

# Science & Public Affairs

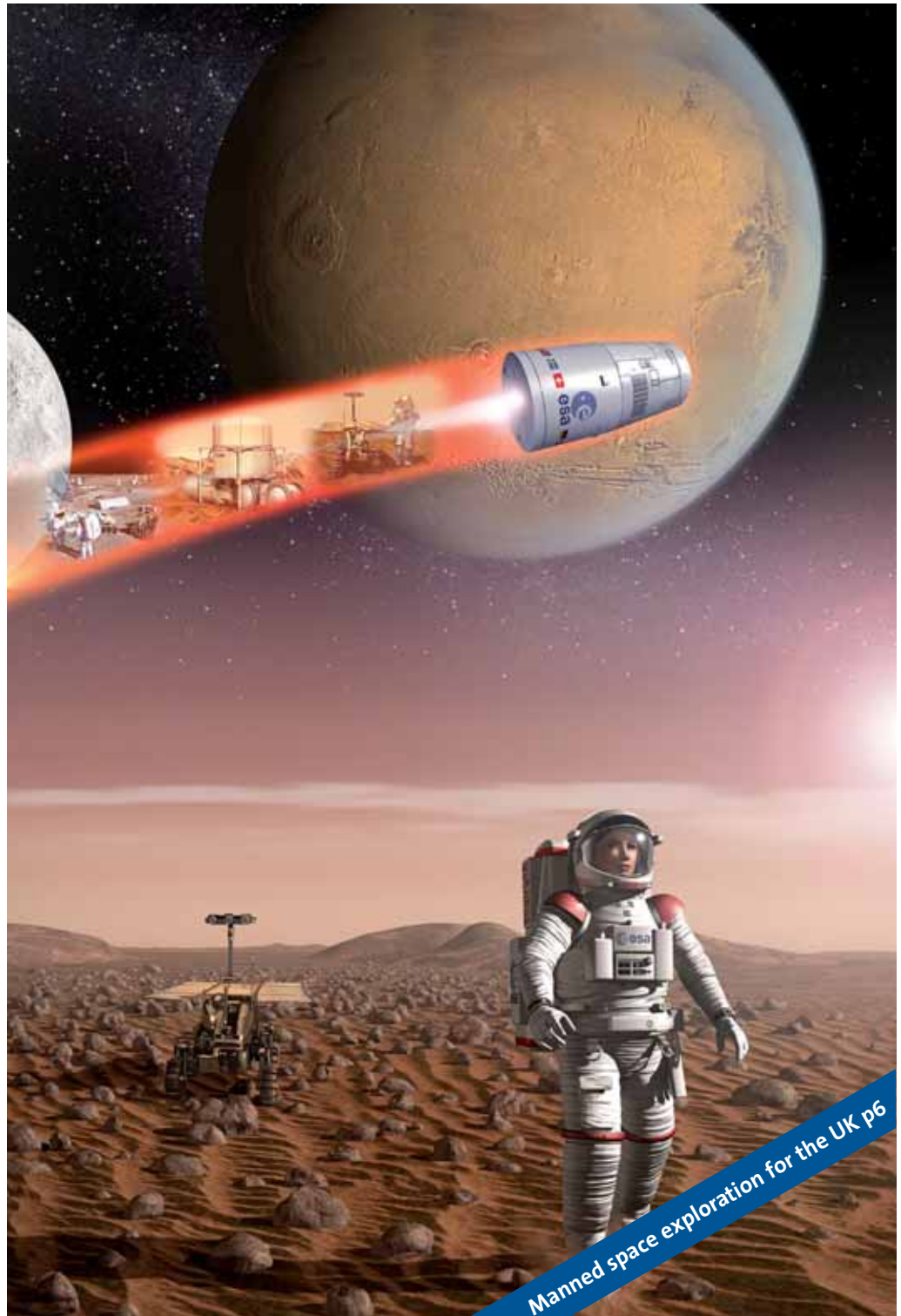
*UK participation  
in human space  
exploration*



Freefloating,  
misdirected and  
perpetual



Codes of ethics  
for scientists



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## Ethics in many guises

Several hefty, ethical arguments figure in this issue.

We, the public, seldom glimpse the world behind medical research. All the more reason to savour the SPATalk (p4), which asks whether regulation of clinical research is damaging public health. From the researcher’s point of view, Charles Warlow’s frustration with jungles of rules and regulations is palpable. His protests spring from experience (sending ‘5789 pages of A4 weighing 26.9 kg to 15 local research ethics committees, all for three trivial amendments, which delayed the research project by months’); he argues that ‘the bureaucratic juggernaut of research ethics committees’ needs sorting. His sparring partner, John Lilleyman, agrees that there are difficulties, but reassures him that everyone involved is showing ‘an emerging will’ to find solutions. He points to improvements, and urges Warlow to hang on in there.

No less passion pours from the page in the discussion of hybrid embryos (pp12-13). Martin Bobrow explains that they could fill the gap in supply of human embryonic stem cells needed for research into disease modelling, drug discovery or individualised stem cell therapy. He sees no ethical problems with creating a specific type of hybrid embryo involving human nuclei and cow or rabbit eggs. David King, on the

other hand, rails against a scientific establishment which, he says, is incapable of understanding the public’s concerns. Ordinary people, he argues, see different species as qualitatively different, and are revolted by mixing them. He forecasts a public backlash against the research.

Stem cell research is one of the areas the Government Chief Scientific Adviser cites to show the need for a code of ethics for scientists themselves. Nigel Praities (p18) surveys the arguments for and against the government’s code. On the one hand, it is welcomed as a tool for ensuring ‘that scientists are reminded of their legal and ethical responsibilities’. On the other, it is dismissed as a paper tiger, which assumes that scientists misbehave because they are naughty rather than because research is increasingly being driven by commercial pressures.

We worry about the value of science for society. But Sheila Jasanoff (p11) would rather cast our expectations of science differently. What, she suggests, if we were to ask how effectively the values of society are being incorporated into the products of science and technology? In a five-point primer to a wider debate, she urges us to dissect the assumptions behind familiar phases such as ‘the public’ and ‘evidence-based policy’. In this and other ways, she writes, we can come to use science and

technology as ‘instruments through which we realize the most enduring aspirations of our societies’.

Science students are already thinking along these lines. Vanessa Spedding (p27) argues that they are just as interested in the ‘why’ as the ‘how’ of science. Surveys show they want more emphasis on the moral and ethical implications of the science they study in the classroom, and that many choose careers with environmental and social goals in mind. Tapping into these concerns would, she believes, attract more students to science.

Tracey Brown (p29) is worried about our propensity to let the ends justify the means. Where the subtleties of evidence get in the way of the aims of policy, she writes, we are invited to overstate the evidence because ‘surely, we approve of the outcome?’ With contentious stories of children overeating, warnings about passive smoking, recycling targets that take no account of energy use and questionable dossiers on WMD, insisting on the evidence is often dismissed as scientific pedantry. She argues that truth has an absolute right to be heard and understood as such, even at the cost of social peace.

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# Is regulation of clinical research damaging public health?

John Lilleyman and Charles Warlow disagree



Anonymity: 'The obligation to anonymise can ruin clinical research'

Dear **John**,

Medical research ethics committees are sometimes unethical. How can that possibly be? After all, they were set up to protect patients from over-enthusiastic researchers' risky experiments. But nowadays, ethics committees have gone too far.

Urged on by a vocal minority who claim to represent patients, committees are inconsistent, partly because of their varying interpretations of the law and contradictory professional guidance.

Moreover, the results of approved research can be so biased that they are misleading. For example, if consent is insisted upon for every patient in a study which just involves confidential observation of medical records, and if anonymisation is neither practical nor possible, then non-consenters would

be excluded. But non-consenters are different to consenters in ways which are impossible to predict (and which can't be measured without their records anyway), so research findings from just the consenters would be biased.

Is that ethical? I think not. And 85 per cent of the population did not think that their details being automatically passed to the national cancer registry would be an invasion of their privacy.

Furthermore, despite the application process being streamlined, it remains difficult and time consuming to get low-risk research through these committees. Researchers are either disguising their research as audit, persisting at the expense of their own research output, or giving up in despair.

Yours, **Charles**

Dear **Charles**,

You protest too much, perhaps. Research ethics committees are not 'urged on by a vocal minority who claim to represent patients'. Rather they struggle with the Declaration of Helsinki, Department of Health rules, the European Clinical Trials Directive and a raft of difficult legislation relating to mental capacity, data and tissue. Interpreting all this, in addition to the inherent subjectivity of ethics, means some inconsistency is inevitable. Nevertheless, all committees now work to standard operating procedures and are increasingly being subjected to quality assurance measures such as accreditation and appraisal.

Your example where you think they 'go too far' is arguable. I agree restricting research access to medical records to those where

patients consent can produce biased sampling. But the same can be said of any clinical study where patients volunteer. Sometimes bias is clinically important, sometimes not, but in the broad context you describe I would not call it unethical. Cancer registries and other exceptions notwithstanding, studying identifiable medical information without consent should not be unrestricted, surely?

As for the application process, efforts are being made to fast-track low-risk studies and to redefine what does and does not require formal ethics review. So do not despair.  
Yours, **John**

Dear **John**,  
Researchers must protest. If we had not highlighted the lunacy of local research ethics committees requiring multiple copies of an application for multicentre observational research, already approved by a multicentre ethics committee, we might still be stuck in the 1990s. Then, we dispatched 5789 pages of A4 weighing 26.9 kg to 15 local research ethics committees, all for three trivial amendments, which delayed the research project by months (the opportunity cost brings tears to my eyes).

Biased sampling does indeed occur in clinical research, which is why it is mostly rubbish. For years, epidemiologists have urged clinicians to use a proper sampling frame. I do not advocate unrestricted access to patient data, but the obligation to consent or anonymise can ruin clinical research.

Ethics committees should embrace the permissive elements of data protection legislation and the concept of proportionality, by balancing the risk of disclosure of patient data (for which there has never been a successful prosecution in the UK) against the public benefit of unbiased research.

Autonomy has gone too far, a residue of Thatcherism exalting the individual over society, while the common good is in retreat. And what of the extraordinary double standard that allows clerks, without any ethics committee review at all, to trawl through the same patient records for auditing the clinical service?  
Yours in desperation, **Charles**

Dear **Charles**,  
There is no need to exhort researchers to protest about the bureaucracy of ethics review since they have never been slow to do so.

Why not encourage them instead to reflect on the unethical medical experimentation highlighted by Pappworth and Beecher in the 1960s? These authors pointed out that several

apparently pioneering novel procedures and trials both in the UK (Pappworth) and the USA (Beecher) took advantage of participants by exposing them to risks they did not fully appreciate. The experimenters invariably and genuinely believed that what they were doing was harmless or justified. Researchers nowadays are no different, which is why they find ethics review so irritating and why it remains important.

The 1991 edict that some 200 local NHS economies should each have a research ethics committee generated many problems, including inconsistency and a lack of understanding that much research is not a local affair. This led to the bureaucratic nightmare you describe.

Tackling it has not proved easy, but England is now well on the way to the goal of a coordinated National Research Ethics Service with fewer committees that will consistently provide proportionate, timely and sensible reviews. The rest of the UK is watching with interest.

As for your thoughts on autonomy, I might agree with you that benign paternalism still has a place in medicine and possibly even in government, but social mores have moved on and so, I suppose, must we.

Yours, **John**

**Experimenters genuinely believed that what they were doing was harmless. Researchers nowadays are no different, which is why ethics review remains important**

Dear **John**,  
I thought you would mention Pappworth and Beecher. Their revelations of invasive experiments lead to research ethics committees, and quite right too. But they didn't have anything to say about non-intrusive research using medical records.

If we are blind to what we are doing, as researchers were in the 1960s, where will we be in another 40 years – no medical research at all maybe? Important research is being suppressed or delayed for no good reason, and this matters to patients – including me.

Because I had cancer of the colon at a young age, my children might like to know that daily aspirin substantially reduces their increased risk. This fact nearly failed to emerge. It was based on following up several thousand patients in two vascular disease trials – all of whom had given consent to be

in the trials for a few years. It took the researchers three years to get permission to track them 20 or more years later through the UK cancer registries, without their consent. They very nearly gave up, such were the delays and frustrations.

I can do nothing but protest, but through your position you could sort out the bureaucratic juggernaut of research ethics committees, for the benefit of patients.  
Will you?

Yours, **Charles**

Dear **Charles**,

So we agree research ethics committees are necessary. We also agree there are difficulties with non-intrusive research using medical records, but this is not down to ethics committees. The 2001 Health and Social Care Act effectively prohibited the use of non-consented patient data without specific approval of the Patient Information Advisory Group set up for the purpose. There was an outcry from researchers and some hastily produced exceptions to the rule, such as cancer registries, but PIAG remains the stern gatekeeper for the type of project you are worried about, rather than ethics committees.

Other bodies also regulate research, of course, including local NHS Research and Development offices, the Human Tissue Authority, the Medicines and Healthcare Regulatory Authority and several dealing with specialised areas. These are all part of your bureaucratic juggernaut. Devolution hasn't helped much, either.

So streamlining the application process for relevant research approvals and ensuring universal proportionality of review will obviously be complicated. Happily, there is now an emerging will to achieve it being shown by all involved. For example, with ethics leading the field, progress is being made on an integrated application form where online data entered once is at one click transferred to the relevant regulators. It's a start. Hang on in there.

