10 March 19.30*
**So You Think You're Human?**
Prof Felipe Fernandez-Armesto, Prof Igor Aleksander and Dr Anthony Grayling

*Monday 15 March 19.00*
**Genetics for the Terrified!!!**
Hugh Montgomery

*Tuesday 16 March 18.30*
**Magnetic Earth**
Prof David Gubbins and Christopher Finlay
Tickets £5

*Thursday 18 March 19.30*
**Total Recall: dreams, memories and consciousness**
Prof Martin Conway and Dr Mark Solms

*Monday 22 March 19.30*
**The Earth, an Intimate History: an introduction to geology**
Prof Richard Fortey

*Thursday 25 March 19.30*
**A New Renaissance? A closer look at art-science collaborations**

*Thursday 1 April 19.30*
**Head Injury in Sport**
Simon Fleming

*Wednesday 7 April 19.30*
**Who was the First Scientist?**
Prof Lewis Wolpert, Brian Clegg and Dr Frank James
Tickets £5

*Thursday 15 April 19.30*
**Vanity, Vitality and Virility: the chemistry of Beauty**
John Emsley

*Monday 19 April 19.00*
**Chemistry for the Terrified!!!**
Dr John Kilkoyne

*Tuesday 20 April 18.30*
**Delving into the Nanoworld**
Prof Paul McMillan and Andrew Pugsley
Tickets £5

*Wednesday 21 April 19.30*
**Kidneys: can we fix them?**
Dr Stephen Powis and Dr David Wheeler

*Wednesday 28 April 19.30*
**The Essential Difference between Men and Women**
Prof Simon Baron-Cohen

*Wednesday 5 May 19.30*
**Mutants**
Dr Armand Leroi

*Tuesday 11 May 19.30*
**The Next Small Step**
Dr Kevin Fong

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## The Royal Society

6-9 Carlton House Terrace
London SW1Y 5AG

Events held at the Royal Society unless otherwise stated

Contact Froniga Lambert: 020 7451 2574

*froniga.lambert@royalsoc.ac.uk*
*http://www.royalsoc.ac.uk/events*

Pre-registration is essential for Discussion Meetings

*Monday 15 March 18.30*
Public Lecture
**Amazonian rainforests: thriving or surviving in a 21st century atmosphere?**
Yadvinder Mahli

*Monday 15 & Tuesday 16 March (all day)*
Discussion meeting
**Plant phylogeny and the origin of major biomes**
Organised by Dr Toby Pennington, Dr Quentin Cronk and Dr James Richardson

*Tuesday 23 March 18.00*
Croonian Prize Lecture
**Risk: food, fact and fantasy**
Sir John Krebs FRS

*Thursday 25 March 19.30*
Public Lecture at Wrexham Science Festival
**Quantum behaviour: magic or physics?**
Dr Nina Snaith

*Tuesday 30 March 18.00*
Leeuwenhoek Prize Lecture
**A Bug's Life**
Professor David Sherratt FRS

*Monday 19 & Tuesday 20 April (all day)*
Discussion meeting
**Configurational energy landscapes and structural transitions in clusters, fluids and biomolecules**
Organised by Professor Paul McMillan and Professor David Clary FRS

*Thursday 6 May 18.00*
Bernal Prize Lecture
**Are low-frequency environmental electromagnetic fields a health hazard?**
Professor Michael Crumpton CBE FRS

*Monday 17 & Tuesday 18 May (all day)*
Discussion meeting
**Myosin, muscle and motility**
Organised by Professor Kenneth Holmes FRS, Dr David Trentham FRS and Professor Robert Simmons FRS

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## The Royal Society of Edinburgh

22-26 George Street, Edinburgh, EH2 2PQ

Tel. 0131 240 5000, Fax: 0131 240 5024

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

All RSE events are free and take place at the RSE unless otherwise stated.

All require registration.

*Monday 1 March 17.30*
**Electricity Supply in the New Century**
Dr Malcolm Kennedy CBE FRSE, Former Chairman of PB Power, Former President of the Institution of Electrical Engineers
Free public lecture – tickets required.

*Monday 15 March 17.30*
**Wind Energy - Powering the Future**
Dr Ian Mays, Managing Director, Renewable Energy Systems Ltd.
Jointly with the Royal Academy of Engineering
Free public lecture – tickets required.

*Monday 5 April 17.30*
**Frank Fraser Darling 1903-1979 - Ecologist, Conservationist, Prophet**
Professor Palmer Newbould, Emeritus Professor of Environmental Science, University of Ulster
Free public lecture – tickets required.

*Wednesday 21 April 2004 (Conf 13.00-17.10, Lect 18.00-19.30)*
**Fire and Structures - Implications of the World Trade Center Disaster**
For further information & to register for the Conference contact the RSE - a conference fee will apply
Lecture: free public lecture - tickets required

*Monday 26 April 17.00*
Robert Cormack Bequest Astronomy Lecture
**Focusing in the Sky**
Professor Sir Michael Berry FRS, University of Bristol
Free public lecture - tickets required

*Monday 10 May 17.30*
**Broadband Access Technologies: Reality and Myth**
Professor Steve McLaughlin, Professor of Electronic Communications Systems, University of Edinburgh
Free public lecture - tickets required

## The BA (British Association for the Advancement of Science)

*www.the-ba.net/nsw.*

*Friday 12 – Sunday 21 March*
**National Science Week**
National Science Week aims to celebrate science and its importance to our lives, giving people from everywhere in the UK the chance to participate in science activities and experiments and to engage in science discussions in their local area.

