

# Science & Public Affairs

National Science  
Week



Personalised  
medicines



Universal ethical  
code for science



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Multi-reader subscriptions  
United Kingdom: £50  
Europe outside UK: £60  
Outside Europe: £70

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The magazine is available at its website, [www.the-ba.net/spa](http://www.the-ba.net/spa)

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Science & Public Affairs is published four times a year.

The views expressed in this publication do not necessarily reflect those of the editorial committee or the BA.

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the BA is a Registered Charity  
No. 212479 ISSN 0268 490 x

Front cover picture: Blue Reef Aquarium

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## National Science Week

National Science Week takes place from 10 – 19 March, giving people of all ages an opportunity to take part in science, engineering and technology activities.<sup>1</sup> It will see the start of the BA's new three-year strategy on climate change. The main focus for National Science Week will be on personal energy consumption, and what we ourselves can do to reduce it.

Sue Hordijkeno (p.12) describes how the BA is enlisting the support of supermarkets to push energy-saving lighting during National Science Week itself, while Anjana Ahuja (p.13) relates her shock at discovering just how much energy she was wasting by leaving domestic appliances on standby, instead of turning them off.

The larger context of the current energy debate is reflected in opposing views of the place nuclear power should have in the government's forthcoming white paper. Andrew Simms (p.10) wants to promote renewable energy sources, microgeneration and decentralisation to meet the nation's energy needs, and 'leave the nuclear white elephant to quietly fade away with as much radioactive dignity as it can muster'. On the other hand, Michael Laughton (p.11) believes the long-term future belongs to renewable

energy, but the bridge to that future involves nuclear power.

There is more argument in the SPATalk (p.4), which focuses on whether Europe should increase its birth rate to support its ageing population. Philip Bushill-Matthews is convinced it should, to provide more young people to pay their parents' pensions. Welcoming rising life expectancy, David Nicholson-Lord disagrees. He advocates saving more, working longer, improving preventive health so that we stay fit, and enabling the millions of unemployed or underemployed people in Europe to get back to work.

While life expectancy is increasing, health in old age is not. Stewart Sutherland (p.17) lays out the conclusions of the House of Lords Science and Technology Committee's recent report on scientific aspects of ageing. He urges the government to focus more resources on preventing the illnesses of old age instead of treating them.

Personalised medicine, which tailors drugs to a person according to their genes, promises a future of safer and more effective medicines. David Weatherall (p.6), relating the findings of a Royal Society report on the subject, says

that there is still so much we do not understand about the part genetics plays in the many causes of disease, that we will have to wait 15 to 20 years for the promise to be realised.

Elizabeth Fisher and Victor Tybulewicz (p.19) have made progress in a related area, however. They have made a 'super transgenic' mouse: the first animal which truly models Down syndrome. They look forward to using it to understand more about the genetic causes of the syndrome, which affects one baby in every thousand.

It was a nervous winter, with many people wondering whether they would be laid low, or worse, by one or another threatening strains of flu. Derek Smith (p.15) explains how the World Health Organisation decides which strains of the influenza virus to incorporate into its jabs, to protect as many people as possible.

Wendy Barnaby, Editor  
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1. More at [www.the-ba.net/nsw](http://www.the-ba.net/nsw)

# Should Europe increase its birth rate to support its ageing population?

David Nicholson-Lord and Philip Bushill-Matthews disagree

Dear **Philip**,

The idea that we need more people on the Earth, whatever the ostensible reason, ought by now to be a self-evident nonsense. The fact that it's not – that many apparently sane people are suggesting it – is a sign of just how deeply humanity is in denial about the environmental crisis it faces.

The planet's population is set to grow by 40 per cent, to over 9 billion, by 2050. The UK, one of the world's most crowded countries, is projected to grow by a sixth – 10 million – over the next six decades. Human population growth is a key factor in every serious environmental problem, from climate change and energy shortages to loss of species and habitats. Proposing more people in a world with too many is not unlike putting out a fire by pouring on more petrol.

Producing more babies to 'support' an ageing population is the economics of the surreal. What happens when the younger people grow older? Do we then ramp up the birthrate even further to maintain the support ratio? On this logic, human population would have to continue growing ad infinitum – a manifest impossibility. There are many sensible ways of adjusting to longer life expectancy without adding to the strain on the planet.

Best wishes, **David**

Dear **David**,

I note your comments about the planet's population as a whole. Rather than respond on behalf of the entire world, may I be more limited in my response and just talk about Europe, or even just the EU?

The European Union population is currently fairly static overall. In twenty years' time, it is projected to have increased by about 10 million before slightly falling back. But even this increase of 10 million disguises a decrease of 20 million people of working age. The increase is only because oldies like me are living longer.

If we want to get a balance in our population in Europe, we need more young people if only to pay the pensions of their parents. This is not 'the economics of the surreal' as you quaintly dismiss it. It is absolutely the economics of the real, in which more real pensioners will be living in real hardship unless there are more real

young people around to pay real taxes to fund them.

The alternatives are either to have more babies, or to kill off some of us ancients. Otherwise the economics just don't work. I have personally done my bit about the former, and am not yet willing to volunteer for the latter. How about you?

Best wishes, **Philip**

Dear **Philip**,

Fortunately, we need neither of your solutions. Rising life expectancy is to be welcomed and the answer to such problems as it poses is undramatic and straightforward: a combination of saving more, working a little longer, improving preventive health so that we stay fit, and enabling the millions of unemployed or underemployed people in Europe, many of them victims of ageism, to get back to work. It is for these reasons that the recent Tomorrow's Company report on ageing concluded: 'There is no pensions crisis...we can afford to grow old.'

I should explain further about the support ratio – the ratio of working to non-working people. A higher birth rate would initially worsen this (babies need feeding, clothing, educating), then improve it (babies go to work) but ultimately make it much, much worse (babies become pensioners) – so that we would then need even more babies to support the babies people like you are currently advocating. The Oxford demographer David Coleman calculates that to keep the support ratio at current levels would require a UK population in 2100 of 300 million – and rising. He calls it 'the incredible in pursuit of the implausible'.

Do you seriously think a UK with a population of 300 million – five times the current level – represents the 'economics of the real'?

Yours curiously, **David**

Dear **David**,

I confess I have not read the report which claims 'there is no pensions crisis'. I am not sure on which ivory tower the author sits, but I talk to real pensioners, and real politicians trying to grapple with the issue, who see a real problem that is not going away. It does need solving,

and it will not get an easier to solve if we (you) pretend it isn't there.

You also quote another academic on a different tower, claiming the 'support ratio' population in the UK would need to be 300 million. I don't buy that either. Please descend to my level and talk about the current numbers.

Finally, I note that you represent the Optimum Population Trust. Do tell me: who does the Trust think should decide what the optimum population is? The Trust? Governments? Or dare we let the people decide for themselves?

In China, the answer appears to be the State Government decides, limiting births to one child per family – with some parents killing off unwanted baby girls so they can use their ration for one son. Is this the future? In the UK many young women would love to have more children – simply because they want to be mothers – yet job pressures prevent them. Is this the future?

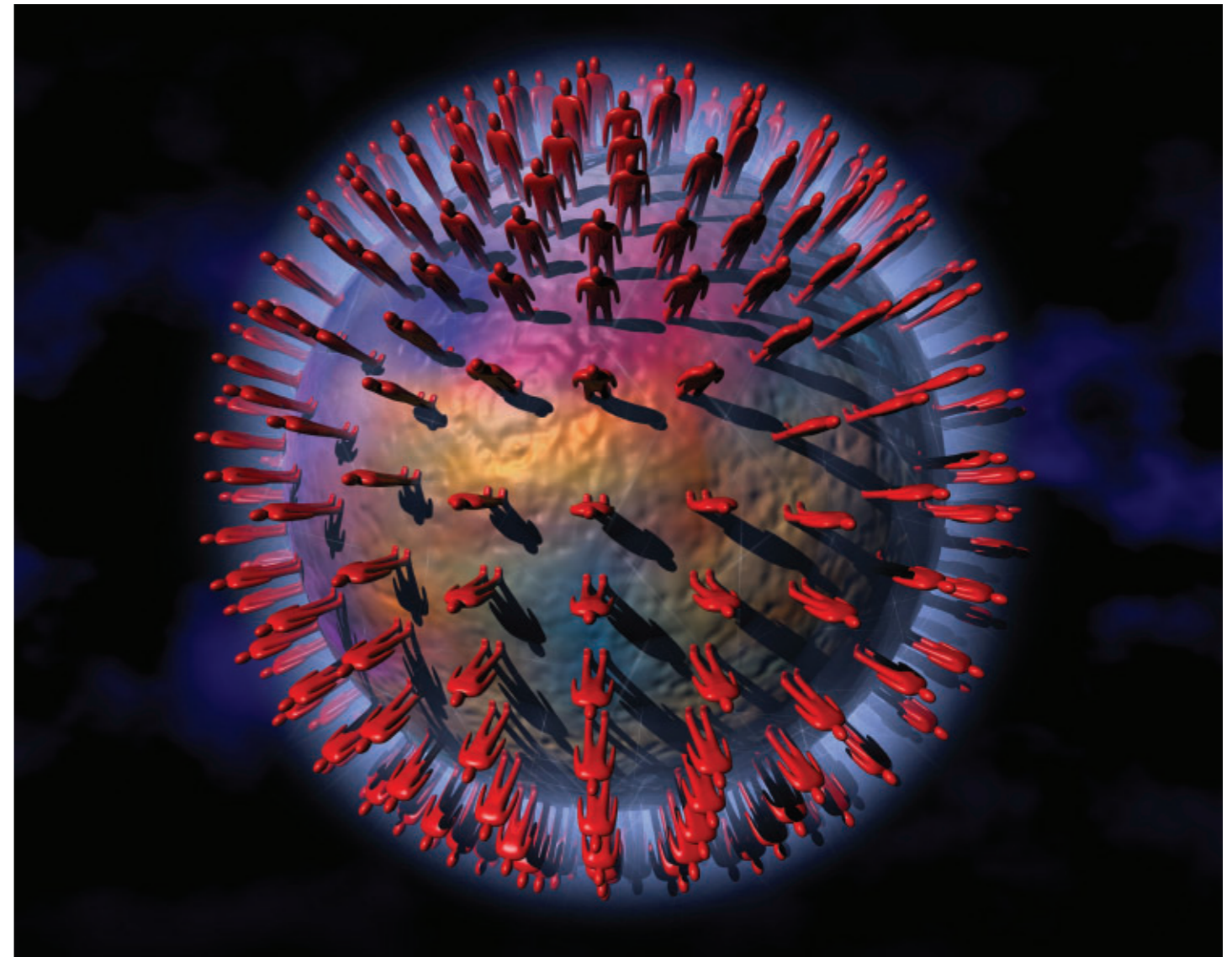
Yours, even more curiously, **Philip**

Dear **Philip**,

I'm sorry you're so dismissive of factual evidence. I don't think the conclusions of Oxford University's (very real) professor of demography or of the group of (equally real) business people, economists and actuaries who produced the Tomorrow's World (a business think-tank) report should be quite so airily rubbished. Never mind – what about The Economist magazine, which on January 5 told us to stop worrying about demographic 'bogeys' and concluded that ageing and shrinking populations were 'something to celebrate'? Or the Pensions Commission itself, which has said more births are not the answer to an ageing population?

By ignoring such evidence (and there's much more), you're in danger of falling victim to myth-mongering. Panic breeding programmes are not an option – unless you're happy to bequeath a world so overpopulated as to put human survival at stake.

You ask about 'optimum' population figures. These are based on research linking human numbers to environmental carrying capacity – surely the key to sustainability. And the people of Europe have indeed 'decided for themselves' – in favour of smaller populations. It's people like



Do we need more people?

you who are telling them to produce more babies! As for China, of course coercion is wrong. But at least China's leaders have recognised the dangers posed by population growth. Isn't it time ours (for example, you) did the same?

Yours less than optimistically, **David**

Dear **David**,

You state that the people of Europe 'have decided for themselves' in favour of smaller populations. I disagree profoundly.

Many have only chosen to limit their families because they feel they had no choice. They wish to have more kids, but are not prepared to bring them into a world where they have limited time – and money – to give them a decent life. The key question was the one I raised in my previous message: Who decides?

It should not be for politicians – or theoreticians – to decide how many children people should have. It should be for parents to decide, and to decide freely.

It is not for us to 'tell them to have more babies'. It is for us to enable them to have more if that is their wish. At present they cannot, because the pressures of life are frankly stacked against them.

If politicians, business leaders and others, can help create a better work-life balance by promoting more flexibility in the work-place, then women can be freed to make a different decision. They can decide to bring more children into this world, which will not just benefit themselves but also benefit society.

Who decides? Let them decide – and let us make it easier for them, by getting out of the way.

Yours finally, **Philip**

Reference

1. The Ageing Population, Pensions and Wealth Creation, a Tomorrow's Company study, 2005, Tomorrow's Company, 235 -241 Blackfriars Rd, London SE1 8NW  
www.tomorrowcompany.com

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# Personalised medicines

David Weatherall finds that great promise needs much preparation

**The concept of personalised medicines, where a person is prescribed drugs tailored to their genes, promises a future of safer and more effective medicines. But has this promise been over-hyped? And if tailored drug treatments become a reality, does the health service have the infrastructure and resources to put them into widespread use?**

The Royal Society has published a report examining these questions.<sup>1</sup> It concludes that an era of personalised medicines will not be with us for at least another 15 to 20 years. This is mainly because there are still so many gaps in our understanding of what part genetics plays in the complex, multiple causes of disease.