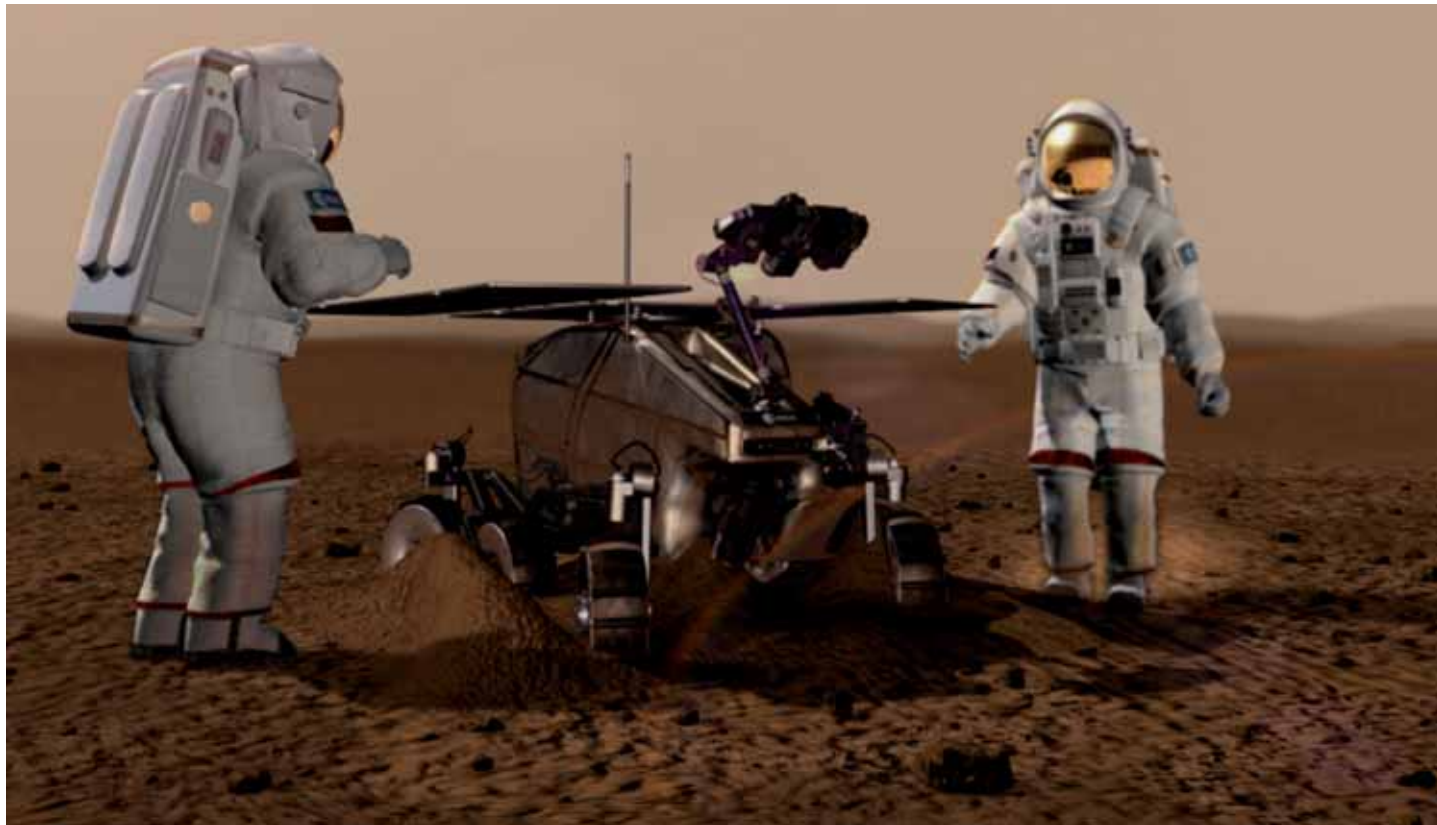
Yours, **John**

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# UK participation in human space exploration

Ian Crawford makes the scientific and cultural case



The ExoMars rover, to be launched around 2011. It will explore the biological environment on Mars in preparation for further robotic and, later, human activity ESA - AOES Medialab

**The UK is currently in the process of reviewing its future space policy. The Parliamentary Select Committee on Science and Technology has recently issued a key report on this subject,<sup>1</sup> and the UK Space Exploration Working Group established by the British National Space Centre (BNSC) is expected to produce another early in September.**

The context for much of this activity is the Global Exploration Strategy that was agreed by 14 of the world's space agencies, including BNSC, earlier this year.<sup>2</sup> This strategy calls for a global effort of Solar System exploration, with the ultimate aim of establishing a 'sustained and ultimately self-sufficient human presence beyond Earth, supported by robotic pathfinders'. In this new global context, the UK must decide whether, and to what extent, it wishes to participate in these exciting endeavours.

## Controversy

Although the UK has been, and continues to be, successfully involved in the robotic

aspects of space exploration, the subject of human spaceflight is controversial. This is because many scientists believe that the limited resources available for space would be better invested in robotic missions. On the other hand, it can be argued that human beings are uniquely qualified to undertake several key scientific investigations in the space environment, ranging from life and physical sciences research in microgravity to geological and biological fieldwork on planetary surfaces. Thus, the scientific argument is by no means clear-cut.

There is in any case strong public interest in, and support for, human space exploration. For example, in a MORI opinion poll commissioned by the Demos think tank in 2004, 60 per cent of those questioned agreed with the statement: 'Britain should be involved in the human exploration of Mars and not just the robotic aspects.'

## Microgravity

The microgravity environment of low Earth

orbit provides unique opportunities for research in the life sciences, materials science, and fundamental physics. Further progress in these areas will rely on the unique capabilities of the International Space Station (ISS). Although the UK has so far opted out of microgravity research on the ISS, the potential scientific benefits are well-documented, and were recognised by the independent Microgravity Review Panel in 2003 which noted that 'without access to such facilities ... the UK will be excluded from entire areas of scientific endeavour.'<sup>3</sup>

Probably the most important scientific benefits of microgravity research will accrue to the life sciences, where research in the space environment is able to provide unique insights into such areas as gene expression, immunological function, bone physiology, and ear, eye and cardiovascular function. These areas are important for understanding a range of terrestrial disease processes (for example, osteoporosis, muscle atrophy, cardiac impairment, and balance and co-

ordination defects), and as such have potential medical applications here on Earth. The UK has a growing space biomedicine community well placed to benefit from, and contribute to, these important research fields.

### Space Astronomy

From almost the very beginning of the space age, astronomy has benefited from being able to place instruments above the obscuring effects of Earth's atmosphere. Most of these observations have been performed by robotic spacecraft, without human intervention. However, one of the principal lessons from the most successful of these instruments, the Hubble Space Telescope, is that access to a human spaceflight infrastructure can greatly extend the life, and increase the efficiency, of space-based astronomical instruments.

This experience teaches us that the operational lifetime, and scientific productivity, of space-based instruments are likely to be enhanced if a human spaceflight infrastructure exists which is able to maintain and upgrade them. In the longer term, astronomy may also benefit from a renewed human presence on the Moon, as the lunar surface provides an excellent location from which to perform astronomical observations across a wide range of wavelengths.

### Planetary Exploration

The Apollo programme clearly demonstrated the scientific value of astronauts as explorers of planetary surfaces, principally because they bring agility, versatility and intelligence to exploration in a way that robots cannot. Although it is true that humans will face many dangers and obstacles operating on other planets, mostly due to their physiological limitations when compared to robots, the potential scientific returns are more than sufficient to justify employing astronauts as field scientists on other planets.<sup>4</sup>

There is little doubt that the UK planetary science community would benefit from involvement in these exciting activities.

### Science education

Space exploration is inherently exciting, and as such is an obvious vehicle for inspiring the public in general, and young people in particular, to take an increased interest in science and engineering. Indeed, in the MORI poll quoted above, fully 70 per cent of respondents agreed with the statement that 'space encourages young people to become scientists and engineers'.

As noted in an earlier report in *Science & Public Affairs*, the falling numbers of UK students studying science and engineering is

a matter of increasing concern for a knowledge-based economy such as ours.<sup>5</sup> UK participation in an expanded, highly visible, human spaceflight programme could prove to be a significant help in this respect, by inspiring more students to take an interest in the scientific and engineering disciplines.

### Industry

Human spaceflight is technically very demanding, and this is indeed one of the reasons why it is so expensive. However, for this very reason, engaging in human space activities must necessarily act as a stimulus for employment, skill development, and technical innovation in the participating industries. This expansion of technical capabilities is in turn likely to find applications in other areas of the wider economy. Human space exploration may be expensive, but the money itself does not leave the Earth; rather, it stays on the ground, where it stimulates additional economic activity.

There are also strong political and ethical reasons for wanting to wean the aerospace industry off its staple activity of producing high-tech weaponry, and an expanded space programme would provide such an opportunity while maintaining employment and innovation in the companies concerned.

### International cooperation

Space exploration provides a natural focus for international cooperation, as indicated by the collaboration of some 15 nation states (currently excluding the UK) in the construction and operation of the ISS. In trying to build a stable geopolitical environment on Earth, it must be desirable to increase the range and depth of such collaborative endeavours. Human space exploration is especially, and perhaps uniquely, well-suited to enhancing a sense of global solidarity owing to its globally high media profile. This is recognised in the Global Exploration Strategy, and it would seem to be desirable that a major economy such as the UK is seen to be pulling its weight in this respect.

### Conclusions

The UK is currently the only major industrialised economy that has consistently declined to participate in human space exploration, and the current review of UK space policy provides an opportunity to reverse this long-standing, but arguably very short-sighted, policy.

As noted above, clear scientific benefits of human space exploration can readily be identified. Given that participation in human space activities would also be inspiring UK

## @ a glance...

The UK is currently in the process of reviewing its future space policy

The subject of human spaceflight is controversial

Microgravity research would enable us to understand some diseases

Humans in space increase the life of space-based astronomical instruments and would be valuable to field scientists on other planets

Space exploration would inspire young people to take an increased interest in science and engineering

Space exploration would also benefit industry and international cooperation

school children, supporting UK industry, and making a positive contribution to international cooperation, there appears to be a strong case for re-examining UK policy in this regard. This is especially so given the new international context provided by the Global Exploration Strategy, where UK participation would provide wide-ranging scientific, industrial and educational benefits that cannot obviously be attained in any other way.

1. See <http://tinyurl.com/2r3ozg>
2. See <http://tinyurl.com/24vwbq>
3. See <http://www.microgravity.org.uk/recommendations.pdf>
4. See, for example <http://eprints.bbk.ac.uk/archive/00000405/01/Binder1.pdf>
5. *SPA* (June 2007), STEM shortages will stymie business, p8

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# Shorts

## In brief

### Top seat at the BA for government guru

Sir David King will assume his new position as President of the BA for 2008 after stepping down from his current position as Government Chief Scientific Advisor. 'I look forward to working with the BA to promote and develop public engagement in science on critically important issues such as climate change and sustainability,' Sir David said.

### Gadgets undermine energy saving

The growing popularity of new forms of home entertainment technology such as flat screen televisions and digital radios is adding to climate change, according to the report *The ampere strikes back*, from the Energy Saving Trust. By 2020 this new category of products could account for 45 per cent of electricity used in UK households.

[www.energysavingtrust.org.uk/aboutest/news/ampere/](http://www.energysavingtrust.org.uk/aboutest/news/ampere/)

### Public not catching up with climate reality

More than half of the 2032 people surveyed by Ipsos MORI on climate change thought that experts were still questioning whether humans were contributing to the problem. A quarter thought there was nothing they could do personally to help avert climate change. More results: [www.ipsos-mori.com/polls/2007/climatechange.shtml](http://www.ipsos-mori.com/polls/2007/climatechange.shtml)

### Carbon offsetting should be aided and vetted

The public should be encouraged to use carbon offsetting schemes – but the government must act quickly to bring forward measures to encourage responsible and robust offsetting and to set out clear criteria that offsets must meet, a report from the Environmental Audit Committee of the House of Commons has concluded.

<http://www.publications.parliament.uk/pa/cm200607/cmselect/cmenvaud/331/33102.htm>

## Government yet to engage public on nuclear power

**The government's Energy White Paper, released in May this year, has generated a flurry of controversy surrounding the issue of nuclear power and has raised important questions about how seriously the government takes the process of public consultation.**

The paper sets out the framework for a 'low carbon economy' for the UK. This includes support for renewable energy, low carbon transport and energy efficiency measures – and even a forthcoming competition for carbon capture and storage techniques – but also an open door to the possibility of a new generation of nuclear power stations.

Acknowledging that nuclear technology is contentious, the White Paper makes clear that policy cannot be finalised until the completion of a full public consultation. This statement has since attracted derision, following Prime Minister Gordon Brown's subsequent declaration of intent to proceed with nuclear power, which he made before the consultation was complete.

### The public at the table

Greenpeace experienced a sense of *déjà vu*, having precipitated a high court ruling in February this year that a previous consultation must be repeated, since the ensuing decision to support nuclear had not been based on the 'fullest' of processes. At the time of writing, Greenpeace's lawyers were awaiting a response to their latest challenge to the validity of the decision-making process.

A spokesperson for Demos, the 'think tank for everyday democracy', pointed out that while Demos has no particular stance on nuclear power itself, 'People won't have confidence in the consultation process where

it's clear they're not being listened to. Having the public at the table is valuable: it leads to more robust decision-making and outcomes. The public bring ways of questioning assumptions that experts may not think to consider.'

### Energy mix

This dispute may be resolved by the time *SPA* goes to press but the question of whether nuclear power is the way forward will reverberate for some time. Nuclear Industry Association Chief Executive Keith Parker, welcomed the government line: 'A diverse energy mix is right for the UK and the White Paper reflects that. Nuclear must be a part of that mix; we cannot hope to reduce emissions without nuclear's contribution.'

Others, however, are sceptical even if the public does show support. Greenpeace points out that replacing the UK's suite of nuclear power stations will cost tens of billions of pounds while reducing the country's carbon emissions by a mere 4 per cent, 'sometime after 2024'.