## SCI

14/15 Belgrave Square
London SW1X 8PS

Contact: conferences@soci.org or 020 7598 1562

*Tuesday 2 March*
**Environmental and Human Health Impacts of Endocrine Disrupting Chemicals**
SCI BioActive Sciences Group, London

*Tuesday 2 March*
**Small and Beautiful**
New Catalysts for Clean Technology SCI Liverpool Section, Bangor, Wales

*Wednesday 10 March*
**Increasing the Effectiveness of World Public Sector Agricultural Research through Partnerships**
Bases for novel paradigms
SCI Pest Management Group, London

*Wednesday 17 March*
**Industrial Odours: Control and Abatement**
SCI Environment Group, London

*Thursday 18 March*
**"Green" Asphalts**
SCI Construction Materials Group, London

*Sunday 21 – Thursday 25 March*
**SCIPHARM 2004**
International Pharmaceutical Industry Congress
SCI Fine Chemicals Group, Edinburgh

*Monday 29 March*
**Environmental Toxicology: Diagnostics**
SCI Environment Group, Edinburgh

*Thursday 1 April*
**Waste Materials in Construction**
SCI Construction Materials Group, London

*Sunday 9 May*
**QSAR 2004**
11th International Workshop on QSAR in the Human Health and Environmental Sciences
SCI BioActive Sciences Group, Liverpool

*Tuesday 25 May*
**Agriculture in Future Rural Landscapes**
Visionary perspectives of opportunities through innovative research in applied biology
SCI Pest Management Group, London

## Royal Pharmaceutical Society of GB

Contact: Judith Callanan 020 7572 2261

*science@rpsgb.org.uk*

*Thursday 18 March*
**The Contribution of Analytical Science to Rapid Microbiological Assessment**
Royal Pharmaceutical Society, London

Tuesday 23 & Wednesday 24 March
**Process understanding: the driver for new standards of performance in pharmaceutical manufacture, quality and regulation**
Ninth Arden House European Conference
Royal Pharmaceutical Society, London

*Thursday 22 April*
**APS Genes as Medicines**
Royal Pharmaceutical Society, London

## Institute of Food Research

Norwich Research Park
Colney, Norwich NR4 7UA

*www.ifr.ac.uk/events/totalfood.pdf*

*Sunday 25 – Wednesday 28 April*
**Total Food 2004 - Exploiting Co-Products, Minimising Waste**
Norwich Research Park, Norwich
International conference




Science in Parliament
3 Birdcage Walk, London SW1H 9JJ
Tel: 020 7222 7085 Fax: 020 7222 7189

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| Editorial Assistant: | Mrs Annabel Lloyd |

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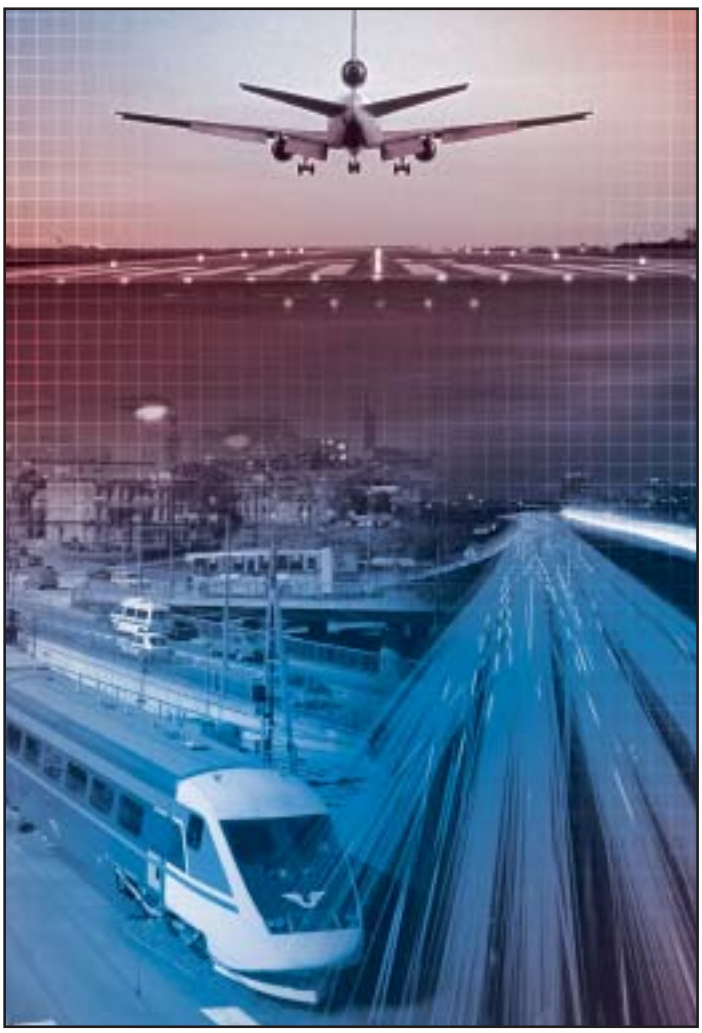

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