The report also points to a handful of encouraging examples of personalised medicine being used in the treatment of cancer, illustrating the value of such an approach.

## Background

Personalised medicine is known as pharmacogenetics – a term first used in 1959 to describe the discovery that variation in the function of a single gene can modify the effect of a drug. Since then it has been broadened to encompass how people's total genetic make-up affects their response to medicines. This can mean recognising subsets of common diseases that can be treated differently, the identification of genes that make drugs effective or harmful and the use of differences in susceptibility to infectious diseases to develop new medicines or vaccines.

With the success of the human genome project and advances in our understanding of how both drugs and genes work, some people have high hopes that the next few years will see a revolution in the way patients are treated. Meanwhile, others have expressed reservations that pharmacogenetics, in its current form, can fulfil such promises within this timescale.

At the same time, the NHS bill for drugs is expected to reach £11b for 2005-6 and roughly 1,100 people a year are dying from adverse drug reactions. The health service would welcome any opportunity for increasing the effectiveness of drugs or reducing the risk of harmful side-effects by taking genetic factors into account.

## Trials and support

What became clear in the report is that we need to know more. Funding is needed for well-designed studies in pharmacogenetics



The future: pills to fit the person

to establish how well it can be applied to clinical practice.

For new drugs these trials will be conducted by industry. But for medicines already on the market, the onus will be on government to fund research. The government could deliver funds through the Medical Research Council and the Department of Health, for studies in partnership with both the medical charities and industry.

Key to this process will be ensuring that researchers are able to link patient records back to the individual's genetic information. This will require access either to samples collected or genetic data already stored. The NHS is well placed to make this possible. In addition, DNA samples should be taken from as many clinical

trials as possible, in order to facilitate trials of the genetic variability of patients' response to drugs.

By analysing the data from clinical trials, researchers may identify groups of people with a particular gene or genes for whom a drug works, but which does not work in the wider population. Such treatments will have a very limited market, so the provision of tax incentives will be important in encouraging industry to participate.

There is also a role for industry in developing and producing diagnostic DNA tests, because accurate, easy-to-use and reliable tests will be essential for correctly administering the drugs. And if such tests are to become widespread, a regulatory framework needs to be set to make

sure they are properly introduced and meet the required standard.

Monitoring should also continue once products are on the market with the aim of linking genetic variability with clinical outcome. This kind of work should be mandated at the national and European level as an extension to the current system of clinical trials.

## National needs

The challenges facing the NHS in introducing personalised medicines, as they begin to filter onto the market, are immense. In the short term, training and awareness-raising among doctors and other healthcare professionals are needed, as few currently understand the area clearly and the benefits it could bring to patients.

Scientists trained in the appropriate areas are needed to really progress this avenue of research. Clinical pharmacologists, biostatisticians and population geneticists will all be in high demand in both industry and academia. There are currently shortages in all these areas, so encouraging young researchers to specialise in these fields will become increasingly important. There were also concerns over the capacity of GPs to be sufficiently up to date with the technology to support widespread use and advise patients successfully.

The collection and analysis of patient data introduces issues of how to store the information securely, who has access to it and how far it is anonymised. There is public concern over these issues so the government needs to consult widely and then clearly outline the ethical framework for industrial and academic researchers who will be creating or accessing large databases of patients.

The newly created NHS Connecting for Health agency is establishing electronic records to store a patient's history. Incorporating genetic data into this system would be invaluable but the ability for researchers to return to patients to take samples if necessary will be essential. Clear guidelines are needed for what will and will not be possible.

## Public attitudes

Alongside the evidence gathered from academic researchers, industry and other institutions, the working group which produced the report held a series of public dialogue meetings. They showed that there is concern about whether the current healthcare arrangements could

successfully deliver genetic technology in the future. On balance, participants thought that the introduction of pharmacogenetics was likely to be beneficial. However, a significant minority were concerned about the increasing use of genetic tests in society.

One of the most pressing issues they identified, which was highlighted in the report, was that with large repositories of pharmacogenetic data being held, there is a need for adequate ethical and consent guidelines. This is to ensure patients are happy with how their data are being used while the maximum benefit to society is gained from analysing the data, including being able to return to patients to obtain genetic samples if necessary.

While participants considered the NHS most appropriate to control access to genetic testing, concerns were raised about whether appropriate safeguards could be given to ensure the accurate, reliable and confidential use of such tests.

## International dimensions

Worldwide, greater harmonisation of research practice is needed. Variation in the laws for conducting genetic research between countries makes it difficult to combine data from across the globe into large-scale clinical trials. The guidelines and regulations for conducting genetic research across international borders need reviewing by the Department of Health in conjunction with the International Conference on Harmonisation.

Pharmacogenetics may prove valuable in the fight against the big killers worldwide, such as malaria, tuberculosis and HIV. Research is needed to establish the cost-effectiveness and clinical value of this approach for developing countries.

The report endorses the World Health Organisation's recommendation that the introduction of simple DNA tests for genetic and infectious diseases in developing countries is vital. This would be valuable in the treatment of malaria, for example, where a single gene difference in a red blood cell enzyme causes severe anaemia when a particular type of anti-malarial drug is taken. Hundreds of thousands of people in tropical countries carry the gene and a simple stick test needs to be developed to prevent them exposing themselves to this risk.

## Reference

1. Personalised medicines: hopes and realities  
The Royal Society 2005  
[www.royalsoc.ac.uk/displaypagedoc.asp?i=17570](http://www.royalsoc.ac.uk/displaypagedoc.asp?i=17570)

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## @ a glance...

Personalised medicines (pharmacogenetics) promise a future of safer, more effective medicines

A Royal Society report concludes that they are at least 15 to 20 years away

Funding is needed for studies in pharmacogenetics to establish how well it can be applied to clinical practice

The challenges facing the NHS in introducing personalised medicines are immense

The public is concerned about accuracy, reliability and confidentiality of genetic tests

## In brief

**Pounds in space**

The UK is to play a major role in the European Space Agency's (ESA's) space exploration and environmental science programmes. On top of the mandatory ESA subscription of £374m for science and 'basic activities', the UK has subscribed £74m to the Aurora programme (which includes a robotic mission to Mars), £141m to the Earth Observation Envelope Programme, and more to satellite monitoring and telecommunication programmes.

**Models of agreement**

The DTI's Lambert Model Agreements have simplified the process of constructing collaborative contracts between academia and industry, according to a survey carried out by the Association for University Research and Industry Links. The survey revealed that the five contracts devised by the Lambert Working Group have proven useful to higher education institutions although more work is required to promote them to industry.

**Best practice for good advice**

The House of Commons Science and Technology Committee is looking into the way in which government obtains and uses scientific advice for the development of policy. The inquiry will explore the technology behind the government's proposal for identity cards among other examples, and in each case will address the process of policy development rather than actual policies, including how risk is handled.

**Science and heritage**

The House of Lords Select Committee on Science and Technology is examining the role of science, engineering and technology in the preservation of the UK's cultural heritage (including buildings, works of art, manuscripts and archaeological relics). It will look at the application of scientific and engineering techniques to monitoring and conservation and new ways of enhancing public understanding of and access to cultural objects.

## Opinion divided on stem cell push

The government is to provide a financial 'shot in the arm' for UK stem cell research, in response to recommendations laid out in a report from the UK Stem Cell Initiative (UKSCI). But some doubt it's chosen the right arm.

Established in 2005, UKSCI is a government advisory body charged with establishing a 10-year vision for UK stem cell research. Its report identified five major themes whose development will increase momentum in national stem cell research: a public-private consortium for the advancement of stem cell technology, to include biotechnology, healthcare and pharmaceutical companies; more infrastructure for the development of stem cell therapy (including shoring up the UK Stem Cell Bank for the next decade); consolidation of research funding dedicated to stem cell work; a favourable regulatory climate; and improved communication and coordination between government, research councils and researchers.

UKSCI estimated this will cost £11m to £74m per year, in addition to existing investments. The government has agreed to the recommendations in their entirety, welcoming them as a "road map" to translate basic research in stem cells into new therapies to benefit patients', and promising an additional investment of £50m over the next two years, in addition to the £50m already allocated.

According to Chancellor Gordon Brown, the investment will help Britain to become 'the world's number one centre for genetic and stem cell research building on our world-leading regulatory regime in this area.' He promised a 'new public-private partnership to invest in

pre-commercial aspects of stem cell research and to coordinate future research.'

While this is good news for stem cell researchers, not everyone is impressed. Josephine Quintavalle of the campaign group Comment on Reproductive Ethics explained: 'The worry is that the government is more concerned about being the global leader in stem cell research than in serious analysis of stem cell claims. The Hwang cloning scandal [in which South Korean Dr Hwang Woo-suk was charged with having faked the production of a stem cell line taken from a cloned human embryo] should be a salutary lesson.'

The group's concern is not with the management or independence of the research but with how funds are distributed between the different aspects of the scientific field itself. '[A] big weakness in the [government's] position is their unjustifiable enthusiasm for embryonic stem cell and cloning research,' continued Quintavalle, 'and their lack of interest in the much more successful cord blood, bone marrow and other adult stem cell therapies.'

Comment on Reproductive Ethics is also sceptical about the ability of the Human Fertilization Embryology Authority to regulate embryonic stem cell research effectively. 'Flexible? They certainly are – or perhaps intimidated. I do not think the HFEA would ever dare say "No",' remarked Quintavalle.

The government response to the UKSCI report is at [www.dh.gov.uk/PolicyAndGuidance/HealthAndSocialCare/Topics/StemCell/fs/en](http://www.dh.gov.uk/PolicyAndGuidance/HealthAndSocialCare/Topics/StemCell/fs/en)

Comment on Reproductive Ethics is at [www.corethics.org](http://www.corethics.org).



Biologists Yong Zhao (left) and Eliezer Huberman found a new source of pluripotent stem cells – the versatile stem cells that can morph into any type of cells. Argonne National Laboratory

## Nanotech concerns

A new government plan to identify the long-term health and environmental risks from nanotechnologies has met with a lukewarm reception. Despite being backed by £5m worth of funding for research into these issues, and having as its desired outcome a 'framework for containing any "unacceptable risks"', the plan risks coming apart at the seams from lack of focus, say its detractors.

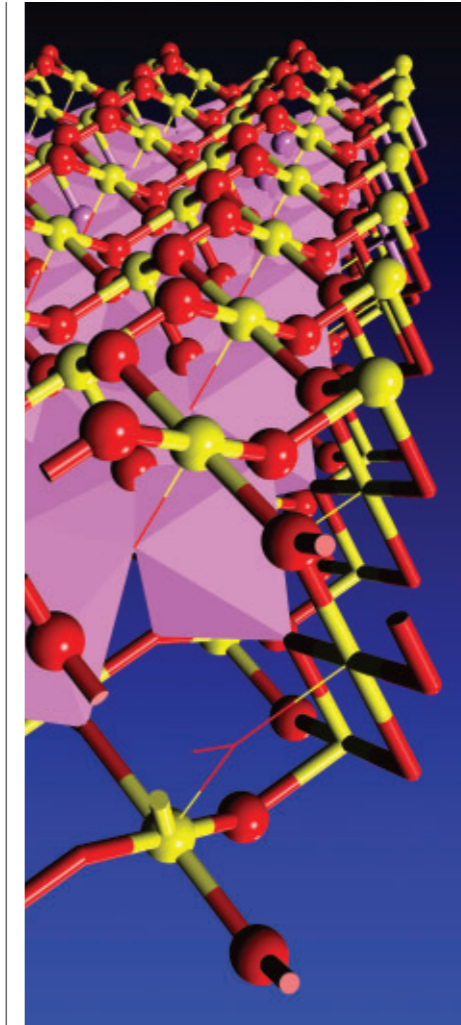
The research plan was announced in response to a study commissioned by the government from the Royal Society and the Royal Academy of Engineering, which concluded in 2004 that greater understanding was required of the longer-term risk to human health and the environment – for example, in agriculture and food production – from nanomaterials, in particular nanoparticles.

Howard Dalton, chief scientific advisor to the Department for the Environment, Food and Rural Affairs which prepared the recent report, said it 'sets out the ambitious and forward-looking research agenda that is needed to ensure that we are able to identify and manage potential risks associated with the use of nanotechnologies.'

But the Royal Society and the Royal Academy of Engineering say it does not go far enough. Professor Ann Dowling, who chaired the 2004 report into nanotechnologies, said, 'The government has identified sound priorities for the research needed to develop safety regulations [...] But we are concerned that its approach to funding this research is rather ad hoc. Rather than strategically building a programme, with a dedicated pot of money, to explore any potential health and environmental risks associated with nanoparticles, it is primarily relying on individual research teams to come forward with proposals and compete against other research areas for funding. This approach leaves it to chance that the right research will be undertaken.'

Their views are largely reflected by those of Richard Jones, professor of physics at Sheffield University. 'The report makes a very good job of setting out the areas in need of attention,' he told Science & Public Affairs, 'but I'm sceptical about whether the framework will be enough to get the necessary work done. [...] People might not come forward with the required proposals.'