Meanwhile, a recent report by the Oxford Research Group casts doubts on nuclear power as a global solution to climate change.<sup>1</sup> It says that, to make a significant difference, 48 reactors must be built each year until 2075, many of them in the developing world. The nuclear industry claims this is feasible, but Dr Frank Barnaby, one of the report's authors, said, 'They rather miss the point, which is: can these countries find enough resources or skilled personnel? Can they run the reactors safely and securely and deal with the radioactive waste?'

1. Too hot to handle? The future of civil nuclear power; see <http://tinyurl.com/3b27r8>



Nuclear power at Wylfa: the current generation

## Whitehall science re-jig: does the public care?

UK science has a new home following Gordon Brown's reorganisation of the DTI and DfES into the Department for Business, Enterprise and Regulatory Reform (BERR), the Department for Innovation, Universities and Skills (DIUS) and the Department for Children, Schools and Families (DCSF). But the implications for the country's science base are likely to be of little interest to the public, according to Peter Cotgreave, Director of the Campaign for Science and Engineering (CaSE).

### Science and innovation

Science now falls within the DIUS, a position that has brought cautious optimism from those following its administration closely. CaSE interpreted the creation of a ministry with innovation at its heart as recognition of the importance of science, but added that if it is to be effective, the new department 'will need to create fresh and robust mechanisms for sustaining strong links with schools and business policy'.

Martin Rees, President of the Royal Society, said: 'The challenge for John Denham, the new Secretary of State for Innovation, Universities and Skills, will now be to ensure that the department has a strong voice at the cabinet table. Science plays a key role in improving people's lives and as a driver for the economy. It is to be hoped that this new department will allow greater recognition of, and support for, that role.'

Molly Webb, researcher for the think tank Demos, thought that those people who are concerned about the public value of science would be reassured by its positioning with universities rather than business. She cautioned, though, that the new structure adds weight to the idea that 'government tends to think of science as a first step in the innovation pipeline.' This, she pointed out, can lead to a narrow focus and preclude the possibility of science rising fully to the huge challenges faced by society. Demos hopes the new structure will in fact be viewed as a 'real opportunity to think afresh about the relationship between science and innovation'.

### Little public impact

Initial disappointment that the word 'science' did not appear in the title of the department, expressed both by Peter Cotgreave and Martin Rees, was tempered by the announcement of a new Government Office



John Denham: a strong voice?

for Science, which will be headed by the Government Chief Scientific Adviser (GCSA) Sir David King, and which will sit within the DIUS.

But the impressions made on most people by all this are likely to be imperceptible. 'There is little impact on the public,' conceded Peter Cotgreave. 'Half of them wouldn't even know who the Science Minister is, let alone care about departmental structures!'

The Government Office for Science has responsibility for carrying out Foresight and Horizon Scanning projects, reviewing the management and use of science in government departments, providing the secretariat to the Council for Science and Technology and the Global Science and Innovation Forum, supporting the GCSA and ministers on international science and technology and supporting the GCSA in providing scientific advice to the Prime Minister and cabinet, among other things.

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## In brief

### MPs urge caution on overhead lines

A cross-party inquiry undertaken by MPs has recommended a moratorium on new homes within 60m of high voltage power lines (275kV and above), and 30m of medium voltage lines (66kV and above) as a precautionary measure against the increased risk of childhood leukaemia associated with fields from such lines.

### Committee reviews space science

Parliament's Science and Technology Select Committee has expressed concern at the shortage of skilled personnel needed for the country's space industry. Its latest report also recommended a national education project to enlighten the public on the importance of space activities to their everyday lives.

<http://www.publications.parliament.uk/pa/cm200607/cmselect/cmsctech/66/6602.htm>

### Global worries

The Pew Global Attitudes survey of 47 nations has found a significant increase in the percentage of people citing pollution and environmental problems as top global threats since the last survey in 2002. Concern about nuclear weapons, AIDS and disease has also increased in many countries, as has wariness of the world's dominant nations and their leaders. See <http://pewglobal.org/>

### A GM hot potato

A GM potato crop trial underway in Cambridgeshire has been destroyed by protesters keen to stop the spread of pollen from the flowering plants. Campaigners say the trial, undertaken by BASF Plant Science to develop genetic resistance to late blight, ignored the interests of local bee-keepers and organic vegetable growers and also overlooks existing non-GM potatoes that already have this resistance.

# Radioactive waste management

We must get it right, argues Alec Broers

**When the House of Lords Science and Technology Committee first examined the issue of radioactive waste management in 1999, it concluded that openness and transparency, as well as public engagement and consultation in decision-making, were vital components in gaining public trust. It recommended the setting up of a dedicated Nuclear Waste Management Commission, which would be independent of government and accountable to parliament.**

The decisions taken now on the disposal of radioactive waste will concern not just us, but our successors, for thousands of years to come. The process of decision-making therefore needs to be beyond reproach or political influence. Everyone has a stake in getting this right.

## **CoRWM: admirable transparency**

In July last year, the Committee on Radioactive Waste Management (CoRWM) published its recommendations on the long-term solutions for managing the UK's solid radioactive waste. The key recommendations were that underground, geological disposal currently presents the best available approach for long-term storage and that any decision on the ultimate location of the repository should be decided by inviting potential host communities to participate in the implementation process. The report also recommended that an independent body should be appointed to 'oversee' the implementation process.



Storing nuclear waste in Sweden SKB Bengt O Nordin

After a somewhat rocky start for CoRWM – we initially criticised it for lacking technical and scientific expertise – its final report marked a welcome step forward in a thirty-year debate over this important issue. In particular, CoRWM deserves praise for the transparent manner in which it reached its conclusions. By contrast, many of the problems and failures of the past were characterised by a culture of secrecy and a process of 'decide, announce, defend' – followed by, more often than not, 'retreat'.

## **Achieving accountability**

The government has accepted CoRWM's recommendation on geological disposal. It has also handed responsibility for implementing it, and for community and stakeholder engagement, to the Nuclear Decommissioning Authority (NDA). However, CoRWM's recommendation for an independent body to oversee the process (itself significantly weaker than the Lords Science & Technology Committee's recommendation from 1999 for an independent commission) has been watered down to an independent advisory body (the new CoRWM) – albeit with some scrutiny function.

With this in mind, in our latest report from June 2007, we were particularly interested in CoRWM's recommendation for an independent body and in the government's reshaping of that recommendation. In our report we restated our long-held belief that a single, independent body with responsibility for overseeing the entire radioactive waste management programme is needed to achieve parliamentary and public accountability.

## **Policy confused**

From the evidence that was presented to us, we concluded that the government's proposals did not provide for sufficient transparency and accountability. The flow of independent advice from the new CoRWM to the NDA appeared compromised, and the process seemed to intermingle with the conduct of scrutiny. Departmental responsibilities were not clear. The process for expert scientific input appeared equally confused. More clarity on why the important decision to set up an advisory body was made would have been desirable.

## **Haste slowly**

We are of course conscious of 'realpolitik', and policy in this area is continually being developed and, we hope, improved. In May, for instance, the government published its latest consultation on a framework for implementing geological disposal. However, after such a long delay (thirty years), we were concerned about the apparent speed of some of these developments.

For example, the consultation includes important questions on an outline implementation programme, public and stakeholder engagement and the site selection process. It might have been a good start for the new CoRWM to be involved in drafting the consultation. Now that it is published, the Committee will have an opportunity to provide its comments on it.

We fully endorse the government's desire to maintain momentum. However, it is equally important that progress should be steady and measured, with enough time allocated to the development of proposals and to expert scientific scrutiny (including by social scientists), followed by public consultation.

## **Need for transparency**

In the Energy White Paper, the government expressed the view that there are no significant technical barriers to including any new nuclear waste in a geological repository together with legacy waste. Climate change requires governments to be able to consider all non-carbon based forms of energy generation. It is therefore essential that the policy framework for radioactive waste management should be transparent and workable into the future.

As a parliamentary Select Committee with a long-standing interest in radioactive waste management, the Science and Technology Committee looks forward to continuing to make a useful contribution to this important issue.

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# Changing expectations

Sheila Jasanoff argues for a broader debate on science



What sort of society do we want?

**Much of the talk around science policy these days focuses on the value of science for society. This is understandable. More public money is flowing into R&D globally now than at any time in history. To justify that surge in investment, policymakers wave aloft the banners of wealth and job creation, competitiveness, health and longevity, and consumer satisfaction. The problems are obvious and we can solve them with science.**

But what if we cast our expectations of science differently? What if we ask how effectively the values of society are being incorporated into the products of science and technology? In principle, there is wide agreement that publics should have something to say about the direction of science and technology. It is, after all, the public's business how governments spend public money. There is a great deal of talk focusing on the bland buzzword of public engagement.

How well are we implementing the principle of engagement in practice? The debate around nanotechnology suggests too narrowly. Given the transformative potential of building a nanoscale world, we are only scratching the surface when we worry about such things as whether nanoparticles in sunscreen cream will penetrate the skin and cause injury.

## Five pointers for a more substantial debate

- We should ask people what worries them most about modern life. The answers might be issues like vulnerability, inequality,

surveillance, war and ungovernability. Next, we should ask how science and technology are alleviating or adding to those concerns.

Let us take for example nuclear power. In a broader debate, we would ask how nuclear energy advances or weakens the values of sustainability, equality and peace. We would think seriously about who is responsible for the linked yet discrete elements that constitute the nuclear world: high-level radioactive wastes, loose nukes, suitcase bombs, and power plant safety. We would engage holistically with the societal project of staying nuclear.

- We should bring to light hidden tensions behind the seemingly benign concept of public engagement. Who, after all, is 'the public'? Is it, as decisionmakers often think, an irrational force whipped up by the media? Is it best to constitute publics from on high, by expert consulting firms that think they can adequately profile populations for particular purposes? Or is it better done from below, by real people who band together to make their concerns visible? And should we give voice to members of the public on the intensity of their convictions, or on an epidemiological approach that recognises only statistical representation as valid?

- We should foster transgressive imaginations that open up our view of the technological world. In January 2001, the New York and New Jersey Port Authority produced a promotional video that celebrated the ability of the Twin Towers to withstand the impact from a fully loaded Boeing 707. They

did not think about the fuel contained in the plane that would instantly catch fire. In developing new sciences and technologies, we need more complete imaginations of disorder as well as order. Ironically, such imaginations may be better at serving our military ambitions today than at advancing the agendas of peace and security.

- We should debate which measures of productivity best reflect our core values. Should we, for example, equate the success of science with big ticket technological applications, like sequencing the human genome, or judge how far we have come by simple increases in life expectancy? We should recall perhaps that in J.R.R. Tolkien's world, happiness lay more with the Hobbits than the Elves, and the supreme gift of life granted to the Numenorean, Aragorn, was the choice of when to leave his.

- When we talk about 'evidence-based' policy, we should remember that evidence is socially constructed and value-laden. Evidence is information that supports particular causal stories about problems we see in the world. To accept evidence is to buy into underlying constructions of what really matters and what should concern us most. We need to keep asking, 'But is that the right problem?'

## Reorienting ourselves

It will require much effort to reorient ourselves in these directions.

First, the discourse of public engagement should be transformed into the discourse of public debate, so that questions of value can be more explicitly foregrounded. Second, pedagogical institutions, most of all universities, need to foster not just scientific research but concurrent reflection on the aims of society. Finally, we have to promote science and technology not as mere problem-solvers for the world but as instruments through which we realise the most enduring aspirations of our societies.

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# Debating hybrid embryos

## Martin Bobrow welcomes the prospect

**Stem cells are un specialised cells that can self-renew and differentiate into specialised cell types. Understanding their nature and potential is an important field of research that many believe could open new avenues for the treatment of human disease and injury.**

Studying stem cells could help shed light on disorders that underlie many diseases, ranging from developmental abnormalities in young children to some cases of degenerative disease, infertility, stroke and cancer. Learning how to control stem cell development could allow the production of specialised cells to treat conditions in which such cells are lost, such as childhood diabetes and Parkinson's disease. The ability to generate specialised tissues in culture, or in animal models, could also facilitate the development and testing of new drugs before they are used in patients.

Ultimately, understanding how adult cells can be reprogrammed to become stem cells offers the potential for a step-change in treating human disease. Potentially, it allows transplantation of cells and tissues containing a patient's own DNA, thus avoiding problems of tissue rejection.

### Human embryonic stem cells

Research into tissue-specific stem cells found in umbilical cord blood and several adult tissues is important and should continue. However, human embryonic stem cells, derived from very early human embryos, could provide a uniquely flexible range of research possibilities and, eventually, potential treatments.

If the full opportunities for disease modelling, drug discovery or individualised stem cell therapy are to be realised, researchers need to control the genetic composition of derived human embryonic stem cells. Somatic Cell Nuclear Transfer (SCNT) offers a way to do this. It entails transferring the nucleus from an adult cell into an oocyte (or unfertilised egg) from which the nucleus has been removed. However, few human eggs are donated for SCNT because patients undergoing fertility treatment need them, and the donation procedure is invasive.

### Inter-species embryos

A recent report by the Academy of Medical Sciences describes proposals by scientists to

overcome this shortage.<sup>1</sup> The idea is to make a specific type of inter-species embryo (cytoplasmic hybrid embryos) by SCNT, involving human nuclei and animal oocytes (cow or rabbit).

The report describes this work in the context of the long history of research on inter-species constructs. For example, mouse-human hybrid cell lines were the basis for early mapping studies on human genes in the 1970s, eventually leading to the successful Human Genome Project; animal cells have been widely used to produce human therapeutic proteins; and transgenic mice expressing human genes have led to key insights into understanding and treating diseases ranging from Alzheimer's disease to cancer.

No insurmountable ethical or safety issues have emerged over three decades of this research.

### UK regulation

The current revision of UK legislation around human embryos offers an important opportunity to consider the future research potential of inter-species embryos in their full scientific, ethical and social context.

We appreciate the sincerely held beliefs of those who consider all research involving human embryos to be inherently unethical. However, UK legislation currently permits licensed research on human embryos subject to defined limits. These are that the creation and use of human embryos for research can only proceed under licence from the Human Fertilisation & Embryology Authority (HFEA); human embryos used for research should not be re-implanted into a woman or animal; and human embryos used for research should not be developed beyond 14 days *in vitro*. It is our considered view that research on human inter-species embryos should proceed under a similar framework of regulatory control.

### Future challenges

The central issue of our report was the creation of human embryos incorporating some non-human material, currently regulated by the HFEA. However, as described above, researchers have for years used transgenic non-human embryos and animals, which are regulated by the Home Office. In the future, the transfer of human embryonic stem cells, or increasing amounts of human

genetic material, into non-human animals and embryos is likely to present increasing regulatory and ethical challenges.

Further consideration will need to be given to the interfaces between the regulation of animal research, human embryo research and human embryonic stem cell lines.

The Academy of Medical Sciences will be undertaking further work on this issue, to include a significant component of public engagement, which we hope will inform future debate.

1. See [www.acmedsci.ac.uk/publications](http://www.acmedsci.ac.uk/publications)

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Embryonic stem cells are in short supply

## David King warns of consumer-driven eugenics

**The debate over hybrid embryos has displayed the very worst aspects of behaviour of the scientific and science policy establishments.**

### Characteristics of the embryo

We have been told that cloned cytoplasmic hybrid embryos (where the DNA of animal eggs is replaced by human DNA) will be 99 per cent human, 1 per cent animal. This is simply untrue: at least until the stage at which stem cells are extracted, the majority of the embryo's molecular components will come from the animal egg.

The claim is based on a crude genetic reductionist assumption that the characteristics of the embryo simply reflect its DNA content. In fact, they will depend crucially on the success with which the human DNA is reprogrammed to begin embryonic development. Because cloning is so unnatural, this is highly inefficient; now these scientists will worsen the problem by asking animal proteins to re-programme human DNA.



Contrary to the recent Academy of Medical Sciences (AMS) report, there is abundant evidence that, even if stem cells are obtained, they will be so abnormal as to be useless or misleading.

### Judging success

The Science and Technology Committee, some of whose members publicly supported this research before even beginning its inquiry, is wrong to say that to make these obvious points is to 'misuse science'. The Nobel prizewinners who signed up to scientific mis-statements should be ashamed of themselves.

The AMS has now retreated to the position that the value of the science can only be established by doing the experiments. This is not good enough: we must make judgements about the benefits and the chances of success, because they are important in weighing whether to allow scientists to cross established ethical lines.

### Attitudes to mixing species

Public concern, meanwhile, is dismissed by the AMS as an irrational 'yuck reaction', or as the usual pro-life objection to embryo research. Funnily enough, it is about what it says it is about: mixing species.

Ordinary people, who see the whole organism, view species as qualitatively different 'kinds'. Their different characteristics are what define the species: leopards have spots, zebras have stripes. The basis of revulsion is the inadmissible mixing of things that are different and should be kept apart, and the creation of entities that are not integrated wholes.

For molecular biologists, species are made from the same molecules, and species difference derives from differences in DNA sequences, which are quantified in percentage similarity figures. Within this paradigm, species differences are a matter of quantitative differences. The mixing of human DNA and animal eggs is unproblematic in this view, because the two are not 'really' different in kind.

Both the popular and the molecular reductionist view have their merits. Scientists should show a little humility, and realise that ordinary people's concerns are not 'irrational', nor 'misunderstandings', but stem from an equally valid world view, focused on the whole organism.

### Genetically modified embryos

Meanwhile, the far more important issue of genetically modified (GM) embryos has been ignored. The government is proposing to allow scientists to begin developing the technology to create GM human beings. We should not be reassured by the temporary ban on creating actual GM babies, since government documents have made their long-term aim perfectly clear.

Since my organisation began campaigning on this issue, the government and the AMS have invented scenarios of varying plausibility for the use of genetic modification in basic research, but these are little more than fig leaves.

This is the first time that any country has sanctioned genetic modification of human embryos. Nearly all other European countries have banned human genetic modification for ethical and social reasons. Consistent with this approach, the EU has banned research aimed at the development of both human genetic modification and reproductive cloning in the last two Framework Programmes.

### Designer babies

The reasons for the ban are compelling: whilst there are many other ways of avoiding genetic diseases, only genetic engineering can produce 'enhanced', 'designer babies', and that is where the real market will be. If we cross this line, we will create a consumer-driven eugenics, in which children will be treated as commodities and parents will compete to give their children genetic advantages over those who cannot afford the technology.

Although we now have 'public engagement with' rather than 'public understanding of' science, it seems that little has changed from the days of food scandals and the GM debate. We still have a science policy elite which listens only to scientists and a scientific establishment which not only manipulates science but is incapable of understanding the public's concerns. Get ready for the backlash.

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# The Fourth Deficit?

Steve Miller reflects on the BA Science Communication Conference

**One of the key challenges facing science communication today is to understand the relationship between those who carry out practical activities in citizen engagement, and researchers in the field known variously as public understanding of science, science in/and society, and so on.**

Clearly the British Association for the Advancement of Science sees this as an important issue. In his opening address to the recent Science Communication Conference, the BA's Chief Executive Roland Jackson set out seven challenges for the assembled delegates. Jackson's plea – in Challenge Number Six – was to bring practitioners and researchers to some level of understanding: for practitioners to understand what was relevant in the research; for researchers to pay more attention to the practice and why it is as it is.

How, then, are we to understand the speech given to the same conference by Professor Steve Rayner, who leads the Economic and Social Research Council's *Science in Society* programme?

## Questioning communication

In his talk, Professor Rayner identified three stages in the recent relations between science and ordinary citizens, at least as they were seen by the scientific and science communication communities. These three stages were each associated with a perceived deficit: a deficit of knowledge, a deficit of appreciation, and a deficit of trust. In each case, Professor Rayner claimed, the scientific community and other powers-that-be proposed that the solution was a communication strategy; and in each case, according to Professor Rayner, the communication strategies 'failed'. So, he concluded, communication could not be the answer.

So what, then, for science communication? Given Challenge Number Six, how does any of the academic research carried out under the auspices of the ESRC relate to or inform science communication? Does it have a future, or should those involved in public engagement and information pack up their bags?

The conference was not provided with an answer. Perhaps Professor Rayner had identified a fourth deficit – the deficit of *social* science knowledge among science communicators – and had decided that any communication strategy between his social

science research colleagues and the practitioner community was also doomed to fail. If so, this is a rather bleak outlook for Roland Jackson's Challenge Number Six.

But does it have to be like that?

## Research can inform practice

For a start, many of those attending the conference – presumably people who define themselves as having something to do with science communication – already show a clear interest in more theoretical aspects of the area. Of 125 attenders who were surveyed, 45 per cent said that they read one or both of the main academic journals *Public Understanding of Science* and *Science Communication*, at least occasionally. Including the BA's own policy-orientated publication *Science & Public Affairs* brought the journal readership up to 58 per cent. So Jackson's Challenge Number Six should fall on fairly fertile ground. Why, then, drive a wedge between the 'thinkers' and the 'doers' in this rather unhelpful way?

In a recent paper in the journal *Public Understanding of Science*, Martin Bauer, Nick Allum and I looked briefly at the history of research in the science and society field.<sup>1</sup> We, like Professor Rayner, identified three stages and the accompanying perceived 'deficits' and the strategies designed to overcome them. And we had our criticisms of all of them.

But that did not lead us to a counsel of despair. Instead, we argued that opening up the agenda to combine quantitative research, such as the regular Eurobarometer surveys, with qualitative indicators, could help to identify the cultural climate for science and associated communication activities.

For example, science communicators planning a major science festival or other event could make use of the survey data to pick up on changing attitudes towards various branches of science, as well as getting an idea of the extent to which scientific concepts have penetrated into general culture. There is a whole spectrum of social science techniques – from the large-scale surveys to small focus groups, from overall media monitoring to detailed content analysis – that can inform practical activities.

So we concluded that there are now real opportunities in science and society/science communication to move the research agenda forward in ways that are relevant to, and



Thinkers and doers: research on the gorillas at Paignton Zoo enabled the zoo to communicate better with visitors *Paignton Zoo*

benefit, those involved in practical public engagement. Let's take them!

1. Martin W. Bauer, Nick Allum and Steve Miller, 2007. What can we learn from 25 years of PUS survey research? Liberating and expanding the agenda. *Public Understanding of Science* 16, 79-95.

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## Steve Rayner responds to Steve Miller



**The early twentieth-century philosopher and sociologist Alfred Schutz coined the phrase ‘reciprocity of perspectives’ to describe the common assumption among parties to a conversation that they share at least some basic common understanding of what is being said. Professor Miller’s reflections on my informal address to the ESRC-sponsored reception at the BA Science Communication Conference may be a timely reminder that this assumption is frequently misplaced.**

### Straw man

I find it hard to identify myself with Professor Miller’s somewhat sniffy caricature of my remarks, none of which was intended to ‘drive a wedge between the “thinkers” and the “doers”’ (having myself spent a considerable slice of my life as a doer on behalf of the US Department of Energy). I am particularly puzzled as to why he identifies me with a fanciful argument about ‘a deficit of social science knowledge among science

communicators’, which I simply did not make. Setting up a straw man to knock down hardly seems to exemplify best communication practice, which, ironically, was one of the issues that I addressed in my talk.

Indeed, my starting point was the overwhelmingly positive observation that nothing in the six-year long ESRC Science in Society Research Programme justified the fears, frequently expressed at the highest levels of our government, that Britain is in the grips of anything resembling an ‘anti-science’ or ‘anti-innovation’ culture.

Along the same lines, my description of the three versions of the deficit model of science communication that have emerged over the past couple of decades was intended to challenge a particular view of science communication that sees it as a solution to what appears to be a non-existent problem – that of an imagined pervasive public attitude of hostility to science. Survey results repeatedly show that science and technology are immensely popular in Britain and its practitioners enjoy public esteem that should be the envy of civil servants or cabinet ministers. The idea of a general crisis of public confidence in science and technology fed by an anti-science culture turns out to have been something of another straw man.

### Governance not communication

I went on to argue that in cases of public concern about specific issues or technologies, such as GM crops, science communication has demonstrably not assuaged that concern because its roots usually lie in issues of governance – not of information. Therefore, more science communication cannot be the solution to such problems.

In fact, some research in the USA suggests that higher levels of public understanding of science are associated with increased concerns about its impacts and governance. In light of these insights, it is reasonable to ask whether an emphasis on science communication may even serve to distract attention from the necessity of both political engagement and reform of the institutions responsible for both science in governance and the governance of science.

The ESRC Science in Society Programme has been careful to distinguish between science communication and public engagement in governance, which was explored in another

strand of the programme. Professor Miller appears to conflate the two when he asks, ‘Does it [science communication] have a future, or should those involved in public engagement and information pack up their bags?’

### No despair

Of course, communicating science and information about science are vital activities in a modern technological society, hence the ESRC programme’s keen interest in exploring what we call popular ‘science connoisseurship’.<sup>1</sup> In my remarks I drew attention to eight research projects that the programme supported under the heading of ‘novel modes of science communication’.

These focused on topics as varied as how zoos and science museums communicate science to visitors; how technical experts, local government and members of the public communicate with each other in pursuit of local air quality improvements; how venture capitalists obtain information about cutting-edge science and technology; and how the public perceives scientific and technological risk.

Far from driving a wedge between researchers and practitioners, all of these projects draw on the experience of practitioners and provide fertile insights of practical benefit to those actually engaged in the communication of science in everyday practice. Admittedly this research doesn’t offer much ammunition for arm-wavers complaining about anti-science culture, but it is a far cry from the straw man ‘counsel of despair’ that Professor Miller attributes to me.

1. P. Healey (2004), Scientific connoisseurs and other intermediaries: mavens, pundits and critics. Report of an ESRC Science in Society Workshop. ESRC Science in Society Programme, Oxford

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# Freefloating, misdirected and perpetual

Frank Furedi, Christopher Hayes and Megan McArdle consider the nature of fear

## Fear has an independent existence

It makes us passive and vulnerable, says Frank Furedi

**One of the distinguishing features of fear today is that it appears to have an independent existence. Fear itself, rather than what it responds to, is a distinct problem of our times.**

Classically, societies associate fear with a clearly formulated threat: the fear of death, the fear of a specific enemy or the fear of hunger. In such formulations, the threat was defined as the object of such fears. The problem was death, illness or hunger. Today, we frequently represent the act of fearing as a threat itself. A striking illustration of this development is the fear of crime. Today, it is conceptualised as a serious problem that is to some extent distinct from acts of crime.

Fear is now represented as an autonomous cause of illness. If people feel that their health is at risk, then this fear is often seen as a risk to people's wellbeing. The legal system in the US and the UK has also internalised this trend and there is a discernible tendency on the part of courts to compensate fear, even in the absence of a perceptible physical threat.

### Floating risk

Treating fear in this way is associated with a growing tendency to conceptualise risk as an independent variable. Instead of being associated with one area of life, it has more of a freefloating and unpredictable character.

For example, constant claims that this or that hurricane, flood and other natural disasters are symptoms of global warming has the effect of altering perceptions and fears of such events. Fear floats into new territory because, since 9/11, normal hazards can be turned into exceptional threats by associating them with the action of terrorists. As a result we do not simply worry about the hazard posed by a nuclear power station; we also fear that it may turn into a terrorist target. This is less an outcome of an increase in the capabilities of terrorists than in the growth of competitive claims about what to fear.

The emergence of the 'at risk' concept ruptures the traditional relationship between individual action and the probability of some hazard. To be at risk is no longer only about what you do or the probability of some hazard impacting on your life – it is also about who



Fear of crime is now distinct from acts of crime

you are. It becomes a fixed attribute of the individual, like the size of a person's feet or hands. This suggests that fear confers identity.