Professor Jones believes that careful scrutiny of existing knowledge to identify the gaps is needed first of all – followed by earmarked



Nanoribbon which could be used as ultrasensitive nanosensors for various gases, e.g. NO<sub>2</sub>, O<sub>2</sub>, and CO. Accelrys

money to fill them. But there is a chance, he believes, that there is not even enough scientific capacity or expertise to achieve this.

The Royal Society and the Royal Academy of Engineering also warned that the research that is needed to underpin safety regulations must keep pace with the rapid development of the science, and expressed concern about the apparent lack of collaboration between government and industry to develop safety testing or public dialogue activities.

The DEFRA report is at: [www.defra.gov.uk/environment/nanotech/nrcg/reports/index.htm](http://www.defra.gov.uk/environment/nanotech/nrcg/reports/index.htm)

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## In brief

**Inspecting military funding again**

The Fellowship of Reconciliation is examining how military organisations fund and influence university teaching and R&D from the students' perspective. Information is available from Martha Beale: [martha@for.org.uk](mailto:martha@for.org.uk). Meanwhile Scientists for Global Responsibility has published a new careers briefing on the military's involvement in science and technology and how it can affect career choice for students and professionals. See: [www.sgr.org.uk/ethics.html](http://www.sgr.org.uk/ethics.html)

**More science needed for waste study**

The Royal Society has suggested that the Committee on Radioactive Waste Management (CoRWM) engages immediately with the scientific and engineering learned societies as it moves into the final stages of its review of the options for managing the UK's radioactive waste. Its work needs stronger scientific input, said the society, to complement its public engagement activities.

**Our energy challenge**

As the government launches its consultation into a long-term energy strategy, amid rumours that nuclear power is back on the agenda, a survey has shown that just over 50 per cent of the public may be prepared to accept new nuclear power stations to help to tackle climate change, but far more believe that promoting renewable energy (78 per cent) and reducing energy use (76 per cent) are better ways of tackling climate change than nuclear power.

**Strong words from new chief**

The new President of the Royal Society, Lord Rees of Ludlow, otherwise known as Professor Sir Martin Rees, has reacted to news that US greenhouse gas emissions rose yet again in 2004 – the biggest annual rise since 2000 – by emphasising the international need to act with 'even greater urgency and resolve now'. UK emissions have also risen in each of the last two years.

# 'What I hope to see in the energy white paper': two views

Andrew Simms makes the case for renewables

**What I hope to see in the next energy white paper is a realistic plan to deliver on the very clear conclusion of the last, very recent energy white paper.**

Just over two years ago the government concluded that renewable energy was the future. They set targets to increase its uptake, but failed to provide an adequate policy and financial framework to make that happen.

Now, in the place of shifting primarily to energy sources that are domestically plentiful, decentralised, diverse, flexible, safe, cheap, secure and environmentally friendly, we have a prime minister extolling the virtues of nuclear power. And nuclear, by comparison is expensive, inflexible, centralised, vulnerable to attack, inefficient (as it depends on a hugely wasteful national grid for distribution), saddled with an unsolved waste problem and dependent on an imported fuel source, whose supplies are both geographically limited and set to be exhausted within decades, even at current rates of use.

Nuclear, a power source that is promoted as the answer to climate change and energy insecurity, turns out to be neither. It is too slow, expensive and limited to help with climate change and, in an age of terrorist threats, it is more of a security risk than a solution.

## Disadvantages of nuclear

In terms of the security of supply, the International Atomic Energy Agency (IAEA), said last year that 'the key question is how long nuclear resources might last,' and cited known conventional resources of uranium as enough to last only another 85 years for 'once through' reactor types at 2002 rates of use. It also noted crucially that, 'The period for which resources are sufficient decreases the more nuclear power is assumed to grow in the future.' But even this masks the fact that the economics of nuclear power are based on access to the even more limited supplies of high-grade uranium ore.

In terms of carbon emissions, a nuclear industry relying on more energy-intensive fuel extraction from low-grade ore becomes far from carbon free. In carbon emissions terms, one of the only full life cycle analyses of nuclear plant, carried out by retired nuclear physicist and former nuclear advocate Philip Bartlett Smith, concluded that even in the best case nuclear power required significant emissions. In the worst case, using low grade ores, it was less climate-friendly than a gas-fired power station.

In terms of the relative costs of reducing carbon emissions to tackle global warming, nuclear power comes at the end of a long list of alternatives. They include: energy efficiency, combined heat and power (CHP) both micro and large scale; offshore, onshore and micro wind power; micro hydro, energy crops, wave power and, according to the government minister for climate change and environment, Elliot Morley, probably 'clean coal' as well.

An analysis of figures relied on by the government suggests that the true costs of new nuclear power have been seriously and systematically underestimated, by nearly threefold.

## Advantages of renewables

The potential for renewables based on available technology is huge, if the next white paper has the common sense to create an adequate policy and financial framework. For example, wave power could meet 15 per cent of electricity demand, and tidal power an additional 6.5 per cent. Solar cells are capable of providing at least 5–10 per cent of electricity needs, with solar thermal units providing around half of a UK household's annual hot water requirements.

Then there's wind. Theoretically Britain has enough to meet its electricity needs eight times over. A combination of offshore and onshore

wind could provide at least 35 per cent of the UK's electricity, even with the national grid's limitations. Advocate of wind energy, Professor John Twidell goes even further. Onshore wind, he believes, could meet 31 per cent of the UK's projected electricity needs in 2030 and offshore a further 51 per cent. Because of different technological 'learning curves' the costs of renewables are also set to fall dramatically compared to nuclear.

But the greatest leap forward would come if the next white paper builds on existing government commitments to develop micro-generation and is coupled to a radical plan for decentralising energy generation.

So, a rational white paper would comprehensively promote renewable energy sources, microgeneration and decentralisation to meet the nation's energy needs and leave the nuclear white elephant to quietly fade away with as much radioactive dignity as it can muster.

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How to generate and transmit electricity?



Michael Laughton makes the case for nuclear

**My main hope is that the outcome of the Energy Review of 2006 will focus on future security of supply linked to the need for a new nuclear build programme as well as more diverse renewable contributions.**

All Engineering Institutions say the same.<sup>1</sup>

## Eminent opinion

Linking the security case for nuclear also to environmental concerns, the former President of the Royal Society, Lord May, said recently in an interview that climate change demands Britain consider building new nuclear power plants and that the time to act is now.

He argued that the idea of Britain meeting its energy needs with renewables alone was simply wishful thinking.

Likewise Dr James Lovelock FRS, a lifelong environmentalist and member of the green movement who developed the Gaia Hypothesis of a self-regulating planet, commented that,

'The Green idea that renewable energy can fill the gap left by retired nuclear power stations – and also meet the constantly rising demand for power – is romantic nonsense. Though it [nuclear] is so much cleaner and safer than fossil fuels – and also easily the cheapest, according to a recent European Commission study – we allow Greens to exploit our fears [concerning safety] in the

same way that churches not long ago preyed on our fears of hell-fire.

'Only because of this pressure, not for any rational reason, governments are afraid to grasp the nuclear lifeline. If a scientific or engineering reason exists against it, I am yet to hear it.

Certainly, no Green organisation has come up with a single argument worth considering.'

## The long-term future belongs to renewable energy, but the bridge to that future involves nuclear power

### Energy outlook

A broader perspective on the case for nuclear energy with implications for both security of supply and environmental concerns was provided recently by the World Energy Outlook, the International Energy Agency's new projections for the next 25 years.<sup>2</sup> It sees world energy demand being likely to rise by almost 60 per cent between now and 2030.

On the IEA's projections, 85 per cent of additional energy will come from fossil fuels. Two thirds of the extra demand will come from developing countries, mainly China and India (plus Russia, Brazil and Mexico). Even without China and India, which rely principally on coal and oil, the market for natural gas seems likely to be stretched for years to come. At the same time, mainland Europe is expecting to import far more gas and so is America, which is now set to make significant demands on the international liquid natural gas market.

Natural gas burning would treble by 2030 from an already substantial level on the IEA's projections, a scenario involving large price rises. The UK forecast of increasing gas use in electricity generation to 2020 is based on some (but not significant) price increases. Yet for the next few decades we are increasingly dependent on gas for electricity generation (and also as a prime feedstock for the chemical industry).

Higher energy prices would be reflected in slower world growth and more people staying poor. The environmental impact of China and India coming up to Western levels of GDP with associated carbon dioxide emissions from energy generation would be catastrophic.

Europe's drive for wind power and other forms of renewable energy will make an insignificant contribution to resolving this dilemma in the foreseeable future. The share of renewables in EU energy supply will double to only 12 per cent from 2002 to 2030. At the same time, nuclear power will shrink from 15 per cent to seven per cent, so the EU will rely more on fossil fuels.

## Options

The choice then appears to be between global warming, nuclear power and keeping poor people poor.

Long before the end of this century, major changes in energy supply availability and patterns of energy use appear to be inevitable. These are changes that will take many decades to accomplish, hence the need for foresight based on an appreciation of actualities and not on faith in unknown possibilities.<sup>3</sup>

I believe that the Swedish Energy Foresight programme came to broadly the correct conclusions that I would like to see enshrined in the results of the Energy Review. In brief, based on our present knowledge of technology options, the long-term future belongs to renewable energy, but the bridge to that future involves nuclear power. I hope that feedback from reality will present these two choices as the main strands of future energy supply policy.

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- 'Everything unknown has great potential', Tacitus, AD 54

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# Bovvering about climate change

The BA is enlightening supermarkets, reveals Sue Hordijkeno

The BA is about to launch our thirteenth National Science Week. It will witness the start of our new three-year strategy to focus on climate change through our main programmes.

The government's Chief Scientific Adviser, Sir David King, has described climate change as a greater threat than terrorism, and each day we learn more about the toll that it's taking on the natural world. The issue seems so huge and so far removed from us on an individual level that it's hard to know how to respond. Boil the kettle, turn the heating on, flick the TV off standby and cosy up in front of head: sand: bury: sand: head: face: bovered?

In research published earlier this year by the University of East Anglia (UEA) and MORI a staggering 91 per cent of those polled believe that the world's climate is changing – and they knew why. In fact, 62 per cent of this group were definitely bovered, believing that every possible action should be taken on climate change. A further 32 per cent indicated that some action should be taken. But how far are we really prepared to go to modify our lifestyles to provoke action on climate change? Could it all really begin at home?

## Individual action

The initial focus of the BA's climate change programme is aimed at us as individuals and our own personal energy consumption. Can modifying my own personal habits really lead to stopping the effects of climate change from getting any worse?

I asked myself this question last year. Like Anjana Ahuja (see opposite), I don't leave the TV on standby, I too recycle and my home doesn't light up South London like the Blackpool illuminations. But what do I use to light up my home? Subsequent research informed me that only about one-third of the UK population uses energy-efficient light bulbs. What did they know that the others (myself included) did not?

## Saving money

Last November, we commissioned a quantitative survey (representative of UK adults) into public attitudes to using energy-saving light bulbs. The results told us that there is one overarching message that needs to be conveyed to encourage their use: they save you money.



Bovered? – about two-thirds of us are, about climate change Getty Images

According to the Energy Saving Trust's website, 'Each energy-saving bulb can reduce your electricity bill by up to £7 a year. They also last, on average up to 12 times longer than ordinary light bulbs.' Older people and those in lower socio-economic groups will buy them if they can get them cheaply, and younger people and those in higher social grades will buy them if they see that they provide an environmental benefit.

**Each energy-saving bulb can reduce your electricity bill by up to £7 a year. They also last, on average up to 12 times longer than ordinary light bulbs**

## Involving the supermarkets

Armed with this information, we targeted the places where most of us shop. Would the major supermarket chains be prepared to respond to our research and work with us to promote individual action in the face of climate change? Would they promote low-energy light bulbs in their stores, and would they reduce their cost for the duration of National Science Week? At the time of going to press, Sainsbury's and Morrisons had agreed to work with us, and we were in discussion with Waitrose.

Our challenge to the big five high street supermarkets is only a part of our focus on climate change for National Science Week. In collaboration with the Economic and Social Research Council we will also be asking you to 'Click for the Climate' and pledge how you will modify your habits and work towards more efficient energy consumption in your daily lives.

UEA and MORI's research reveals that a large proportion of those surveyed indicated that they believed that energy demand could be managed through behavioural change. National Science Week will examine just how bovered we really are.

To 'Click for the Climate', go online now at [www.the-ba.net/climatechange](http://www.the-ba.net/climatechange) and make your pledge.

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# The personal approach to saving the planet

Anjana Ahuja has her eyes opened

**Whenever I turn off for the night and see, through the darkness, the crimson LED twinkling at me from the corner of the television, I grit my teeth.**

My husband has done it again. He's put the telly on standby instead of turning it off.

This will trigger a predictable sequence of events – I will mention it, in a slightly piqued manner, and he will point out the number of halogen lights in the kitchen. With that marital score settled, we can get back to the important things: bedtime reading, cocoa and Radio 4.

## Revealing all

Other people's environmental shortcomings always seem so much worse than one's own. I've always hated waste – I recycle, drive a fuel-efficient car, don't leave the tap running while brushing my teeth, never fill the kettle when I'm making just one or two cups of tea, have never owned a tumble drier and would balk at getting a takeaway when there are leftovers in the fridge.

So it was a shock to have an outsider come into my home and reveal my profligacy, as happened in 2004, for a feature in the Times. I met the makers of Wattson, a little gadget that clips to the electricity cables entering a house and measures that household's usage. Before I had even let Richard Woods into my house for a cup of tea, Wattson, attached to cables in the porch, had already detected unexplained energy usage. At this rate, Wattson's display informed me, my electricity bill would be £70 a year. And I hadn't even switched anything on!

The gadget measures the surge in electricity that occurs every time an appliance is turned on. It displays the result either as the number of watts being used or, more painfully, as an estimated cost if the same output continued for a year. This is how Woods, an industrial design graduate from the Royal College of Arts, was able to tell me that the bright lamp in the corner of my kitchen costs a whopping £30 a year to run.

## Switched-off profligacy

Woods left Wattson with us for a day, and what an eye-opener it was. At 9pm, with the lights, telly, dishwasher and washing machine on, Wattson was registering a staggering £3,000.

But what shocked me most was the power being drawn from the mains when my appliances were switched off. 'Digital clocks still draw power, and most appliances are designed to be most efficient when in full use,' Woods explained later.

Woods also told me how Wattson had affected the behaviour of his three housemates when it spent a week in their sitting room. Woods recalls: 'One of them was a hi-fi nut who read somewhere that, to get the best sound quality, you had to leave your hi-fi on so that the circuits were always warmed up. After he saw how much power it was using, he switched it off for the first time in years.' And if Wattson showed a surge of 2,700 watts, Woods would know that somebody had put the kettle on. 'I'm not sure what it did for energy efficiency but it was fascinating socially,' he said.

And how has Wattson fared since that 2004 article? Woods and Corke set up a company called DIY Kyoto, which received £35,000 from Nesta last year. The company's mission is to provide products that allow individuals to comply with Kyoto at a personal level. The company is at the final stages of preparing Wattson for the market, and is hoping to turn it into a covetable product desired by environmentalists and design buffs alike. The final selling price hasn't been settled, but is expected to be at least £150.

## Standby for a billion

Wattson certainly changed my short-term behaviour (although I fear that my continuing fondness for halogen lights may be letting me down). I try to do less washing but, with a toddler keen on cooking and gardening, there is only so long you can hold out.

And what of that twinkling standby light? A government website informs me that this twilight state, neither on nor off, consumes between 3 and 20 watts. In America, the collective cost of the television standby button could be as high as a billion dollars a year. Perhaps I should deliver this statistic to my beloved, along with the cocoa.



Domestic energy use: more dramatic than you think!

## Running costs

This is the estimated cost of household appliances if they were left on continuously for a year.

DVD:	£9
Hi-Fi:	£30
60-watt bulb:	£40
28-inch TV:	£80
Home computer:	£150
Toaster:	£500
Tumble-drier:	£1,000
Kettle:	£2,000

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# Database for women in science

Debbie Walsh explains the thinking

**Science, Engineering and Technology (SET) organisations are waking up to gender inequality. This historically male-dominated and male-orientated sector is slowly starting to examine its relationship with women.**

The UK Resource Centre for Women in SET (the UKRC) is flagging up potential female candidates for positions on their own merit. It has recently launched 'Get SET Women', a new online database to capture women working within SET at all career stages from graduation onwards. It was initially conceived as a vehicle to assist the government achieve its 40 per cent female representation on SET-related boards and governing bodies such as science Research Councils, government advisory bodies and committees and even museum governing bodies. It now has a much broader remit, raising the visibility for women at all levels within SET.

The aim is that the database will contain 2,000 names within 18 months. It will offer a unique resource to both external bodies, such as media looking for speakers, and to the women themselves with a range of contacts, networking and training opportunities that will be developed alongside it.

## Role models and mentors

Two key outcomes will be the identification of potential role models and mentors. These will come from all levels of expertise, depending upon who is seeking them. For example, a world-leading scientist might be an inspirational role model for a young student but on a practical level, someone mid-career might be a relevant mentor for her.

Similarly, with the database as a source for female specialists, the level of the 'expert' in a subject depends upon context and audience. To a room full of top scientists, the leading world expert is the one to go for, whilst to the general public it might be someone with a good scientific grounding but less specialised, who can help make the science accessible to non-scientists.

All women within SET-related careers are invited to register on the database, which will comprehensively cover start of career, mid career and senior status – the latter category requiring more in-depth information to be supplied.

There is an obvious need for such a database.

## All-round women

Changing demographics, skills training issues and other factors mean that SET organisations are increasingly faced with recruitment difficulties and skills shortages. Yet despite the fact that over 50 per cent of the UK workforce

is female, just one-quarter of the

overall workforce within SET

is female, and women hold

only one-eighth of

managerial positions in

SET. Positions of true

leadership and power

are even less fairly

distributed. Yet why

should gender be an

issue in leadership?

The recent female

FTSE showed that

only 11 of the FTSE

100 have female

executive directors.

Yet a striking fact

about those

appointed in 2005

is that, compared to

their male

counterparts, they bring a greater all-round diversity to the boards, being more likely to be international, have board experience and come from more varied backgrounds.

The sad fact is that the advantages of a better gender balance at top-level management are not adequately valued and the barriers to achieving that balance are not understood.

## Top achievers

The terms 'glass ceiling' and 'sticky floors' are well known. We also now have the 'glass cliff': an apparent practice of women being brought into top management positions when businesses are precarious and thus statistically more likely to fail. It is unsurprising then, that often those women who get to the top are quite remarkable and inspiring to others, although they, themselves, often fail to recognise the full extent of their achievement.

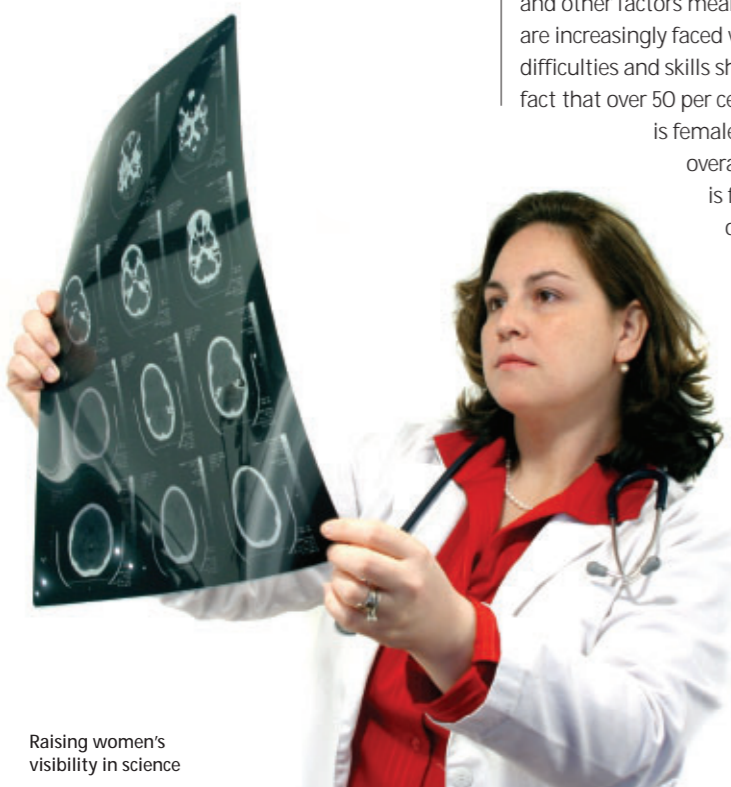
It is these women who reach the top, and those likely to be part of the expert section of the new UKRC 'Get SET Women' database, who are seen as the real key to instigating change both in the SET workforce as a whole and within leadership in that sector. Having become visible and influential, they are in the ideal position to really change both culture and perception, to dismantle barriers, introduce other women into the right networks and bring more diversity of views into management.

The subject of Gender and Leadership will be examined thoroughly at the UKRC's annual conference in London on 8 March 2006.

To book a place at the conference please email: [setwomenresource@bilk.ac.uk](mailto:setwomenresource@bilk.ac.uk) or call: 01274 436485.

To join the database, please visit [www.getsetwomen.org.uk](http://www.getsetwomen.org.uk)

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Raising women's visibility in science

# Mapping the flu virus

Derek Smith explores vaccine selection

**Annual influenza epidemics in humans affect 5 – 15 per cent of the population, causing an estimated half million deaths worldwide per year.**

The most common treatment against flu is a preventative vaccine, recommended for the elderly and other groups at risk in most developed countries. Flu shots are administered in autumn in preparation for the winter season and have to be repeated every year. This is partly because the effect of the vaccine wears off and needs to be refreshed, but mostly because the flu virus continuously mutates, thereby escaping the defence mechanism provoked by vaccination.

Our bodies fight influenza infection by producing antibodies that attack a type of protein that sits on the surface of the virus. A flu vaccine primarily contains proteins from recent strains. These are carefully chosen, with the expectation that they will trigger the production of antibodies that will recognize the wild type virus of the upcoming winter. Protection will be strongest if the person comes into contact with the precise strain of flu that they have been vaccinated with. However, if the strain they come into contact with has changed significantly, the efficacy of the vaccine will be reduced.

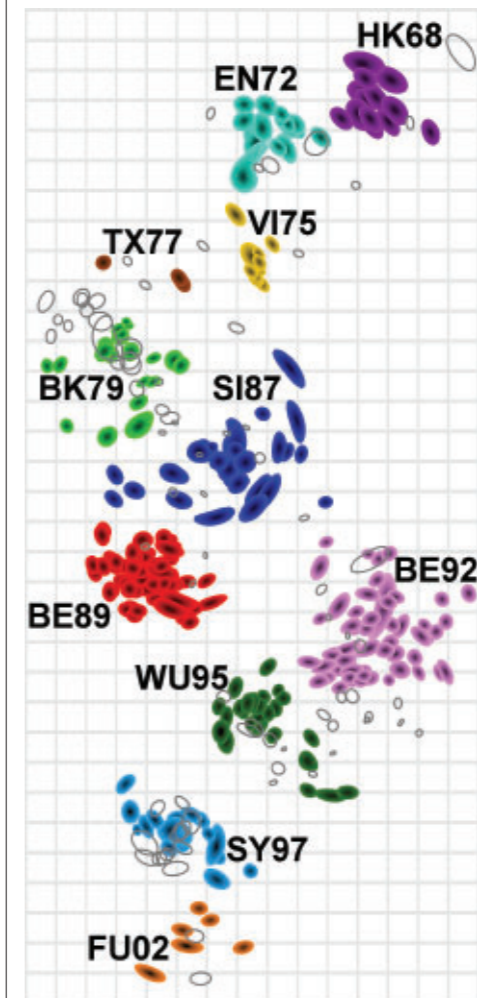
Over time, all flu strains mutate and evolve. This phenomenon is known as antigenic drift, because the body's reaction to the antigen – the protein on the virus surface – is gradually diminished as the virus evolves away from its original makeup. Roughly, the greater the difference between the vaccine strain and the strain encountered, the weaker the immunization effect will be.

## Selecting vaccine strains and global surveillance

Twice a year, once for the Northern and once for the Southern hemispheres, representatives of the World Health Organisation (WHO) and the four international laboratories collaborating on influenza surveillance meet to discuss and select the season's vaccine strains.

Over the year, thousands of influenza viruses are isolated and analysed by these centres. They have to decide how much protection vaccination with one virus will give people against others. The aim in selecting a strain for a vaccine is to identify a strain that will induce

Mapping flu strains. Each label identifies a cluster of flu strains. The best candidates for vaccines are found near the centres of the clusters. With permission from Science (Smith et al., 2004)



protection against the largest possible range of circulating viruses. To do this it is necessary to understand the antigenic properties of all circulating strains.

Thousands of sentinel physicians worldwide and the 112 national influenza laboratories together form the bulk of the WHO global influenza surveillance network, continuously collecting, testing, and identifying strains of flu circulating in their area. They carefully record and pass the results to one of four international collaborating centres, which use them as the basis for deciding vaccine composition.

When it is time to select strains for a flu season, a small international team of experts from various flu laboratories gathers to interpret the information collected – to identify

the strains that will offer the widest range of protection. The data used as input to this collective effort can sometimes be difficult to interpret.

## Mapping influenza

It is at this stage of the strain selection process that the novel method of antigenic cartography – mapping the viruses – plays a role in addition to the existing methods. In this, a computational analysis processes the collected antigenic information and converts it into a simple map that shows how distant strains are from each other.

Strains that would induce effective immunisation against one another are pictured as being close together, while those that do not offer good cross-protection are placed further apart. The figure shows an antigenic map that illustrates how influenza strains tend to form clusters that correspond to epidemics. The map helps in strain selection, because potential vaccine strains, i.e., those that are most likely to be widely protective, will be found near the centres of these clusters.

The data collected for vaccine strain selection purposes also form a remarkable record of the evolution of influenza viruses. The application of antigenic cartography to influenza vaccine strain selection is a good example of a positive feedback in which a new research method contributes to a critical public health process and the expertise and data gathered by the public health process contributes to basic research in evolution.

These collaborative efforts have potentially wide-ranging implications for strain surveillance, for vaccine strain selection, and for research involving other highly variable pathogens such as HIV, hepatitis C and malaria.