To be at risk assigns to the person a passive and dependent role. Increasingly, someone defined as being at risk is seen to exist in a permanent condition of vulnerability. This stands in sharp contrast to the formidable

powers attributed to the everyday challenges that people confront.

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# Fear misdirected

We fear the wrong things, argues Christopher Hayes

**The problem isn't so much fear *per se*, though it can be debilitating to the health of a democracy. It's fear of the wrong things. There are threats out there, either to the nation or its individual citizens, and if those threats are real, relatively likely, and preventable, then it seems prudent to do something about it. The problem is that so much of our fear has been misdirected over the last six years, to disastrous effect.**

To take but one example, we launched a massively expensive and deadly war to counter weapons of mass destruction that didn't exist, while simultaneously underfunding the existing programs to decommission the stockpiles of nuclear fuel that have now spread through the former Soviet Republics in largely unguarded facilities.

## Costs of misplaced fear

In his new book, *Overblown: how politicians and the terrorism industry inflate national security threats, and why we believe them*, John Mueller points out that inaccurate assessments of risk and misplaced fear have

profound, even deadly, costs.<sup>1</sup> And nowhere is this more evident than in our so-called War on Terror. In his book *The one percent doctrine*, Ron Suskind describes a rubric that Vice President Dick Cheney devised in the first uncertain days after the 9/11 attacks to evaluate threats.<sup>2</sup> If there was even a one per cent chance of some massive attack, the government was to act as if it were a certainty, hence the title of the book.

From an actuarial perspective, this is deranged. In computing potential risk you multiply the likelihood of an uncertain event by its potential damage to arrive at an expected cost. If you simply assume that something is certain because it is potentially very damaging or costly, you end up with, well you end up with a 1-2 trillion dollar war waged over weapons of mass destruction that don't exist.

'A threat that is real but likely to prove to be of limited scope has been massively, perhaps even fancifully, inflated to produce widespread and unjustified anxiety,' Mueller writes. 'This process has then led to wasteful,

even self-parodic expenditures and policy overreactions.'

## Worthwhile goals

Consider for a moment what risks and threats that money could have been spent on: it could have offset the possible economic disruptions that might ensue from a move towards Kyoto-style reductions in carbon emissions. It could have paid to decommission every single bit of unused nuclear fuel in the world, or for health insurance for the uninsured, or simply ensured every American has access to a flu shot in order to prevent some of the 20,000 deaths every year due to the virus. But then, it's hard to win an election waging a War on Phlegm.

1. (2006), Free Press

2. (2006), Simon and Schuster

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# Nothing new

Terror is the near-perpetual state of mankind, laments Megan McArdle

**Consider this passage from science-fiction writer Robert Heinlein: 'Brace yourself. In 1900 the cloud on the horizon was no bigger than a man's hand—but what lay ahead was World War I, the panic following it, the Depression, Fascism, World War II, the Atom Bomb, and Red Russia. Today, the clouds obscure the sky, and the wind that overturns the world is sighing in the distance.'**<sup>1</sup>

Heinlein was writing in 1950, those halcyon days before the Cold War, AIDS, terrorism, and the death of modern morals. They were, apparently, terrified – and, like us, looking back to an earlier, simpler era when everything was still all right. It is probably no accident that in almost everyone's mind, the peaceful days of plenty are conveniently located in their childhoods, when they didn't have bills to pay or careers to angst over.

## Comparing happiness

Human beings tend to rate their state of mind compared to their immediate past, or how happy their neighbours seem to be, and they expand or contract the scale according to their

own life circumstances.

Dan Ariely, a behavioural economist and a major burn victim, has written movingly about his own experiences, noting how hard it is to compare his happiness to that of others: '... there is no way that I can convince myself that I am as happy as I would have been without the injury. There is not a day in which I do not feel pain, or realise the disadvantages in my situation. Despite this daily awareness, if I had participated in a study on wellbeing and had been asked to rate my daily happiness on a scale from 0 (not at all happy) to 100 (extremely happy), I would have probably provided a high number, probably as high as I would have given if I had not had this injury. Yet, such high ratings of daily happiness would have been high only relative to the top of my privately defined scale, which has been adjusted downward to accommodate the new circumstances and possibilities.'<sup>2</sup>

Thus, while it is possible to show that ratings of happiness are not influenced much based on large life events, it is not clear that we feel that happiness equally strongly.

## Look for possibilities

I'd like to deliver an inspirational message about how we should stop looking for things to be afraid of, and start looking for possibilities. So I have a modest proposal.

Everyone should focus on telling Americans that being afraid will give them forehead wrinkles. It's probably true. And if we're going to tell everyone to get hysterical about something, it seems only right that we should pick something we can cure with monthly trips to the dermatologist.

1. Robert Heinlein (1993). *Expanded Universe* New York: Ace Charter, pp 349-350

2. Dan Ariely, *Painful Lessons*.

<http://web.mit.edu/ariely/www/Papers/myypain.pdf>

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# Codes of ethics for scientists

Nigel Praities hears some dissenting voices

**Brilliant, blue-eyed physicist, Jan Henrick Schön, was poised to become the youngest ever Co-director of the prestigious Max Planck Institute before his dubious methods were brought to light. Although regarded as one of the most promising and prolific researchers of his generation – publishing about 80 papers on nanoelectronics in two years – he was found to have falsified and fabricated data by an independent committee, and was fired by Bell Laboratories in 2002.**

While this audacious act of fraud shocked the physical science community, there was little evidence of any soul-searching to prevent this happening again. Rather, Schön was presented as a tragic, misguided figure; but not representative of the state of science itself. Yet these events, and the even higher profile fall of cell biologist Woo Suk Hwang in Korea last year, have raised questions about how widespread misconduct is in science and whether we can trust scientists to behave ethically.

The UK government has sought to address this question, with a proposal from the Council for Science and Technology for a new *Universal Code for Scientists*.<sup>1</sup> This code has been largely welcomed by the scientific community, but some have voiced concern that it is too simplistic and is unlikely to be effective.

## A 'useful framework'

The government's code broadly covers three main areas: research ethics, reflection among scientists on the implications of their work and communication with the public. The code is designed to be a basis for discussion and to 'raise awareness' of ethical issues in science.

## In the increasingly competitive environment of science, can this code address the considerable pressures on scientists to get results?

'The public increasingly demands that scientific developments are ethical and serve the wider public good, as evidenced by the debate on stem cell research,' said Sir David King. 'The code has been developed in my office to help us meet this challenge.' In



Unease about the pharmaceuticals industry, amongst others

March of this year, as part of National Science and Engineering Week, King issued a challenge for scientists to adopt and help promote the code.

The code is regarded as a 'useful framework' for scientists to develop their own codes and 'has considerable value as an educational and awareness-raising tool to ensure that scientists are reminded of their legal and ethical responsibilities,' said Professor Martin Taylor, Vice President of the Royal Society. In addition, the Royal Society of Engineers has already used the code to develop a *Statement of Ethical Principles* for professional engineers.<sup>2</sup>

As a research scientist in the Department of Physiology at University College London, Dr Frances Edwards regards the code as 'common-sense: intrinsic things that make good science. But I can't imagine myself being in the situation where I would say "Shall I do this or not? I had better look at the code!"' She thinks that it is more useful for undergraduate science students and the public to understand that these principles are 'part of your training and your general personal ethics as a scientist'.

King also believes that the code can be used to guide young researchers and, in the longer term, he would like to see it included

in the school curriculum, thereby helping to instil in young people 'the values embedded in the code long before they enter the workplace'. However, is it naive to assume that these principles are second-nature to scientists? In the increasingly competitive environment of science, can this code address the considerable pressures on scientists to get results and publish, conditions blamed for both Hwang and Schön's unethical behaviour?

## Misconduct in science

'The code suggests that misconduct occurs simply because people are naughty. But basically people are in an equilibrium with their environment,' says Dr Ronán Conroy who is an epidemiologist and member of the Ethical Committee at the Royal College of Surgeons in Ireland. 'In an environment which is being increasingly driven by commercial pressures and vast sums of money to be won or lost, it is no longer a cricket pitch.'

The amount of misconduct in science is hard to measure, but one recent study of 3,247 early and mid-career researchers showed that that one in three admitted committing some form of misconduct during the previous three years.<sup>3</sup>

'I think that the corruption in science is

unwitting rather than witting, but I do think that it is widespread,' says Conroy. 'For example, the sidetracking of medicine by the pharmaceutical industry, and the massive sums of money spent on cosying up to the medical profession, compromise the integrity of medical research.'

## A recent review of 342 clinical trials showed that reported outcomes were significantly more likely to be positive if funded by for-profit organisations

Clinical trials funded by pharmaceutical companies are better funded and designed, but are often strategically positioned to show a particular drug in a better light. A recent review of 342 clinical trials showed that reported outcomes were significantly more likely to be positive if funded by for-profit organisations.<sup>4</sup> These subtle, corrupting influences are much harder to identify than the blatant fraud of Schön or Hwang, and are not addressed by the new code.

### Enforcement of the code

Known as the 'pride of Korea', Hwang was a respected scientist and a national hero in his homeland in 2004. But the whiff of unethical behaviour around Hwang's practices led to the discovery of the greater stench of fraud in his closet. Allegations that his female researchers had been coerced to donate eggs for research were published in the journal *Nature*, leading to further revelations that staff were encouraged to counterfeit results and that his data on cloned human embryos were fake.

A written code of conduct for scientists may provide greater encouragement for researchers in a similar position who wish to whistle-blow and report dubious lab practices. Yet, King's code is entirely voluntary and there is no mention of how to encourage good behaviour in science.

Professor Steve Fuller, a sociologist at the University of Warwick, argues that this lack of teeth means that the code is unlikely to have an effect on scientific misconduct. 'King's code is just a paper tiger,' says Fuller. 'If you had a serious code you would define misconduct in operational terms. You could then identify who had committed the offence and do something about it.'

Including stringent definitions of misconduct, such as the submission of fabricated or duplicated data, would enable

## @ a glance...

The UK government has drawn up a new *Universal Code for Scientists*

This code has been largely welcomed by the scientific community

It is also criticised for lacking teeth and being unlikely to have an effect on scientific misconduct

It does not address corrupting influences which are harder to identify than fraud

It is debatable whether this code will bolster trust and prevent misconduct

greater clarity and could enable the code to be policed by a public body. This is common in other areas of society which are self-regulated, for example the Press Complaints Commission for the media, or the Association of the British Pharmaceutical Industry for drugs companies.

However, it could be debated how effective this type of control is in curbing bad behaviour or building public trust in the media or the pharmaceutical industry. Fuller admits that this approach has a major drawback in the case of science: 'If you have a real, professional code with sanctions, it could end up removing trust from science.'

### A PR gimmick?

Perhaps the problem with the code is that it is more a list of value statements than a code of conduct. It assumes high-profile cases of fraud, such as those committed by Schön or Hwang, are the result of science going wrong, rather than a product of the way science works itself. 'It looks to me like a PR gimmick,' says Fuller. 'I think that King probably thinks that we are fine and the problems with science are outside of it.'

## The code assumes that high-profile cases of fraud are the result of science going wrong, rather than a product of the way science works

It is reasonable to assume that most scientists are honest, but Schön and Hwang highlighted some cracks in the august façade of science. They exposed the pressure to publish results and the weaknesses of the peer review process as a regulatory mechanism. These may reflect more

fundamental flaws in the structure of modern science. Papering over these cracks with some weak value statements is unlikely to stop them from appearing again in the future.

The privileged position of science in our society depends on continued public trust in scientists and their work. This remains at a high level, with 70 per cent of the public trusting that scientists tell the truth, compared with 23 per cent in the case of government ministers. But it is debatable whether this new code for science is the tool to bolster this trust and prevent misconduct. That largely depends on whether Schön or Hwang really were two bad apples, or signs of a wider disease within the heart of science.

1. Department of Trade and Industry. *Universal Ethical Code for Scientists*. See <http://tinyurl.com/3dvyeu>

2. Royal Society of Engineers, *Statement of Ethical Principles*. See [www.raeng.org.uk/news/releases/pdf/rae\\_statement\\_of\\_ethical\\_principles.pdf](http://www.raeng.org.uk/news/releases/pdf/rae_statement_of_ethical_principles.pdf)

3. Martinson et al. (2005), *Scientists behaving badly*. *Nature*, 9, 435 (7043): 737–8

4. Ridker PM and Torres J. (2006), *Reported outcomes in major cardiovascular trials funded by for-profit and not-for-profit organisations: 2000-2005*. *JAMA*; 295: 2270-2274

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# Water, yuck and consultation

Stewart Russell describes an Australian experience



As reservoirs run dry, inland Australian towns like Goulburn have been considering water reuse schemes

**Australia is suffering one of the longest droughts in living memory. In spite of our wet summer, we may soon have to consider the techniques Australians are turning to as part of better integrated water management strategies. One of these is reusing highly treated wastewater.**

Australia's experience introducing its first water recycling schemes has been far from straightforward, not least because of public reactions to some proposals. It holds valuable lessons on how we understand public responses, and on the need for utilities and authorities to undertake serious consultation when planning new systems.

## A yuck factor?

Australia already has several hundred schemes using reclaimed water. Most are small systems irrigating golf courses and sports grounds, but the list includes several large pioneering ventures for industrial and agricultural applications or supplying new suburbs through dual-pipe networks. Overall, though, recycling still makes only a small contribution compared to its acknowledged potential.

Among a public already responding conscientiously to water restrictions, and finding ingenious ways to save, there is widespread acceptance of the idea of recycling, at least for uses like watering gardens and flushing toilets. But research consistently shows a more cautious response to applications where personal contact is more likely. Not surprisingly, the level of

concern has been highest where there have been proposals for supplementing drinking water supplies in inland towns where the reservoirs are nearly empty – notably in recent times in Toowoomba, Queensland, and in Goulburn, New South Wales. In a referendum last year Toowoomba residents roundly rejected a planned potable reuse scheme.