**Dr Derek Smith**  
is a mathematician in the Department of Zoology at the University of Cambridge. He recently won a £1.4m Director's Pioneer Award from the US National Institutes of Health to continue his work on mapping flu viruses with Terry Jones, Ron Fouchier and Alan Lapedes  
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# Cuddling, calculating and commercialising the biosciences

Perceptions of bioscience are misleading, argues Monica Winstanley



Advances in plant technologies: the underlying science can be invisible

The popular acclaim of David Attenborough's latest TV natural history series must have been amongst the least surprising media events of last year. Life in the Undergrowth made largely unseen aspects of the natural world visible to millions. Ironically, much of modern bioscience remains stubbornly invisible to most people.

The public is not only fascinated with the life of plants, animals and microbes, but also with the application of bioscience. This is true for the newer bio- and nano- technologies as well as for traditional areas such as food and medicine. But in both curiosity-driven research, and in the development of new technologies, the underlying science can become 'invisible'. The connection between the two can also become obscured.

## Problems of disconnection

This has several important and undesirable consequences. First, the contribution of bioscience research to everyday wellbeing in areas such as new cancer diagnostics and treatments, safe foods, and greener but sustainable agriculture may be undervalued. At a time when researchers are being urged to 'make the case' for public funding, this could potentially disadvantage the bioscience community. We have to make visible the underpinning contribution of bioscience research to the UK economy and to a range of public goods.

Secondly, ambivalence in public mood about bioscience means that demonstrating successful commercialisation or the growing

quantitative power of biology, for example, in design-led plant breeding, and in predicting disease epidemiology, or patients' responses to new drug interventions, risks misinterpretation as 'industrialising nature' or 'playing God'.

As a society we seem to want it all ways: to have better, quicker diagnostics; new and safer drugs; inexpensive wholesome foods; and all in harmony with a romantic and non-commercial notion of 'nature'. It's a tough call! Yet some of the most publicly inaccessible areas of bioscience actually are promising just this.

## Methodologies eclipsed

Informatics and 'omics' technologies enable us to begin to understand in a formal and predictive way how systems work from the level of individual genes and proteins down to small molecules in cells, and up to cell to cell communication and whole organism systems such as immunity and ageing. But challengingly, insights emerge increasingly from mathematics and computation, rather than from observing the natural world.

In the area of agri-food science, such advances may become inextricably linked in the public mind to particular applications of the science. So, the imagery suggests, traditional biology yields a nature-friendly traditional agriculture, whereas genomics and proteomics generate high-input or GM-dependent farming that the public at large does not want. Not so. The new technologies can be used to develop low input, organic, high-input, or GM agriculture – or any combination of these.

In medical and pharmaceutical arenas, the background bioscience may be completely lost to

sight. Cancer research is an obvious example, where the roles of cell biologists, biophysicists and bioinformaticians are easily eclipsed by publicity surrounding the medical and social contexts of advances in diagnosis and treatments.

## Maths declining

Beneath these issues of perception is a particularly disturbing trend. It seems that, while bioscience is evolving into an increasingly quantitative subject that uses mathematics, engineering and the physical sciences to solve biological problems, the mathematical skills of students are declining. Overall, only 9 per cent of undergraduates entering biological sciences courses have a full Maths A level. There is concern that some postgraduates begin their research careers seriously unable to deal numerically with life science problems.

This situation needs urgent attention if the UK is to retain its top-flight bioscience research community. At a meeting with heads of leading research departments at the end of last year, BBSRC considered a range of possible actions.

Revision of the Quality Assurance Agency's Benchmark Statement (which specifies the content of undergraduate degrees) would seem to be a good starting point. The meeting of Heads of University Bioscience in March will provide an opportunity to push for the inclusion of mathematical skills.

In the meantime, BBSRC has invited researchers to identify ways in which it might support mathematical skills training more directly, for example through targeted MSc courses and 'vacation bursaries'.

We need to find a way of conveying to young people the importance of mathematics to modern biology, without deterring them. Given the high public interest in the life sciences, and the exciting insights emerging from more quantitative approaches to biological systems, perhaps this could be the basis of David Attenborough's next series!

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# The scientific aspects of ageing

Stewart Sutherland thinks the UK could do better



More research would improve the prospects for health in old age

## Although life expectancy is increasing, so are the years of ill-health at the end of life.

The House of Lords Science and Technology Committee recently held an inquiry to consider how science and technology might contribute to this trend being corrected and reversed.<sup>1</sup>

The NHS undoubtedly devotes a large proportion of its resources to the care of older people, and the diseases which are particularly prevalent in old age. A recent Department of Health report<sup>2</sup> stated that 'health in old age is improving and should continue to improve'. But the opinion of the Department's own officials was that while life expectancy is increasing, health in old age is not.

## Resources

If resources were focused more on the prevention of disease rather than its treatment, the later years of life might increasingly become years of good health.

One example particularly impressed the Committee: countries such as Canada have a far higher proportion of stroke patients making good recoveries. The main reason seems to be that they position brain scanners in A&E departments with the aim of diagnosing the stroke as soon as possible. In this country, fewer than half of stroke patients have a scan performed within two days of the stroke. This is just one small change which could greatly improve the outcome in terms of both fatalities and dependency.

## Research

In the longer term, it is research into the problems of old age, and the diseases particularly prevalent then, which will make a difference.

We found that this type of research is very much the poor relation. Four of the research councils are responsible for different aspects of ageing-related research. Of these, the Medical Research Council states that it devotes 28 per cent of its budget to ageing-related research, but much of this goes on projects which have only a marginal connection with ageing. The Economic and Social Research Council spends only a lamentable 1.2 per cent of its budget on this research. We recommended that this should be greatly increased.

The Committee also thought that the coordination of ageing-related research was woefully inadequate. A succession of bodies supposedly responsible for this coordination had inadequate resources and powers, and signally failed in their task.

We visited the US National Institute on Aging and admired the work they do. A similar body would not be appropriate for this country, but we said that the Office of Science and Technology must set up a coordination body with the necessary constitution, membership, powers and funding. When it can attract the best researchers to this type of work and coordinate their efforts, the prospects for better health in old age should greatly improve.

## Lifestyle

In the still longer term, health in old age reflects what happens in youth. Physical activity, good nutrition, and absence of risk factors (such as smoking and excessive drinking) all promote good health and slow the ageing process.

Inadequate exercise and lack of education about health matters contribute to the startling variations in life expectancy between different social classes and different geographical regions, which can amount to as much as ten years. Halting the sales of school playing fields is just one way in which health in deprived areas could be improved.

## What concerned us was the ageist attitude of the public and the media

### Technology and ageism

We looked too at technology. It is largely already there, but is not being applied nearly as much as it might to improve older people's quality of life. We found a generalised failure by industry to recognise the enormous potential of the market which older people represent. This is largely a matter for industry itself to resolve.

This is part of a wider problem. Old age is still regarded in a very negative light. What concerned us was the pervasive but often unrecognised ageist attitude of the public and the media towards diseases prevalent in old age, and the ageist approach of industry to older people as consumers. We believe the government could do more to help combat these attitudes, directly through government departments and the NHS, and indirectly by its influence on schools, industry and the media.

Our recommendations were numerous and forceful. We look forward to analysing the government's response.

### References

- Ageing: Scientific Aspects. See <http://tinyurl.com/9vtmc>
- Better health in old age: Professor Ian Philip's report to the Secretary of State, November 2004

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# Security, development and the arts

Arts and humanities research benefits all problems, says Damian Popolo

**We tend to ignore the human dimension of problems such as global terrorism, and forget that they cannot simply be resolved with increasingly sophisticated technological devices. The European Commission's latest proposals for a European programme on security research have a very strong focus on technological advances.**

The same mindset has applied in the US. There were only six graduates in Arabic from all US colleges and universities in 2002. It is not surprising that the US Senate declared 2005 to be 'the year of languages'. The resolution stresses the importance of training and research in languages for a number of issues, ranging from economic well-being to security threats, cultural understanding and critical thinking.

Virtually all disciplines within the humanities have something to contribute to our understanding of security problems, from religious studies, cultural theory and identity politics to history and philosophy.

Almost a third of all UK public spending in research is channelled through the Ministry of Defence, and this exacerbates a research focus on traditional science and engineering disciplines.<sup>1</sup> Only six per cent of the UK defence research budget is spent on preventing conflict.

The Arts and Humanities Research Council (AHRC), in collaboration with the Economic and Social Research Council (ESRC) and the Higher Education Funding Council for England (HEFCE), is funding a £22m programme to create a world class cadre of researchers who have the language skills to undertake research that will ultimately enhance the UK's understanding of the Arabic-speaking world, China, Japan, and Eastern Europe including areas of the former Soviet Union.

## Millennium Development Goals

Research in the arts and humanities is of fundamental importance for the attainment of the Millennium Development Goals.

Such research can help build inclusive, culturally diverse societies, allowing people full cultural expression. It can be deployed to communicate across cultures and disciplines. Its advantage is that it can put subjective cultural experience at the centre of 'development theory' – crucial if policy is to help people survive poverty.

A central theme of the AHRC's 'Diasporas, migration and identities' programme is an



We need to speak Arabic to understand the Islamic world

understanding of how societies and cultures view themselves. The AHRC also funds a number of projects on diasporic communities with origins in the developing world. For example, a £124,000 grant was recently awarded to explore to what extent Muslim diasporas act as mediators of business knowledge in their countries of origin.

## Creative industries in developing countries

The fostering of creative industries – such as the Indian film and Brazilian music industries – also promises to generate employment and open new opportunities for international trade in developing countries. Creative industries are estimated to account for more than seven per cent of the world's gross domestic product and are forecast to grow, on average, by 10 per cent a year.

The creative industries call for research in many fields including design, art and art history. These industries have high developmental potential because poor countries have what is needed to foster them: excellence in artistic expression, abundance of talent, and openness to new influences and experimentation.

The AHRC funds research in the creative and performing arts in developing countries. Collaborations between UK performers, writers and artists and those based in the developing world can help create a market for cultural products. Such activity also opens opportunities for transferring skills and expertise to those involved in developing local creative industries.

## Creativity and innovation in the UK

The creative industries account for 8 per cent of the UK's GDP and, according to Lord Sainsbury, have twice the impact on our balance of trade as the pharmaceutical industry.

The varied backgrounds of academics, industrialists and consumers educated in different ways of thinking has meant that subsets of design communities have grown with their own distinctive cultures. Cross-fertilisation of ideas is essential if old forms of production are to modernise and new forms are to flourish.

To bring about this cross-fertilisation, the AHRC and the Engineering and Physical Sciences Research Council are taking forward a joint £5m initiative entitled 'Designing for the 21st century'. One project is designing attractive outdoor play spaces for children, to get them moving and help prevent obesity. Its research teams include architects, landscape designers, traffic engineers, community safety experts, child psychologists and NGOs involved in child welfare. Their cooperation will ensure that designs for public open spaces integrate the elements vital to encourage children and adolescents to play in safety.

Reference

1. See [www.sgr.org.uk/pubdescs/SITL.html](http://www.sgr.org.uk/pubdescs/SITL.html)

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# Understanding Down syndrome

Elizabeth Fisher and Victor Tybulewicz have made a new mouse

**John Langdon Down was a progressive liberal Victorian doctor who first described the constellation of features that we now know as 'Down syndrome' in 1862. In 1959, almost 100 years after Down published this description, Jerome Lejeune discovered that people with Down syndrome have an extra copy of chromosome number 21. Instead of the usual 46 chromosomes, they have 47.**

This was a seminal moment in the history of Down syndrome research, as it told us that the syndrome does not arise from abnormal genes, or gene mutations, but from simply having one extra dose of normal genes – three copies of the genes on chromosome 21, rather than the normal two. So Down syndrome (DS) is a gene dosage problem.

However, we know that human chromosome 21 carries at least 250 genes, so working out which genes are particularly important for DS is a complex problem.

## Important to study genes

We are interested in understanding the genetic causes of Down syndrome for two reasons. People with DS have a greater frequency of many disorders (such as autoimmune diseases, heart defects, diabetes) than the rest of the population, so if we can work out which genes on chromosome 21 are associated with specific aspects of the syndrome, we can try to target therapies to help alleviate these disorders in both the DS and chromosomally normal population.

Secondly, we don't know very much about how abnormal gene dosage causes disease. It's turning out that many other disorders arise from abnormal gene dosage, often caused by tiny deletions or duplications in individual chromosomes.

## Mouse models

We can start to work out which genes on human chromosome 21 give rise to the learning difficulties, which underlie the heart defects, and so on, by studying the chromosomes from some people with DS. But we cannot refine this work to tell us exactly which genes are important, and we cannot then experimentally test our findings. For this reason, and because DS involves a complex interaction of the whole body, most groups working on the molecular genetics of DS work with mouse models.

As we share the same ancestor as mice, we naturally share the same genome and the same genes – and generally the same disorders. However, no naturally-occurring mouse has the same arrangement of chromosomes as humans do, and therefore none has the exact equivalent of human DS. Therefore, over a decade ago, we set out to make a new kind of mouse model to help us understand DS in humans.

Looking ahead with Down syndrome



## A new mouse

Using a mix of old technologies used for culturing cells, and newer technologies such as manipulating mouse embryonic stem cells, we have put human chromosome 21 into a mouse so that the new strain of animal really does model human DS. This mouse has three copies of the genes on chromosome 21 instead of the normal two, just as humans with DS do. In this animal we find learning and memory defects, heart defects and other characteristic alterations.

In effect, we have made a 'super transgenic' mouse. Rather than carrying one or two human transgenes (like the mice we've been making for the last 25 years or so), our new mouse carries 250 human genes (which is still less than one per cent of the genome).

## Understanding and therapies

The importance of the new mouse is two-fold. Firstly, it is a technical step forward in transgenic techniques that will help us understand other human disorders that arise from an abnormal number of chromosomes (and these are reckoned to account for at least five per cent of pregnancies and are mostly lethal). Secondly, we will now be able to breed this mouse to other mice that, for example, carry only one copy of a gene of interest, and thus we can say whether that 'candidate' gene has specific effects, for example on heart development. In this way we can work out which genes and which regions of the chromosome are important for DS, in a way that we could not do with existing models.

The generation of the new mouse model took us more than a decade, and we envisage that working out which of the 250 genes on chromosome 21 cause which aspects of DS, will also take a long time. Nonetheless we are optimistic that this will eventually lead to a better understanding of the syndrome and hence point us to possible therapies.

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# Thirsting for power

Wendy Barnaby finds that politics provides solutions to water problems

**In times of drought, people living in the Okavango region of Namibia cut down more fruit trees, and harvest more grass and firewood, than sustainability allows.**

'There are no rules if people go to collect the trees, grass and firewood,' said one villager.

'There were rules before, but we do not implement them anymore, but our forefathers implemented them and took care of the natural resources.'<sup>1</sup> The villagers use what they do partly to meet their immediate needs, but also because of changing attitudes to the authority that used to curb excesses.

Traditional leaders used to make sure that their communities used natural resources sustainably. People either obeyed local rules or, if they broke them, accepted the fines the traditional authority imposed. Now, however, many people refuse to accept the authority of the traditional leaders, and current regional government legitimates harvesting that traditional leaders would want to ban.

The politics of natural resources is hardly recognised in research projects seeking to improve the living standards of people in developing countries. A new review of EU water research concludes that water allocation is an intensely political process, and that researchers must recognise and act on this if their work is to have the desired impact.

The review is to be presented to the 4th World Water Forum meeting in Mexico in March.

## The review

Over the last 10 years, the international science and technology cooperation (EU-INCO) programme of the EU has spent well above 50m (£34m) on research into water resources management and water services more generally.

A panel of 10 scientists has reviewed 60 EU-INCO research projects conducted since 1994 in Africa, Asia, the Caribbean, Latin America, the Mediterranean, Russia, Eastern Europe and Central Asia. The period reviewed covered 1994 to 2005, broadly corresponding to Framework Programme (FP) 4 to FP6. The aim of the review was to identify strengths and weaknesses of EU-INCO's past research and to guide future investment.<sup>2</sup>



Planting seedlings in Havana's new environmental park  
Thomas Ammerl

## A political process

The fact that water allocation is political is obvious, given a moment's thought. All stakeholders have vested interests in the way water is allocated between different groups. If one group gets more, others will generally have less. Farmers near a river may be ordered to draw less water from it to irrigate their crops, to allow more for the river's ecosystem. Many will resist the policy, not wanting their immediate income to suffer for the sake of the river's longer-term health. What actually happens will depend on the political tussle between the competing interests.

The review panel finds that this fact of life is hardly ever recognised in the way research projects are conceived. All EU-INCO projects demand participation by researchers in the EU and in developing countries, over a wide range of disciplines; but in an area traditionally dominated by geography, engineering, hydrology, climatology, soil science and ecology, it is unusual for the scientists to take on board sociological and political factors which may be crucial in determining what – if anything – happens to their results.

## Water in context

Some individual research teams have recognised the importance of building politics in from the beginning. One project has converted an abandoned quarry and rubbish dump in a slum area of Havana into an environmental park.

Working closely with the population, the researchers ran workshops which brought together local people, local leaders, local government institutions and regional and city planning authorities. During the last couple of years, they have marked out the area of the park, installed a fence, planted 150 seedlings to stabilise the slopes, and built an information centre. The project has not only converted the quarry, but cleaned up a section of the Quibú river and educated the district's people about their environment.

Given the necessity of taking the political dimension into account, the panel concludes that we can no longer think in terms of a 'water sector', for no such unified sector exists.

In its last call for research applications, EU-INCO has demanded that projects become relevant to policy and also address the politics of water management. This, the panel finds, means that the latest projects reflect a deepening understanding of the way politics determines how water is managed. By analysing factors such as the Okavango traditional leaders' loss of authority, future research may find more enduring answers to water problems in developing countries.

## References

1. Report from the WERRD project: Water and ecosystem resources in regional development. Balancing societal needs and wants and natural resources systems sustainability in international river basin systems. See [http://europa.eu.int/comm/research/water-initiative/iwrm\\_review\\_en.html](http://europa.eu.int/comm/research/water-initiative/iwrm_review_en.html)

2. The full report is available via [http://europa.eu.int/comm/research/water-initiative/iwrm\\_review\\_en.html](http://europa.eu.int/comm/research/water-initiative/iwrm_review_en.html)

Wendy Barnaby is the Editor of Science & Public Affairs. Her brochure on the review will be released at the 4th World Water Forum in March  
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# Universal ethical code for scientists

The Council of Science and Technology marks its introduction



Scientists should minimise environmental effects of their work

**As part of National Science Week, the Government's Chief Scientific Adviser, Sir David King, will launch an ethical code of conduct for scientists.**

The code, Rigour, respect and responsibility: a universal ethical code for scientists<sup>1</sup> (see box) has resulted from a working group Sir David convened in 2004. He asked the Council for Science and Technology (CST) to look at how the code could be disseminated more widely and how, in practice, it could have a useful role.

During consultation, the proposed code was generally well received by universities, professional bodies and so on, and there was general agreement that it could be a useful catalyst for stimulating debate and raising awareness among scientists of their ethical, professional and legal responsibilities.

## Purpose of the code

Two main roles were identified:

- Educating and training new scientists  
Recent developments in GCSE and A level curricula, which require students to develop a greater understanding of the way science works and that are in part intended to increase young people's interest and engagement with science, mean that the

code could provide a useful resource for teachers and students.

At the university level, the code could contribute to taught courses on research ethics and methods at both the undergraduate and postgraduate level.

Several universities gave examples of courses that they offer where the code might be used.

- Informing and supporting the development of more specific codes

The consultation confirmed that many organisations have codes of conduct and ethical frameworks in place that are specific to their own needs. The code could form a checklist of minimum standards for the content of more specific codes and could also sit alongside as a supplement. For example: the Royal Academy of Engineering used the code to inform the development of their Statement of Ethical Principles for professional engineers; several professional bodies said that they would post the code on their website and bring it to the attention of their members; and one University told us that they will be amending their own policies to bring out the expectation that scientists should 'seek to discuss the issues that science raises for society'.

The CST's consultation had suggested some more formal roles for the code, such as forming part of graduation ceremonies, being linked to employment and research contracts, or being adopted by institutions or individuals as a public statement of their working methods. There was almost no support for these proposals. The general view was that there is little to be gained from introducing an ethical code into formal structures unless it can be enforced, and it is very difficult to see how enforcement mechanisms could be applied to such a general code.

## Promoting and piloting

CST therefore recommended that Office of Science and Technology (OST) should promote the code's role as a focus for reflecting on the ethical, professional and legal responsibilities of scientists.

OST is leading an exercise through the cross-government science and society champions network to pilot the code among government scientists. An interim report will be available in March, with a final report in the autumn.

## Rigour, respect and responsibility: a universal ethical code for scientists

### Rigour, honesty and integrity

- Act with skill and care in all scientific work. Maintain up to date skills and assist their development in others
- Take steps to prevent corrupt practices and professional misconduct. Declare conflicts of interest
- Be alert to the ways in which research derives from and affects the work of other people, and respect the rights and reputations of others

### Respect for life, the law and the public good

- Ensure that your work is lawful and justified
- Minimise and justify any adverse effect your work may have on people, animals and the natural environment

### Responsible communication: listening and informing

- Seek to discuss the issues that science raises for society. Listen to the aspirations and concerns of others
- Do not knowingly mislead, or allow others to be misled, about scientific matters. Present and review scientific evidence, theory or interpretation honestly and accurately

## Reference

1. See [www.cst.gov.uk/cst/business/files/ethical-code-letter.pdf](http://www.cst.gov.uk/cst/business/files/ethical-code-letter.pdf)

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# The smoking ban

Public policy informed by good science?

The Health Bill is currently winding its way through Parliamentary processes. If enacted in its original form it will lead to a partial ban on smoking in public places, against the advice of health experts. Why has this happened and does it herald a new low for scientific advice to government?

## Experts and politics

Jack Stilgoe wants more openness about their relationship

Two years ago, I was lucky enough to interview Professor Sir Richard Doll for a project on expertise.

Right up until his death last year at the age of 92 Doll worked tirelessly to convince the world of the dangers of smoking. Thanks to Doll and others we now know, and are constantly reminded by our cigarette packets, that smoking kills – active or passive.

Leaving aside any uncertainties that might blur its edges, this piece of knowledge has saved lives, and allowed policymakers to make better decisions. But, as David Hume told us long before the invention of the cigarette, you can't get an ought from an is. Science can inform policy, but it can't determine it. The issue of smoking in enclosed public places might look like a scientific one, but it is also deeply political.

### Evidence-based policy

As part of New Labour's attempts to modernize policy, the men in white coats are increasingly told to work with the men in Whitehall to create 'evidence-based' policy. But this is often a way of abdicating responsibility for making decisions.

The recent history of controversies around BSE and GM have reminded us that it's never as easy as science speaking truth to power. Most recently, the clashes over the MMR vaccine have told us that, even when the science seems clear, we must at least take into account the politics of trust. As Doll told me, 'Government are never going to handle those issues correctly.'

### Messy politics

The government's Chief Medical Officer, Sir Liam Donaldson, is the latest scientist to be dragged



Science informs but doesn't determine policy

into the messy politics of expert advice – a victim of an attempt to take the politics out of a political problem by making it appear like a scientific one.

As we have seen from media coverage of the issue, the question of whether we should allow or forbid smoking in pubs is about much more than what we know of its dangers. At the very least, it's also about liberty, it's about responsibility and it's about economics.

We must acknowledge that, most of the time, science cannot tell us what to do. Science's voice must be heard, but it must not drown out others. The smoking ban that

disappeared and then reappeared is a political mess. But this should only come as a surprise to those people who thought that there was an easy answer.

Dr Jack Stilgoe is a researcher at Demos. He is co-author of *The Public Value of Science*, available to download from [www.demos.co.uk](http://www.demos.co.uk)  
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# Election manifestos and power plays

Vivienne Nathanson is not depressed

The government has received clear advice from health experts, including from Sir Liam Donaldson, its Chief Medical Officer.

That advice says that the evidence of health harms from direct and indirect or passive smoking is overwhelming and compelling. There is no safe level of exposure to tobacco smoke. If we wish to protect the health of the nation we must protect from exposure to smoke. Further evidence makes a compelling case for the inadequacy of ventilation systems in offsetting this health harm.

### Pledge

Why was this advice ignored? The answer appears to be about the contents of the election manifesto and about power plays within the cabinet. John Reid was Secretary of State at the time of the white paper and made it clear that he was against restrictive

legislation. That commitment became government policy and was included in the manifesto; he appears to have persuaded his cabinet colleagues that this is one manifesto pledge that should be kept.

Why did John Reid ignore at least part of the advice he was given? Is it related to his own relatively recent recruitment to non-smoking? Could he still hanker after the weed? Does he really still see smoking as enjoyable – 'the last pleasure of the poor living on sink estates'? If he does, then his resistance to a total ban was inevitable. But he did move a long way from early suggestions of voluntary guidance.

### Huge advance

So what does this mean? The reality is that we should not be too depressed. Although the draft legislation snatches defeat from the jaws of victors, it is still a huge advance on where we

thought we might be. A clearly reluctant Secretary of State (John Reid) was persuaded against his own clear preferences to include a moderately extensive ban within the legislation, and other ministers have since indicated that a total ban is inevitable in the near future.

The decision to allow a free vote must also be a reflection on the consistency of advice to parliamentarians. Advice has had an impact. The weakness of the health lobby was to underestimate John Reid's addiction to the idea of smoking. Next time, we will not make that mistake.

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# Banish smoke, not smokers

Teresa La Thangue says a total ban is unfair

Our view of the science is that exposure to environmental tobacco smoke (ETS) is associated with various short term health impacts, such as exacerbating symptoms in asthmatics and respiratory illnesses in children.

The science on ETS and chronic diseases, such as lung cancer and heart disease, is in our view not definitive and at most suggests that if there is a risk from ETS exposure, it is too small to measure with any certainty.

So while we understand and support measures to reduce involuntary exposure to ETS, we do not believe that blanket bans on public and workplace smoking are fair or necessary, as there are more practical solutions based on air quality standards.

### Freedoms and responsibilities

We don't think people should be free to smoke wherever they like and we know many people dislike the smell of tobacco smoke and find it annoying.

But we believe that total smoking bans are unnecessary and unfair. It is perfectly possible to continue to strike a balance by

accommodating non-smokers and smokers separately and providing proper ventilation to reduce involuntary exposure to ETS.

Most governments are seeking to balance freedoms and responsibilities. Very few countries have adopted the total public place smoking bans that have been introduced in Ireland, Norway and New Zealand and a complete ban in 1999 in British Columbia in Canada, for example, was overturned by the courts in March 2000 on the basis that it was excessive.