Popular discussion assumes these objections are explained by a 'yuck factor' – people cannot get past their disgust at the association with sewage. For some commentators, it reinforces their frustration that people are incapable of making rational judgements and are not persuaded by expert assessments of the health risks. The disgust explanation has been reinforced by psychologists who claim to demonstrate that, in the formation of attitudes, our emotions dominate our beliefs and values.

Much can be said about the adequacy of the yuck explanation, but most worryingly it offers little guidance on how people's responses might change. Paradoxically, its proponents swing between despair that this gut reaction will be impossible to counteract, and calls for more effort to educate and persuade: perhaps people will see the light if they are provided with more facts and figures, or they will overlook the link with sewage if we find the right euphemisms and avoid pushing the wrong buttons.

## Understanding before attitudes

Our experiments with integrated information and discussion sessions on recycling in different Australian communities has convinced us that opportunities for deliberation are crucial. People need to learn about the systems – disgusting aspects and all – to discuss the issues, and to develop their views in interaction with others and over time.

This is a point both about understanding people's reactions and about engagement with them. It makes little sense, like much survey work that tries to measure public acceptance, to take a snapshot of 'attitudes', without reference to the level of understanding people have developed. It is especially pointless when there has been almost no public education and dialogue. We can only understand people's complex and often ambivalent responses in the process of allowing them to grapple with the issues.

So we need consultation processes that allow understandings and views to develop. With notable exceptions, the water industry and authorities in Australia have been reluctant to engage with the public seriously and early in the planning process. It will be the only way to build a robust public evaluation of recycling and its role in a sustainable water future.

## Need for consultation

In the wake of the disastrous rejection of the potable reuse plan in Toowoomba, many commentators bemoaned the media beat-up, the emotive slogans of groups like 'Citizens Against Drinking Sewage', and the failure of the public to understand the water treatment processes and the science that should have reassured them of its quality and safety. The yuck factor had triumphed. But we suggest the reaction owed as much to the lack of consultation, to the mistrust that a traditional 'decide, announce, defend' approach had reinforced, and to the siege mentality that gripped authorities as opposition emerged.

Nowadays the need for public consultation on infrastructure projects and sensitive scientific and technological issues is widely acknowledged, at least in the abstract. Its key principles have become almost a ritual incantation – transparency, openness, information, timeliness. The Australian experience with water reuse demonstrates they must be put into practice.

## Stewart Russell

works at the Institute for the Study of Science, Technology and Innovation at the University of Edinburgh. With colleagues from Wollongong and Cranfield Universities, he worked on social issues in the parallel European and Australian multidisciplinary projects on water recycling *AQUAREC* and *Oz-AQUAREC*. The project reports are available at [www.aquarec.org/](http://www.aquarec.org/) and [www.uow.edu.au/science/chem/aquarec/index.html](http://www.uow.edu.au/science/chem/aquarec/index.html) [stewart.russell@ed.ac.uk](mailto:stewart.russell@ed.ac.uk)

# Science and technology in the 2008 US Presidential elections

Henry Kelly lays out the issues

**US elections often seem to hinge on advertising budgets and the candidate's personality, hair style, and mannerisms. But the gap separating President George W. Bush and his Democratic opponents on substantive issues is now so wide and so visible that the 2008 elections are likely to provide an unusual platform for discussing important policy choices – including choices that hinge on matters of science and technology.**

## Not only Iraq

The debate over the US future in Iraq is likely to dominate the election debate. In a recent CNN Opinion Research poll, 88 per cent of adult Americans found Iraq to be either very or extremely important and 80 per cent felt the same way about 'terrorism'.

But there is also surprisingly strong interest in education (80 per cent), health care (78 per cent), and gas prices (74 per cent). Even global warming (53 per cent) and stem cells (48 per cent) were considered very or extremely important. And the issue of whether the Administration is suppressing or distorting federal scientific reports has received surprising levels of press attention.

When three of the candidates for the Republican nomination revealed that they don't 'believe' in evolution it made front page news – though it's disconcerting that anyone with such opinions would be taken as a serious Presidential candidate in a nation that owes its wealth and welfare to science and technology.

## No publicity

While the public may be interested in discussing these issues, it's not at all clear that the pundits advising candidates want to allow it. While a number of candidates have nuanced views and strong records in science and technology issues, it is often difficult to learn this from a review of standard stump speeches and candidate websites.

John McCain (R-AZ), for example, has a strong record on climate change. He resisted opposition from his own party to hold thoughtful hearings on the subject and introduce a serious bill on carbon cap and trade, along with Senator Lieberman. Yet his campaign materials seldom mention his

achievements on these issues.

The scientific community should be pleased that a surprisingly strong bipartisan agreement has emerged about the need to increase research spending – at least in the physical sciences – driven by concerns about the future competitiveness of the US economy. Yet, the issue is virtually invisible in the campaign thus far. Hillary Clinton is essentially alone in laying out a detailed programme to promote innovation.

The silence is not necessarily good news, however, since US research will be affected by the election's outcome. Will tax cuts make it impossible to fund the desired research spending? Will biological and health research continue to be cut? Will ideological restrictions continue to block stem cell research and tangle priorities in reproductive health?

## When three of the candidates for the Republican nomination revealed that they don't 'believe' in evolution it made front-page news

### Energy policy

One potential bright spot is that virtually every candidate has been forced to grapple with US energy policy. Even candidates who usually oppose federal intervention in the economy have proposed subsidies and other interventions that would encourage automobile fuel economy improvements and alternative fuels.

The issue of what Americans are really willing to pay to cut oil consumption and improve the environment can, at some point, only be resolved through elections. This may carry over into a genuine discussion of climate change. With luck we'll see someone elected with a mandate to make the tough decisions.

One problem, of course, is that the American public and much of the press corps has only a shaky grasp of many scientific concepts and an understandable fear of being misled. This fear has been cynically exploited by groups whose goal is to inject enough



Only elections will decide what Americans are willing to pay to cut the cost of oil consumption

distorted information into the public debate to create confusion and doubt, even when the scientific community has come to a clear consensus. Few reporters covering campaigns have strong science credentials, and prefer to treat disputes between candidates on technical matters as they would any disagreement about their opinions.

### Scientists and Engineers for America

Many members of the scientific community are justifiably concerned that the fog of election debate will make it all too easy for candidates to avoid taking thoughtful positions on a wide range of questions that hinge on issues of science. A group of Nobel laureates and other scientists (including myself) have formed an organisation called Scientists and Engineers for America. Its goal is to ensure that these issues are considered by candidates, and that their positions are easy to access and easy to understand. There is reason to be optimistic that we'll succeed.

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# Cultural change after Stern

We need to change behaviour, says Tim O'Riordan

**Last October's Stern Report on climate change was the latest warning that the point of potential disruption to planetary life support functions could occur above a global additional temperature increase of 2°C.**

This suggests that the maximum concentration of human-created carbon dioxide in the planetary atmosphere cannot exceed 450 parts per million by volume (ppmv), compared with about 385 ppmv today, and 270 ppmv in pre-industrial times. In essence, global 'greenhouse gas' emissions need to be cut by 80 per cent by 2050. This in turn means a 30 per cent reduction by 2020, and 50 per cent by 2030.

## Behavioural change

Although political establishments are beginning to recognise this, the Stern Report was not designed to promote cultural change. Somehow we will need to change the social and economic culture that thrives on high carbon living so that we can reduce emissions in a manner that does not cause social outcry and political fright. We require behavioural change because, even with the most advanced and successful technology improvements, they can only – at best – halve emissions in the timescales envisaged.

In the meantime, the scientific community needs to hold its nerve. The most likely immediate reaction by the vociferous elements of the public may be to question the science behind these climate change predictions. Right now the general point of view is to believe scientific judgments. But, so far, there have been no restrictions on how we consume, how much we drive or fly, and how to calculate the carbon that lies in the production, transport and disposal of all of the goods and services we buy.

How do we establish this social revolution?

## Practical measures

Here are some things we should do:

- Provide every household with a checklist of its energy and carbon budgets. The Department of Environment, Food and Rural Affairs ([www.defra.gov.uk](http://www.defra.gov.uk)) is now producing this, but to get it into the actions of every household will require serious civic engagement. Schools have a big role to play here.
- Ban all sales of fluorescent and incandescent light-bulbs by 2010. This could



Taping up: practical measure to reduce emissions

cut buildings-related energy use by 13-17 per cent by 2012.

- Change the rules of energy provision so it pays the generating companies to reduce demand, not to increase supply.
- Change the stand-by arrangements for all electrical products so that they automatically cut off in non-usage periods. This will require supporting regulation to require all electrical goods to have 'inactive' cut-off technology inbuilt (if new goods) and refitted (if existing goods).
- Via schools, via reality television, via social groups such as the church and the scouting movement, and via community-run programmes such as community carbon challenge, encourage citizens to sign up for carbon reduction targets to their lifestyles. This could be enhanced by setting a deadline of 2012 after which it would be illegal to put a property on the market unless it meets a certain level of energy efficiency and carbon reduction. Such a scheme would encourage job training and job creation in low income neighbourhoods to enable neighbours to install insulation, efficient heaters and renewables technology to low income and poorly insulated homes. All of this would increase property value, add to the life of the home (or commercial property) and create thermal comfort for residents.
- Design into the benefits system an arrangement for grant aid to undertake these audits and to meet the necessary costs of upgrade. The cost of this should come from

a carbon levy, thereby meeting the sustainability provision of paying one's way.

- Launch a major, national campaign of civic virtue around low carbon living. This would create the necessary social support for a carbon levy and establish an element of tolerance over avoidable carbon usage in air and road travel, where the technological and carbon removing options are fewer and more uncertain.
  - Begin the process of establishing a carbon debit card scheme. This would eventually lead to a personal carbon allowance. Such a scheme would enable everyone to trade excess and unneeded carbon allocations via an internet market (with scope for purchase by those not familiar with the internet). To introduce a carbon debit card will require much social preparation (and plenty of care over the technology, social fairness, and anti-fraud arrangements). Hence it should only come in at the end of this sequence of transformations.
- It may not be possible to establish a low carbon culture by 2030. But all the signs are that we should seriously try, for otherwise we will enter into uncharted planetary waters.

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# Blogging science

Sarah Tomlin lurks in the ether

**First, some confessions. I am not a blogger. I fear I would not have the stamina to blog with the frequency most bloggers achieve. Worse than that, I lurk. This is blogging jargon for people who visit blog sites to read the posts but never leave a comment themselves. I realise this is considered rude because I am not sharing in the conversation. But I don't like to think of myself as a lurker: I'm more of a hit-and-run reader. I just don't hang around long enough to post a comment.**

So why do I read science blogs? As a journalist I am always on the lookout for news leads, and blogs are a window into academic coffee room chatter of the sort the media is not normally privy to.

But the biggest draw is finding communities with niche interests – be they bird flu, climate change, cosmology or medical ethics – that inspire not just media but also great public curiosity. And blogging is by nature a very public activity: there are now more than 70 million blogs, with new bloggers voicing their opinions every minute. Scientists who blog are a small but growing minority in this sea of online chatter.



Immediate access to readers

## Easy access

Blogging has existed in one form or another ever since Internet users built websites they could update themselves. But what made blogging an Internet phenomenon was technology that made reading and keeping up to date with such websites much easier. By using 'syndication feeds' (rss and so on), bloggers can deliver new content directly to their readers. And by using a 'feed aggregator' readers can keep track of their favourite blogs and organise their feeds in a way that makes it easy to scan them over morning coffee.

Once bloggers and their readers became connected in such an instantaneous way, the evolution of online communities, including the science blogosphere, was inevitable.

## Blog categories

As a reader, I divide the existing science blogosphere into roughly five different categories.

There are single issue blogs, written by scientists who care deeply about one issue, from tracking the intelligent design debate to regular updates on bird flu. There are group blogs, written by groups of scientists with overlapping interests who share the blog duties between them. There are insider blogs written, sometimes anonymously, by scientists from inside a large organisation, whether a drugs company or a government lab. And there are event blogs tied to a specific scientific event or expedition, such as the many excellent blogs written by scientists from the British Antarctic Survey. Finally, there are blogs that exist to provide media analysis, and to debunk bad science reporting by the mainstream media.

## Specific sites

Some blogs combine two or more of these features. The RealClimate blog is a group blog focusing on climate change, started with the aim of providing a quick response from climate scientists to new climate stories in the media and 'to provide the context sometimes missing in mainstream commentary'.

According to Gavin Schmidt, a NASA scientist and RealClimate blogger: 'RealClimate fills a hunger for raw but accessible information that goes deeper than newspaper articles, but is more easily understood than the scientific literature. Magazines fill a void, but they can't react or

interact as effectively as a blog.'

The media itself is also getting into blogging, with blogs written by journal editors and science writers jostling to share the same space.

**Blogs are a window into academic coffee room chatter of the sort the media is not normally privy to**

## Starting off

All this can be confusing for the blogosphere newbie. If you're unsure where to start, a good place to get a feel for the activities of science blogs is scienceblog.com. This easy-to-navigate website brings together 60 science blogs spanning social and science issues, including the popular Pharyngula blog written by Paul Myers, a biologist at the University of Minnesota. Myers writes frequently about the intelligent design movement and, explaining the appeal of blogging, says, 'A blog's more like the conversation you'd have at the bar after a scientific meeting.'

Another easy way to find blogs is to use a search engine. Both [www.technorati.com/blogs](http://www.technorati.com/blogs) and [blogsearch.google.com](http://blogsearch.google.com) specialise in helping you to navigate the blogging universe. And when you find a blog you enjoy reading, you can easily discover other blogs by checking out the 'blogroll' – this is a list of other sites the blogger says they like to read, usually a list of their blogging friends.