### Ventilation

There are good and workable ways to banish smoke but not smokers, so that people who smoke don't have to suffer social exclusion. Recent research shows that proper fresh air ventilation works. The University of Glamorgan in Wales investigated the effectiveness of ventilation systems in UK on behalf of the Atmosphere Improves Results initiative.

The results, published in the Building Services Journal in March 2005, show that ventilation keeps levels of some important gases and air-borne particulates well below any recognised

occupational exposure limits for a range of common pollutants.<sup>1</sup> The tests were run on the pubs' busiest evenings and at the busiest times, so with fewer people in the pubs, the results from this equipment would be even better.

Public health bodies have reported that exposure to ETS is a cause of various diseases. The risks they report are far lower than those associated with active smoking, but are said to be large enough to make public smoking an important public health issue.

### Reference

1. See [www.bsjonline.co.uk](http://www.bsjonline.co.uk) and search the archive for 'No ifs or butts'

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# Limiting genetic disorders

Some parents carry major predisposition genes to serious, life-threatening conditions such as cystic fibrosis, haemophilia or Huntington disease, which would affect their children. These parents are currently able to make use of preimplantation genetic diagnosis (PGD), a technique which enables their fertilised egg to be examined to see whether it carries the gene. Until now, PGD has only been used for conditions which have been caused by altered genes or chromosomes that definitely will give rise to a specific genetic disorder.

The Human Fertilisation and Embryology Authority (HFEA) has been carrying out a consultation<sup>1</sup> to probe views about licensing PGD for conditions such as



Setting boundaries for the next generation

familial breast cancer. These conditions can be life threatening but it is not certain that the children carrying the gene will necessarily develop them.

The HFEA is about to start considering its response to the consultation, which will help guide its decision-making in applications for PGD for these conditions.

## The best chance for my children

Emily Fazal wants a burden lifted

**Who wouldn't want a fit and healthy child with a lowered risk of inheriting a serious and debilitating condition?**

I have knowingly lived with such a condition from the age of 19 when I was diagnosed with Multiple Endocrine Neoplasia Type 1. My tumour suppressor gene doesn't have a 'switch off' button for tumours that grow in my endocrine system. They are mainly benign but unfortunately can spread and become cancerous.

I would not wish it upon anyone else, especially a child.

### Operations

So far I have had tumours removed from my parathyroids and all of my pancreas removed, suddenly becoming a type 1 diabetic. I also continue to have a pituitary tumour

(prolactinoma) with probable surgery in the future.

Although I do lead an enjoyable and fulfilling life within limits, I have to deal with the symptoms and consequences of MEN1 on a daily basis. It would be so wonderful not to have to worry about the results of the next blood test or what the next scan might reveal or how soon the next operation will be.

But the worst thing is that I could pass on this burden to my child: a 50/50 chance, like the toss of a coin. Could I take that risk and have my child turn around to me and say: 'Mummy, you knew you had this condition, so why did you pass it on to me?'

### Lifting the burden

The urge to have children is no less strong in MEN patients of child-bearing age, but their

experiences of MEN leave a sense of fear for the future of any child they produce. Even though that child may be diagnosed early on to ensure time-appropriate treatment, this risk feels too great.

PGD would give my family the opportunity not to have to pass this burden on. I couldn't guarantee my child's total safety but I would at least have ensured in the beginning that I had helped to provide my child with the optimum chance in life.

Emily Fazal

together with her mother Liz was a co-founder in 2002 of AMEND (Association for Multiple Endocrine Neoplasia Disorders, [www.amend.org.uk](http://www.amend.org.uk)). The views expressed here do not necessarily reflect the views of AMEND or its members [emily.fazal@amend.org.uk](mailto:emily.fazal@amend.org.uk)

## Each family is different

Reasonable requests should be considered, says Alison Lashwood

**Every family's experience of the genetic condition affecting them will be different.**

A condition that does not result in death, but has an impact on quality of life, may be unacceptable for some, whilst others may cope with the implications. A 10 per cent risk of having a child with a genetic disorder is high for some, low for others. It will depend upon many factors, including support within the family, past experience of other family members with the condition, family dynamics, family size and the existence of affected children.

### Different options

Each family usually considers alternative options. Many opt for prenatal diagnosis (PND – a test in an ongoing pregnancy). In some cases, couples will have opted for PND because they would terminate an affected pregnancy. As the recurrence risk is the same in each pregnancy this may have occurred several times. For some couples, termination of pregnancy is not acceptable under any circumstances. For others, it may not be acceptable if they consider the

risk of the genetic condition in their offspring not high enough to warrant termination.

PGD may be more acceptable to couples who are concerned about having a child with a genetic condition which has affected other family members, but where they feel the risk of the child developing the condition is not high enough to warrant PND and termination of pregnancy.

### Risks and requirements

PGD is lengthy and complex. It has to be carried out in association with in-vitro fertilisation. The procedure carries risks for the woman: the frequency of multiple pregnancies is high and the impact of PGD on children born has yet to be fully evaluated. Most couples undertaking PGD are normally fertile and choose to compromise their chances of pregnancy as the success rate is only 20 per cent. The cost is high – between £5000-9000 per cycle – and this cost is borne by the couple if no NHS funding is available.

It is essential that those families seeking PGD treatment have access to highly skilled

professionals in well-established PGD centres. As clinicians working in those centres, we have a responsibility to ensure that couples requesting PGD are fully informed about the procedure, the alternative options and the potential difficulties, and to help them make an acceptable decision. When patients and professionals reach a consensus that PGD is the way forward, it offers something that no other technology can currently do.

Reference

1 Choices and boundaries. See [www.hfea.gov.uk/AboutHFEA/Consultations/Choices\\_Boundaries.pdf](http://www.hfea.gov.uk/AboutHFEA/Consultations/Choices_Boundaries.pdf)

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## Deciding when to use PGD

Tom Baldwin sets the boundaries

**There are important questions about the proper boundaries to the use of PGD.**

It is widely accepted that enabling couples to avoid having a child who would inherit a significant predisposition to cancer is very valuable. This type of disorder involves a serious physical condition, and one possible boundary would be a restriction of PGD to such disorders.

But there is strong evidence that some mental disorders (e.g. schizophrenia) are heritable. Supposing there to be a reliable genetic test indicating a significant predisposition to a mental illness, there seems no good reason why potential parents should not be able to use PGD to avoid having a child with such a predisposition. So a more defensible boundary condition would be a restriction of PGD to enable parents to avoid having a child

with an inherited disorder leading to serious physical or mental illness.

### Outside the boundary

The type of case which would transgress this boundary involves the use of PGD to enable parents to choose positively to have a child with a desirable non-medical characteristic such as high IQ.

At the moment this possibility is entirely speculative and in my judgment is likely to remain so; nonetheless we can consider whether it would be in principle acceptable to use PGD in this way.

The critical fact here is the power parents would have to determine the kind of child they will have. Opponents argue that giving parents this power is wrong: it violates the respect

which parents owe to the fact that their children are individuals in their own right.

Although the principle which motivates the objection is correct, it is not clear that using PGD simply to enhance the possibilities available to a child would violate it. At present, however, the great majority of the public regard such a use of PGD with horror, and until it is clear that a positive use of PGD would have only a modest and beneficial enabling effect, it is sensible to maintain a firm boundary against it.

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# Opacity impoverishes

Dear Editor,

I come to the debate as an engineer rather than a scientist, but my experience at sea, first as a seaman and later as a marine journalist, seems to bear on some of the issues raised by your correspondents ('Self-limiting technology', S&PA September/December 2005).

It's true – looking at a printed circuit won't tell you anything about its function, and it may be irrelevant as long as it works, but its opacity, in terms of allowing you to understand its working, impoverishes you.

I cross the Millennium Bridge almost every week, and I'm fascinated when I look underneath it (as I do every time) to see how it's made, and how they solved the problems of it swaying. I'm glad I have just enough engineering knowledge to make a stab at understanding the wonderful engineering that's gone into it. Pity, with me, the thousands who use the bridge every day, and have no interest or knowledge of what lies beneath their feet. Richard Hallam (S&PA September 2005) says: as long as the mobile phone works, it's not important how it does so. Maybe: but you lose a lot.

So let's get back to sea. Once you were far enough away from shore, there was nobody to help you when you broke down. No email ordering of spares, nor express delivery. You improvised, you sweated, you swore and eventually you managed. It taught us a lot about how engines were made and shafts aligned and the chemical composition of fuel oil. The best and most useful engineering education you could ever hope for.

Many years later, when I became a journalist, I was at first astonished and then depressed when I found how digital technology had taken over the ships. Most ships' engineers are competent at diagnostics and few know how things work. A few clicks on the mouse show them any problems on screen, and which PC boards to replace. And if they aren't quick enough, head office, 12,000 miles away will immediately tell them what to do. Not a dirty rag or oil-stained boiler suit to be seen.

Comparable changes on the bridge have also led to a much more insulated life, yet despite this almost every week there's a collision or a near collision because the man on watch is

looking at the radar or the VDU, rather than over the bow; lookouts have been more or less replaced by video cameras.

It would be stupid to suggest a return to those earlier days: it's an impossible thought anyway, and ships – the one area I know something about – are more efficient than ever they were. We have to accept that technology is no longer transparent, and is likely to become even more obfuscated. It won't be a case of looking at a PC board in bewilderment; it will be so small you won't be able to see it anyway.

So do we need to know how a mobile phone works? I think we should try to find out. We must discourage the attitude that 'if it works – don't ask why'. If we never ask why we'll turn into printed circuits ourselves.

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Digital technology has taken over

## Homeopathy

Dear Editor,

It was refreshing to see three sides of the debate into the issue of homeopathy.

An important aspect of this debate was the raising of the much maligned placebo response as a potential mechanism of action for homeopathic treatment. Any treatment which leads to a benefit (even one only perceived by the patient) is something we should embrace rather than use as a tool to discredit.

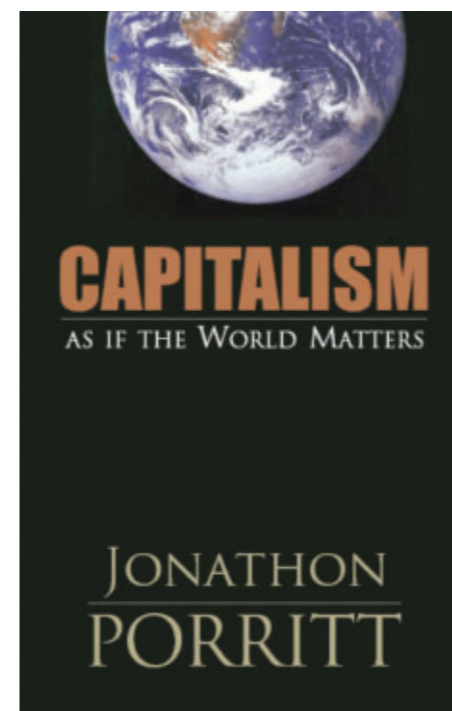
A minor error was the inclusion of a picture of the Echinacea flower. Echinacea is used for its effects on the immune system at pharmacological doses, not homeopathic ones. This serves to illustrate a misconception held by much of the general population, namely the similarity between homeopathy and herbal medicine. There is a greater similarity between herbal medicine and pharmaceutical medicine than there is with homeopathy.

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# The new green manifesto

David Santillo and Paul Johnston consider capitalism

Capitalism as if the World Matters by Jonathon Porritt (ISBN 1-84407-192-8 Earthscan, 2005)



Re-engineering mindsets  
Earthscan

### Is sustainability compatible with capitalism?

How far must economic systems change for societies across the globe to approach a more sustainable future? Can technology fill the gaps, ensuring that we can position ourselves, and remain, one step ahead? Or is some much more fundamental rethink of our engagement with our planet and each other unavoidable? Ultimately, can a more sustainable world also be a more desirable world, in which our lives on an increasingly crowded planet are nevertheless richer and more fulfilled?

These are some of the central questions addressed by Jonathon Porritt in his well researched exploration of options for sustainability against a backdrop of global capitalism.

### Framing the debate

Though at first sight somewhat technical, the book is well structured and readable. In logical progression, it summarises the most unsustainable aspects of our current state of living, analyses what capital and capitalism are and how they influence us, and outlines critical

pathways for change and some visions of a sustainable future. It stops short of prescribing any radically new solutions, offering instead a collation of thinking from the last few decades.

Porritt contributes a timely synthesis of challenging (frequently conflicting) analyses in an accessible form, thereby framing a debate we so desperately need to have.

### No option but capitalism

A central tenet is that, given that the collapse of capitalism is so improbable, and the threats to the biosphere so severe and immediate, we have no option but to find ways of living with capitalism and using it to achieve tangible progress towards sustainability. He explores the nature of capitalism, challenging views that market-based economics inevitably mean unbridled and destructive economic growth. While a bitter pill to some, his analysis is useful, not least in dissecting a seemingly impenetrable monolith.

On natural capital, for example, he raises critical questions on environmental valuation. How can one assign monetary values to ecosystems and the services they provide? And thereafter, how far can one substitute natural capital with manufactured or financial capital? In turn this raises fundamental questions about whether preservation of ecosystem 'function' is sufficient and how far this can be engineered. As Porritt stresses, 'technology alone cannot get us out of a hole; we have to re-engineer our mindsets at the same time.'

### Sustainability

Clearly there are no simple solutions. The visions and practical approaches explored in the book propose that governments, corporations and civil society accept more readily the urgency of problems we face, and diverse and effective programmes of action. Attempts at being 'less unsustainable' must become real efforts at 'genuine sustainability'. Given the complexity of interactions this entails, we urgently need wider acceptance of meaningful sustainability indicators. To this end, the book draws on principles first developed in the 1980s to develop a baseline against which we can judge the sustainability of human activities.

### Criticisms

There are two possible criticisms to be levied. First, we should challenge Porritt's confidence that it is through pursuit of sustainable development that we will reach sustainability – especially as he himself says that 'sustainable development' can mean all things to all people. After so many years, we must question whether sustainable development can be reconstituted in any effective form or whether we would be better served by developing sustainability itself as a guiding approach, rather than just an end goal.

Second, for a book which is so positive about the possibilities of a genuinely sustainable future that is also profitable and fulfilling for all, it is rather negative about the contributions made to date by environmental NGOs. Porritt's analysis reflects again and again on the 'demise' of environmentalism, suggesting an unwillingness or inability to engage effectively in solutions. From personal experience over two decades, we know this is far from the case.

That said, this was an enjoyable and informative read. Porritt brings to the discussion a convincing blend of pragmatism and optimism which, with the right vision, will undoubtedly be vital in the decades to come. To have any chance of success, he argues, sustainability must be compatible with capitalism. Porritt feels this is possible. We have to hope he is right.

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# Talking takes time

John Warren is increasingly frustrated



Science communication: a distraction?

## Scientists are being pressurised to engage the public in dialogue.

We are expected to engage fully in discussions with the public about our research and its wider environmental, health or ethical implications. Unlike our predecessors who were simply encouraged to go forth and educate the masses, or more politely 'enhance the public's understanding of science', we are told to be involved in a democratic two-way process.

Encouraging scientists to converse with the public raises a number of interesting issues. First, are the two skills compatible? During my time in various British universities I have been fortunate enough to have worked in the same departments as a number of brilliant scientists of the highest international standing. However, some of these appeared to live on a different planet from the rest of us. Expecting them to communicate with the unwashed public in any meaningful way is like asking Gordon Ramsey for a plate of beans on toast.

But let's be generous and assume that the majority of scientists are talented enough to unravel the mysteries of the universe and have the communication skills to purvey this understanding to non-specialists.

## The public must understand

The next problem is that for a meaningful two-way discussion to occur between scientists and

the public there must be at least some understanding on the part of the non-specialist. But this appears to be a politically unfashionable view, which is easy to dismiss as arrogance on the part of ivory-towered scientists.

I am currently involved in research in the controversial area of assessing the potential ecological impacts of the escape of genes from cultivation into the wild. I could use the debate about genetically modified organisms (GMO) to illustrate the problems that can occur when the scientific community tries to communicate with the public. But unfortunately the arguments here are so entrenched and the scientific facts so little understood that they have long since become irrelevant. Instead let me illustrate the problem with a project that was designed to find out how much the public value biodiversity.

## Flawed democracy

The problem here is that, unlike the GMO example, the public are happy to confess their ignorance and admit to having virtually no understanding of what biodiversity is. So before we could ask them how much they valued biodiversity, we had to tell them what we meant by the term.

This is true focus-group democracy and it is fundamentally flawed. As with the GMO example, letting the public be involved in

decision making in the absence of any real understanding does not work because the value that they ascribed to biodiversity in these discussions was simply a reflection of how important we told them it was the minute before. Would you apply such a system of consultation the next time your car needs fixing? Will you ask one qualified mechanic or take the average opinion of 100 members of the public?

Somewhere between these two extremes lies a workable mechanism for scientists to have a meaningful discussion about their research, its implications, risks and benefits with the public. But it involves investing a great deal of time by both parties, grappling with the complex science before the ethical aspects can be addressed.

## Efforts not rewarded

The demand for dialogue is one example of the way academics are being pulled in multiple directions by unequal forces. While the Research Assessment Exercise requires us to carry out research of the highest international standard, does it recognise our efforts to be involved in dialogue with the public? Will it help bring desperately needed funding into our department? Hardly at all.

Many British scientists are becoming increasingly frustrated with their lot. We are expected to do several very different challenging jobs all at the same time. Many of us are more than delighted to talk with the public about our science, but it has to be appreciated that this takes time and effort, and distracts from our research and teaching for which we are primarily paid.

To find time to write this article I am in the office late at night after the end of term, so is it any wonder that scientists are often ineffective at communicating with the general public? They have much more sense than to be worrying about science at this time of night and have long since gone down the pub to relax.

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# Has the internet globalised science?

Wesley Shrum thinks friendship works better

## A decade ago, I began to wonder what would happen if scientists in developing areas could communicate freely and easily with those in Europe. Could the internet truly globalise science?

The question was important, because of two striking findings from a 1994 analysis of scientific communication in Ghana, Kenya, and Kerala (India).<sup>1</sup> The first was that the more scientists communicated outside their geographical area, the less they communicated inside. The second was that scientists from developing countries who were educated in developed countries had no more contact with professionals in developed areas after their return home than those who were educated locally. One interpretation was that communication difficulties prevented the maintenance of ties, and that their costs required the trade-off between colleagues inside and outside their area.

At the recent World Summit on the Information Society (WSIS), the dominant view was that collaboration through information and communication technologies will dramatically improve science for developing areas. While this is conventional wisdom at the present time, our evidence suggests it is time to reexamine this view.

## Benefits and costs

The benefits of collaboration seem clear. Institutions collaborate when they do not themselves possess the funds, equipment, or personnel necessary to achieve some objective. They collaborate when multilateral or national funding centres establish a programme and when their leadership recognizes an opportunity, sees a trend, and commits resources. Researchers

collaborate to solve technical and scientific problems, but they do so in the context of careers and organizations that are very different in Africa, Latin America, and Asia.

When people decide to collaborate, they incur costs as well as benefits. During the past decade the benefits have been emphasized while the costs have been largely ignored. The promise of the internet is that the reduction of communication costs makes coordinating projects easy, changing the overall balance of costs and benefits. Post-internet collaboration should be easy and productive because costs are low and benefits are great.

## Surprising findings

Unfortunately, that is not the case in the developing world. For the past decade we have examined the changes wrought by the internet in the scientific communities of developing areas.<sup>2</sup> There is little evidence that internet collaboration generally increases productivity. Sometimes it seems to reduce output.

Our Indian scientists, who are relatively productive, collaborate very little. Kenyan scientists, who collaborate a great deal, are relatively unproductive. As a Ugandan put it during the recent WSIS, 'Africans love to start projects. They just don't like finishing them.' But a Filipino administrator put it more accurately: scientists have got to move on to the next project or consultancy as soon as the final report is written. The need to publish the results in the open literature is secondary, and often they are ill-prepared to do it.

There are two major aspects to the communication problem. One is that many research institutes and universities in

developing areas are simply not connected to the internet, when 'connectivity' is understood as an unshared computer in one's office with a broadband (always on) connection to the internet. The second is that scientists, policy makers, and programme managers assume that their colleagues in the developing world are connected to the internet and use it in the same way (sure, there are some problems – but I get emails from Africa all the time). The evidence indicates that costs are indeed lower than before, but access to the internet is limited, shared, and often domestic.

## Limited change

The internet has changed the conditions under which data are stored and manipulated. It has altered the speed of communication, but it has not changed the local processes that shape the way researchers are hired and paid, the way they teach, their extended family obligations, their administrative responsibilities, consulting opportunities, and dependency on donors.

Seeking to understand international scientific collaboration, we have had to form one – and that has changed us in the process. Perhaps the most important aspect is friendship, from which I have learned that lower internet connectivity, and different ways of using the internet, is not actually a 'problem' except as I defined it as such. It is best viewed as a condition. Donors – like me – have become a significant part of the long term problem by creating conditions of dependency. Social and scientific relationships across national boundaries are the only antidote. And they are not best created through the internet.

## Reference

1. W Shrum and P Campion (2000). Are scientists in developing countries isolated? *Science, Technology and Society* 5 (1), pp1-34
2. The original sites were Ghana, Kenya and Kerala (India). More recently we have studied South Africa, Chile and the Philippines.



International collaboration: social relationships are better than the internet

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# Pump up the volume

Time to raise the silent voice of science, says Ian Gibson



**Big science-related issues have recently dominated Parliament. From the possibility of building more nuclear power stations to the furore over banning smoking in pubs, the parliamentary agenda has never been so ripe for scientific contribution.**

But where is the scientific voice? Science as usual sits on the benches and is called upon only when a selective use of 'facts' is needed to back up half-baked arguments.

As usual, I have been musing about science and the way it speaks to the world around it.

Science is a quest for truth, and therefore the key to ending dilemmas posed by hard political decisions. Yet this very quest for truth has made it the unwitting handmaiden to all sorts of unsavoury masters.

How is science to free itself? Or is it inevitable that science will always be the megaphone, the tool that others use to amplify their own voices?

**Science is a quest for truth, and therefore the key to ending dilemmas posed by hard political decisions. Yet this very quest for truth has made it the unwitting handmaiden to all sorts of unsavoury masters.**

## Science and the Republican right

In Britain, we are fortunate that science has not been abused to the extent it has been in the United States. And it is to the US that I have looked for lessons on how we could bring science out from the background in this country.

The Republican war on science by Chris Mooney<sup>1</sup> has been causing a storm across the water. It details how an unpleasant alliance between government, industry and religious fanatics has enabled science to serve the political cause of the Republican right. It has led to a situation in which big businesses fund supposedly objective think tanks and scientists to conduct research which invariably backs 'evidence' which questions the need to do anything about climate change or second hand smoke.

Add to this cauldron the lobbying of powerful religious conservatives to get intelligent design cemented into school curricula, halt stem cell research, reverse the emphasis of sex education in favour of abstinence: the list goes on and on.

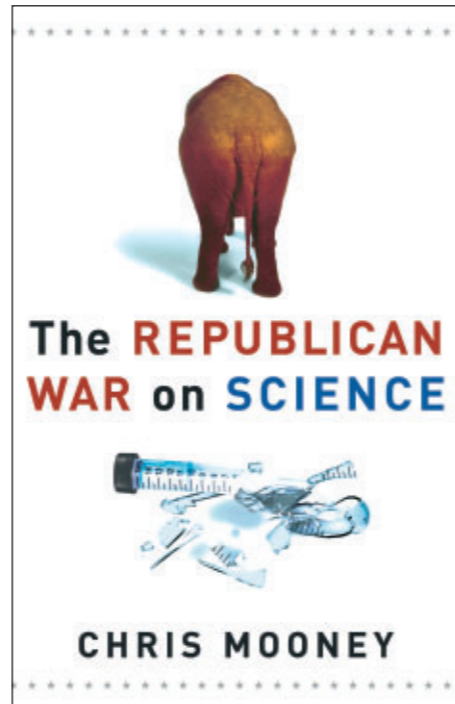
## Laughable statements

There is nothing new per se about the position of these groups (the 'denial lobby', as Mooney aptly describes them), but what is worrying is their use of 'science' to back up their nefarious claims.

When religious conservatives take issue with the distribution of condoms, they do not argue that extra-marital sex is against God's will. Instead, they point to 'evidence' which claims to show that condoms are ineffective in preventing HIV. Such statements would be laughable apart from the fact that it is a stance that the American government has adopted in its dealings with the developing world.

Aids NGOs and charities who receive US money increasingly have to advocate HIV prevention strategies which back abstinence in order to receive aid.

One must also note that, as Mooney suggests, it is a war, and as in all wars, there are two sides. There is a less powerful, but no less engaged, left-leaning side, which has also behaved towards science in the same disingenuous manner (one only has to think of the furore over GM foods) and has its own arsenal of think tanks and public relations specialists.



Causing a storm Basic Books

## New think tank

I have no wish to turn the UK into a land in which the left and right use science for their own ends. In order to avoid the US's mistake, in which science is used as a megaphone, we need to turn the politician into the megaphone and amplify the voice of science through him or her. No easy task – but we have the dubious advantage of not having attempted it before.

I believe that, for all their potential pitfalls, think tanks are a splendid idea. Whatever one may think of those in the US, one cannot get away from the fact that they have teeth and know how to get their message out. I am more and more convinced that we need such bodies here and I am in the process of setting up one myself. Interested individuals should contact me on [gibsoni@parliament.uk](mailto:gibsoni@parliament.uk).

It's time that science went to war against those who seek to silence or abuse it. Get in touch.

Reference  
1. Basic Books, 2005

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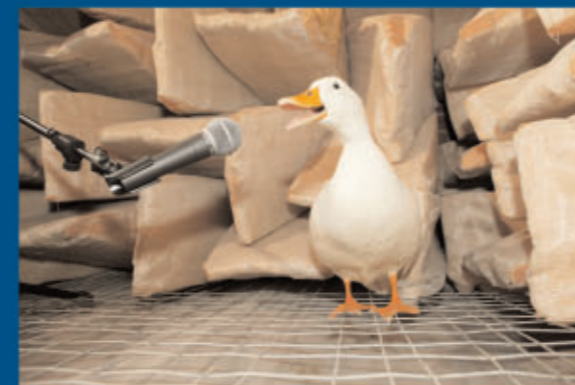


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