Still unsure about the blogosphere? My advice is to go try it for yourself. Just remember it's okay to lurk, but you should never, never become a troll.<sup>1</sup>

1. A troll is someone who intentionally posts derogatory or otherwise inflammatory messages about sensitive topics to bait users into responding.

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# Possibly the last science book prize

Jon Turney pleads for its survival

Last year, the Royal Society announced it was looking for a new sponsor for its science book prizes. But answer came there none. The 2007 awards – one for adult titles, one for children's books – went ahead on a reduced budget (there was champagne at the awards, but no dinner). But, having got by for a year on residual cash from its former sponsor, The Aventis Foundation, and some clever internal accounting, there is now nothing left to eke out. The Society still needs a new funding pledge if the 2008 prize is to happen.

This is a surprise all round. Book prizes are thick on the ground, with around 300 in the UK alone, but few cater at all for non-fiction. The big prizes seem to keep big sponsors happy (Man for the Booker prize, Costa coffee taking over from Whitbread for their award). And the science prize, which has just notched up its twentieth winner, is a going concern which just needs the right funder's name stitched into the logo. Despite reports that the popular science publishing boom has faded, entries are still strong – with new

publishers appearing each year – and sales of shortlisted titles compare well with other prizes, according to the Royal Society.

So where's the problem? Well, promoting and managing a high-profile prize – and keeping the high profile – can come expensive. The Booker winner gets £50,000, but the Man group spends £1m a year altogether on the UK prize and the new Man Booker International Prize. Prize money for the Royal Society awards totals £30,000.

**Like any prize, it is also a great starting point for discussion about whether the judges got it right**

#### Drugs company support

At the same time, the big science-based companies may be a tougher target these days. Drugs companies have been the mainstay of the science prize. The award began life as the Science Book Prize, then

became the Rhone-Poulenc Prize in 1990. When the company merged with Hoechst in 2000 the name was changed to the Aventis Prize, to match the new corporation.

The final shift was to support from the modestly-endowed Aventis Foundation in 2004, though this didn't require another name change. But it means that really just one company has been involved all along.

#### Everyone's a winner

But surely promoting science books in this straightforward way is a worthy cause for someone? Everyone benefits from the body of work which has been laid down by science writers these last few decades. You could say that never has so much science been so well explained in so many ways. The titles on offer are getting more diverse, as well as more

numerous. So if the three million people who bought Bill Bryson's 2004 winner, *A Brief History of Nearly Everything*, are wondering where to go next, the prize can help.

Of course, like any prize, it is also a great starting point for discussion about whether the judges got it right. Was Daniel Gilbert's *Stumbling on Happiness*, this year's winner, really a more satisfying read than Chris Stringer's *Homo Britannicus*? Did Stephen Hawking win the prize in 2002 because *The Universe in a Nutshell* was a good book, or for being Stephen Hawking? (My answers: no, no, and yes.)

#### Investing in young scientists

OK, so maybe it has not always generated the publicity enjoyed by the fiction prizes. Even the science prize's moment of political edginess, when 2006 winner David Bodanis donated his winnings to David Kelly's family, got surprisingly little press. But it does get support from bookshops and libraries. And the companion prize for children's books, which involves a large panel of young readers in the judging, is equally important for furthering the cause of good science communication. As Miriam Farbey of winner Dorling Kindersley said at this year's award event, 'We at DK frankly don't care who wins this prize. We just think that in the tough commercial environment of children's non-fiction publishing it's fantastic to have events like this that remind us how important it is to invest in young scientists.'

All of which suggests what a shame it would be if the prize were to falter after two decades, as well as a sad comment on science's place in literary culture. The word is that the Royal Society have lowered their target a little for the size of the pledge which would keep the show on the road. So – offered: one book prize. One careful owner. Good runner. Going cheap. Any takers?



Short of money: this year's long list *The Royal Society*

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# Coming to London

Clive Cookson anticipates the World Conference of Science Journalists

**The world's science journalists will gather in London in 2009 for their sixth conference. The primary purpose of the meeting will be to enable science writers – and the communicators and PR people who enjoy a symbiotic relationship with them – to discuss issues of professional interest, from uncovering academic fraud to the embargo policies of research journals. But the occasion will also provide a glorious opportunity for the host city and indeed the whole of Britain to show off its scientific strengths to the international media.**

The World Conference of Science Journalists (WCSJ) is coming to London as a result of a bid prepared by the Association of British Science Writers. At the fifth WCSJ, held in Melbourne last April, the ABSW beat off a rival proposal by its Italian counterparts to take the conference to Trieste.

The 650 participants in Melbourne acclaimed that conference a great success, so London has a lot to live up to. An attractive feature of the Australian meeting was its liveliness – a consequence of appointing a 'producer' to organise each session as if it were a radio or television show. This format is likely to be repeated in London.

## Hobbit session

The best sessions in Melbourne blended top scientists with journalists who had led the media coverage of their research. My favourite was not about one of the big subjects like stem cells and climate change but 'Uncovering the hobbit, *Homo floresiensis*'.

This brought together Chris Turney and Bert Roberts of the University of Wollongong – two leading figures in the excavation and analysis of dwarf human remains on the Indonesian island of Flores – with Deborah Smith of the Sydney Morning Herald who had covered every twist and turn of the story. The controversy over whether the fossils represented a tiny new human species or *Homo sapiens* with a dwarfing disease came vividly to life. (The verdict was that the hobbit is indeed a separate species.)

## London in gear

London has much to organise in a relatively short time. At the time of writing, many of the key personnel are already in place. Julie Clayton of SciDev.Net is conference director, Ted Nield of the Geological Society is chairing



London in their sights

the steering committee in his capacity of ABSW Chairman, and Pallab Ghosh of the BBC plays a key role, as Chairman of the World Federation of Science Journalists. Fiona Fox of the Science Media Centre, who chairs the programme committee, aims to bring in some really big names from politics and the media to discuss scientific issues.

But most of the practical arrangements, including the location and timing, are yet to be decided. Previous WCSJ events have been in grand hotels. In Melbourne, everything took place on the third floor conference suite of the downtown Hyatt. This single centralised venue facilitated (or forced) friendly mingling of the delegates.

London hotel prices are so high that we may not be able to maintain that tradition. Academic venues could provide a tempting alternative: perhaps Imperial College and its neighbouring museums (Albertopolis) or UCL with the new Wellcome Trust buildings on Euston Road. The current aim is to hold a three or four day conference some time between April and July 2009; precise timing will depend on the price and availability of venues.

## Sponsors needed

A high priority is to find sponsors and raise funds. A financial obstacle faced by any conference aimed at journalists is that the media are accustomed to attending scientific and technical conferences – even those charging four-figure sums to other participants – free of charge. It is therefore

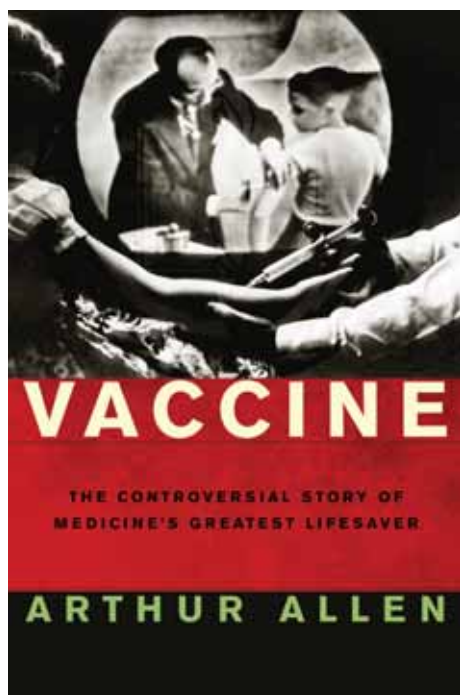
hard to get journalists (or their employers) to pay to attend a professional meeting. And most science journalists from the developing world, who benefit particularly from attendance at the WCSJ, cannot afford travel or accommodation in London, let alone a conference fee.

The Melbourne conference benefited from generous support from the state government of Victoria (whose sponsorship enabled me to attend) and the Australian federal government, as well as a host of other public and private sector organisations. We hope that their counterparts here will be as forthcoming, in the cause of supporting worldwide science communication.

Although the main point of the WCSJ is professional development rather than providing news stories directly from the conference itself, participants can expect a cornucopia of stories and feature material from visits and/or briefings that will be laid on for them before and after the main meeting, not only in London but elsewhere in the UK.

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# The difficult questions of vaccination



Weighing individual risk against social good

**An eminent scientist speaks out against vaccination. Public health officials insist that vaccines are safe. The public think otherwise and vaccination rates fall dramatically.**

No, this is not 1998. Exactly a century before gastroenterologist Andrew Wakefield raised concerns about a possible link between the MMR vaccine and autism, the British health authorities were grappling with another vaccine revolt.

## 'Baby hunters'

In the late nineteenth century, those failing to submit to vaccination faced fines and the workhouse. There were frequent public protests and the 'baby hunters', as the vaccinators were known, were pelted with eggs and fruit. Things came to a head in 1898, when parliament met to deliberate the findings of a Royal Commission on the safety and effectiveness of vaccination.

Lord Alfred Wallace, the naturalist who, along with Darwin, had proposed a theory of natural selection, published a pamphlet arguing that smallpox vaccine actually caused the disease. Parliament gave in and passed a new law permitting 'conscientious objectors' to be excused vaccination. Over the next fifty years, smallpox vaccination rates fell from 50 per cent to 18 per cent.

## Not only science

As journalist Arthur Allen's fascinating history makes clear, public anxieties about vaccination

## Felicity Mellor on enduring public anxieties

Arthur Allen, *Vaccine: the controversial story of medicine's greatest lifesaver* (New York: W.W. Norton, 2007)

are as old as the technique itself. Drawing both on original sources and scholarly analyses, Allen shows how vaccination, throughout its history, has been as much a political, social, economic, religious and even military issue, as it has been a scientific one.

A medical intervention in otherwise healthy subjects inevitably raised difficult questions. Should vaccination be compulsory or voluntary? Was mass vaccination always the best strategy, or were policies of containment, quarantine and selective vaccination preferable? How would the elimination of certain diseases from children affect the prevalence and progression of those diseases in the adult population? And – the most fundamental question of all – how could individual risk be weighed against the promise of a social good?

## Official denials

Public doubts about the benefits of vaccination were often not helped by technical difficulties with vaccine production or by public health officials' refusal to acknowledge these difficulties. In Philadelphia in 1901, contaminated smallpox vaccine led to an outbreak of tetanus. Doctors initially denied a link and blamed newspaper scare stories and the victims' own poor hygiene.

During the second World War, the only major epidemic to afflict the US army was vaccine-linked hepatitis. Sixty-two people died and over twenty thousand were infected. The authorities insisted that the hepatitis was spreading from the civilian population before finally identifying a contaminated yellow-fever vaccine as the source of the epidemic.

A measles vaccine tested in Britain in 1961 caused raging fevers in most of the children it was tested on. In a comment that must have given little reassurance to concerned parents, a US epidemiologist claimed that the importance of measles 'should not be measured by disability or deaths, but by human values.' The disease should be eradicated 'because it is there... and it can be done.'

## Modern protestors

Allen reveals the intransigence and arrogance

of some vaccinologists, but he also portrays the vaccine protestors of modern-day America as selfish individualists – middle-class mothers who claim that illness is healthy and that vaccination is merely a means for negligent working mothers to avoid having to stay home with their sick children.

Allen also makes clear that it is not a lack of education that prevents parents from vaccinating their children. Indeed, he finds that in Colorado a high concentration of PhDs is a risk factor for whooping cough. In at least one Colorado school, roughly half the children go unvaccinated.

## US v. UK

Allen details the occasions on which vaccines have been found to be unsafe, but his account also shows how each such incident prompted more regulation and oversight leading to ever-safer vaccines. His focus is firmly on the history of vaccination in the United States. There, the lack of government intervention in the vaccine market meant that, as regulation and litigation increased, many pharmaceutical companies abandoned vaccine production. Allen concludes that vaccines 'were square pegs that didn't fit into the triangular holes of market capitalism.'

From the US perspective, the Wakefield episode was just another blip in a long-running dispute about the link between vaccination and autism. To Allen, the UK offers an example of how vaccination can be better managed. In the UK, he notes, a more sceptical public is more fully vaccinated than in the US, Wakefield's intervention notwithstanding.

For many British scientists, the Wakefield affair seems to have become a shorthand for media irresponsibility and public gullibility. Anyone tempted to take such a simplistic view of attitudes towards vaccination should read this book.

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# How many experts does it take to switch students on to science?

Vanessa Spedding says we are missing a trick



Science for sustainability: a drawcard for students

**It's more than five years since Gareth Roberts published his much-cited review, which found serious shortages in the supply of people with high-level maths, physics, chemistry and engineering skills. Since then funding for science has increased. Energy and cash have been pumped into public engagement activities. People in departments formerly known as the DTI and the DfES collaborated on programmes to address the problem.**

Without doubt, encouraging results have transpired; we have new centres of excellence to further the skills of science and maths teachers (see *SPA* December 2006, p8), a new science GCSE and thriving science cafes and festivals across the country. Yet young people's interest in science and technology is still on the wane. Are these good intentions perhaps missing a trick?

## STEM graduates declining

Earlier this year, a report from the Council for Industry and Higher Education and LogicaCMG (see *SPA* June 2007, p8) revealed that behind the short-term growth in Science, Technology, Engineering and Mathematics (STEM) graduates is a progressive decline in those taking STEM A-levels – the next generation of graduates. The Confederation of British Industry has stated that the number of new science graduates will have to double by 2014 to prevent British employers looking overseas for recruits. The Campaign for Science and Engineering and the Association for the British Pharmaceutical Industry also regularly lament the situation.

This level of concern is shared at the top. Witness the summer reshuffle of government

departments that transmuted the DTI and the DfES into three new departments including the Department for Innovation, Universities and Skills (DIUS). It's no surprise that innovation, universities and skills are segments of the same umbrella, nor that science comes under it. While throwing himself into plans to meet the STEM skills challenge, Ian Pearson, the new Minister for Science, might do well to take note of another trend that has occurred in parallel with the decline, for it could contain a clue to that missing trick.

## Focus on 'why'

It happens also to be five years since 2000 students aged 16-19 revealed via a survey<sup>1</sup> that they were as interested in the 'why' as the 'how' of science. More than half wanted more emphasis on the moral and ethical implications of the science they were studying in the classroom.

## Students are calling on government to invest in scientific endeavour that is geared to creating a lasting future for life on the planet

Over that time, campaigning organisation Scientists for Global Responsibility (SGR) has reported a huge growth in interest in its project Ethical Careers in Science, Design and Technology<sup>2</sup>. Its Ethical Careers Briefings are flying off the presses and website despite minimal publicity; in the last year, around 7000 copies were ordered or downloaded. SGR is also invited to exhibit at dozens of university careers fairs where, suggest anecdotal reports, interest is keen and growing rapidly, with many science students turning their backs on the flashy displays and large salaries of commercial and military recruiters to find out how they can help the planet instead.

A survey of university applicants undertaken in June this year by the university clearing house UCAS and Forum for the Future<sup>3</sup> showed a very high level of interest in

sustainability issues and a strong desire for college courses across the board to address environmental concerns seriously. Of the 54,240 students surveyed, more than three-quarters expressed a belief that lifestyles would need to change radically for human civilization to survive into the next century. The survey left no doubt that environmental and social concerns and the opportunity to address them in their prospective careers shape student choices very strongly.

## Science for positive futures

Isn't it staring us in the face? More students will take science once they no longer perceive that so many scientific careers are concerned with exploiting the natural resources of the planet rather than restoring them. More students will take science if it encompasses science for sustainability (a subject, incidentally, that is taking off in the USA but still barely evident in the UK). More students will take science once they are confident their career options won't default to toeing the line in a corporate world where ethics may be compromised in pursuit of profit.

Those with ears to the groundswell can hear a student voice that is calling on government to invest in scientific endeavour – as both an academic activity and an economic sector – that is aimed at solutions of intelligence and maturity, not greed and short-termism: conflict resolution not war; resource management not resource grabs; appropriate technology not consumerist gadget-technology; knowledge and wisdom, not opportunism; that is, scientific endeavour that is geared to creating a positive, lasting future for life on the planet.

1. Science Year (2002). Young People Review Science Curriculum. See <http://tinyurl.com/2l32xu>

2. See [www.sgr.org.uk/ethics.html](http://www.sgr.org.uk/ethics.html)

3. UCAS and Forum for the Future (2007). Future Leaders Survey. See [www.forumforthefuture.org.uk/future/test\\_head\\_page499.aspx](http://www.forumforthefuture.org.uk/future/test_head_page499.aspx)

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# Climate change

M. D. Smith argues for mandatory curbs on emissions



Ecosystem destruction: cost of economic growth

## Dear Editor,

On climate change at least, Claire Fox aligns herself with the Washington free-market apologists for the Bush administration's intransigence on the issue (SPATalk, SPA June 2007). In arguing against mandatory caps on greenhouse emissions, Fox perpetuates a number of fallacies.

## Industrialisation: costs and benefits

Fox claims that the overall results of 200 years of industrialisation have been 'massively positive'. From a human perspective, it is undeniably true that the tremendous technologically-inspired economic progress since the industrial revolution has led to great advances in material wealth, public health and a host of other aspects of modern life.

Nonetheless, even in purely human terms there are costs to be set against the benefits. Industrialisation has, for instance, come with its own health problems, often brought about by exposure to the noxious products and by-products of industrial processes. In many countries (including the UK), rapid growth has not been reflected equally across the population and has driven a widening of the socio-economic divide. And by bringing about a divide between town and country, urbanisation has left the majority of city-dwellers disconnected from the production of the food they eat, unaware until recently of the costs of the intensification of the agriculture on which they depend.

## Planetary costs

It is at the biospheric and planetary scale, however, that the true cost of industrial economic growth can be seen. Fox, then, is surely wrong to dismiss so readily the enormous – and sometimes devastating – environmental impacts: of the chemical pollution of land, sea and air; of the destruction of habitats and ecosystems and loss of biodiversity; of the general degradation and uglification of the landscape in which we live. For a species accustomed to thinking of himself as master of all he surveys, the dawning realisation that nature can bite back comes as something of a shock.

Nevertheless, only a few on the extreme quasi-religious wing of the green movement would argue for a post-industrial return to some mythologised pastoral idyll. Yet at the other end of the eco-spectrum, Fox's blind belief in the capacity of human ingenuity to overcome the finitude of natural and economic resources is hardly more rational.

## Mandatory emissions curbs

Climate change is real, it is happening now and it seems to be accelerating. Only the most ostrich-like of sceptics can now deny the need to curb greenhouse emissions.

The hard-line ideologues in the Washington cabal and beyond can now be seen to be more concerned with preserving the wealth and lifestyle of the world's 'haves' than with improving the lot of the 'have-nots'. The

consequences of inaction may be catastrophic. The science, moreover, suggests that we need to act urgently: we may have no more than 10 years in which to avoid dangerous and irreversible changes in climate.

Given the size of the Western consumerist juggernaut, voluntary action is unlikely to be sufficient. Mandatory curbs on emissions for each and every one of us seem to me to be the only way to achieve the necessary cuts, whilst allowing development among the poorer nations. The curbs will need to be progressively tightened in the initial years, and supported by government help to meet them.

Emissions quotas should be complemented by a major and intensive drive to develop and implement new clean technologies. We also need a concerted international programme to halt destruction of the world's natural habitats and conserve its remaining species and biodiversity.

## Longer perspective

Our limited vision, a result of the youth of our civilization in relation to the vast age of the Earth, and our culturally innate anthropocentrism, have deceived us into attributing to the Earth and its climate a stability and benevolence it does not possess. Admittedly, the chances of a catastrophic, even apocalyptic shift in the global climate occurring in the next few generations are probably slim. Nonetheless, a longer view of history than our species traditionally adopts suggests that we would be unwise to dismiss the possibility.

We, *Homo sapiens*, need to rid ourselves of the illusions of our place at the centre of things, and of the hegemony of economics. We need instead to recognise and accept our species' interdependence with the intricate web of physical and biological systems that make up planet Earth. Then there may still be time to avert the environmental disaster that threatens to subvert our economies and wreak further destruction upon the biosphere. But time is short. We need to act in concert and with determination – and we need to act now.

M. D. Smith  
Selby, North Yorkshire

# Lies for our own good?

Tracey Brown worries about a trend



**Last year, a lot of my post began ‘How could you!’: ‘How can you live with future generations suffering [obesity, chemical sensitivity, alcoholism] because of your foolish comments?’**

The complaint was that I had asked chemical scientists to publicise their criticisms of ‘detox’ diets as we headed into yet another season of expensive but pointless New Year rituals. It was an opportunity to address mounting misconceptions about how our bodies function (they can be flushed of fats, like a drain; Christmas eating overburdens us with ‘toxins’, and so on). Scientists’ views of this detox fad – that it has no scientific rationale – were missing. They had become used to garbled pseudo-science in the lifestyle industry and made few moves to challenge it. The outraged reaction when they did has highlighted a strange tension about giving the public ‘the facts’.

Those who complained objected not so much to the facts, but to scientists publicising them. The head of a health store conceded that there was a lot of nonsense in the claims on remedies but, he argued, their broader message of getting people to focus on their health could only be A Good Thing.

## In a good cause

This response was hard to dismiss. It fits with an attitude creeping through health promotion and other policy areas, where the subtleties of evidence apparently get in the way of policy aims. With contentious stories of children over eating, warnings about

passive smoking, recycling targets that take no account of energy use and questionable dossiers on WMD, a growing range of officials and advocates invite us to endorse exaggerated public ‘messages’ about the evidence or overlook holes because, surely, we approve of the outcome?

Under this pressure, anyone who questions the evidence risks being accused of endorsing an opposite view, wanting people to be exposed to smoke, get fat, create landfill problems... or endure dictatorships! At the very least, insisting on the evidence is often dismissed as scientific pedantry or deemed ‘unhelpful’.

In 2005, the health writer Oliver Gillie published a critical review of the government-sponsored Sunsmart scheme (a campaign to prevent skin cancer through over exposure to the sun). Sun exposure converts cholesterol into Vitamin D, which our bodies then store. To get the requisite 90 per cent from sun exposure, Gillie argued, people in the UK need more exposure, not less. He was not surprised that this elicited strong reactions. What did surprise him was being accused not of a wrong calculation, but of ‘irresponsibility’ in raising it.

**The head of a health store conceded that there was a lot of nonsense in the claims on remedies but, he argued, their broader message could only be A Good Thing**

## Not quite Plato

Viewed ungenerously, the desire to maintain policy messages against further evidence sounds like a conspiracy of the enlightened: ‘We know it’s not that simple, but let’s not confuse the plebs’ – a modern incarnation of Plato’s Noble Lie. Unlike Plato’s Republic, however, which was to depend on a coherently constructed myth to hold society together, our noble lies are emerging accidentally through initiatives to improve our attitudes and behaviour – in health, environment, education and security. ‘Evidence-based’ policies in these areas seem to be generated without much regard for the stability or extent of the data,

perhaps because the need for action seems self-evident at that moment.

Maybe I’m being unfair. Public health advice, in particular, shouldn’t always change from one research finding to the next. As parents will testify, we can end up in an interminable ping-pong of studies: nursery school makes children aggressive/ helps children to be social and confident; television overstimulates children/makes them fat/is a social tool.

**Anyone who questions the evidence risks being accused of endorsing an opposite view, wanting people to be exposed to smoke, get fat, create landfill problems or endure dictatorship**

But having launched a policy initiative, what do you do about material that is now off-message? Accuse it of being unhelpful? The physicist Robert Park argued that this can set you on ‘the road from foolishness to fraud’. The road is travelled further when people who draw attention to misleading claims are berated for not playing along to get the ‘right’ social outcome.

## Good faith

It’s sometimes a tough call. But truth is the standard in scientific discourse and, surely, truth must also be the standard in public life. As the science writer Norman Levitt asks, restating Sophocles, ‘Does truth have an absolute right to be heard and understood as such, even at the cost of social peace?’ He says it does.

Not only is there a duty to behave in good faith, but to challenge and debunk. Only in this way can we stop society creating easy pickings for cranks, and have any basis on which to object to cynically selected information, whether in product marketing or the justification for war.

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# Scientists can't be politicians

Science should dictate policy, declares Ian Gibson



## 'Would you keep your scientist friends in the kitchen? We will be in the front room.'

This was the way we ran parties – with discussion of C4 pathways in one room and anything but science in the other. This reflected the feeling that scientists were geeky – solely interested in the details of their world, with drinks and gossip thrown in. Many scientists remain interested in other things besides science, even if the discussion of David Beckham resorts to the physics of his free kicks. But there is a wide suspicion of science and scientists which extends to the political arena, where they are viewed as 'on tap but not on top'.

### Scientists define

The scarcity of scientists in the political arena is a fact of British life. It explains, I believe, the poor attitude to evidence in policy-making and, indeed, how to handle evidence. It's no use pretending that the scientist incorporated into decision-making is not 'on message', but malleable to be 'one of us'. This is how the science establishment reacts with government, from the Minister of Science to the Chief Scientific Advisor to the Prime Minister.

Scientists are much better at defining problems and moving to investigate them. Politicians are blown in the wind by the media and constituents and often fail to see the real problem. Their job is colossal. In the field of climate change, for example, real

issues need to be addressed like car usage, how to heat homes and the personal life style of the individual. A precautionary approval is often the only answer.

### Blaming the public

And so we move to address the problem by talking of public understanding of science. We set up committees attached to august bodies to resolve the problems, as if the fault rests with the public.

I have served on several such committees and they always struggled to deliver the message to the public. This, despite the meetings, publications and initiatives at annual conferences like the British Association for the Advancement of Science runs. We don't have any obvious areas of endeavour around public understanding of Latin, for example. So science remains in a class of its own: too difficult, technical and carried out by a strange class of people.

### Scientists' arrogance

It is true that there is an arrogance amongst many scientists which says that they alone can understand science and related phenomena. This is a necessary view to maintain the discipline of research and study.

The anger around the GM plant issue was not reserved for the biotechnology company alone. Scientists too felt it was enough to do it and the public would follow. They did not: instead, they walked away. It will be interesting to see if the scientific community has learned, as further GM initiatives are declared as a solution in the battle of climate change and its effects in the developing world. I doubt it!

## The scarcity of scientists in the political arena is a fact of British life. It explains the poor attitude to evidence in policy-making and how to handle evidence

The difficulty is compounded by the difference in public attitudes in the US and UK. UK academics *en masse* hide from the media and have little time for those who indulge it, despite their popularity.

Some even think David Attenborough is not a scientist.

A large sector of the British public remains suspicious, even without evidence of the effect of low radiation, new food crops, drugs and their efficiency, genetic profiling and many other new technologies. Science is now being used in an attempt to amend our abortion policies, and even 'intelligent design' is competing with evolution and natural selection to explain our life forms.

## It's no use pretending that the scientist incorporated into decision-making is not 'on message', but malleable to be 'one of us'

### Science must benefit us

It remains for me in subsequent articles to discuss the way forward for science, not just in the UK but internationally. When science and industry develop cures or treatments, it does not benefit science when people even in the UK are denied the treatment. Science and politics intermingle in taking 'the blame'.

My next article will examine how from primary school to higher education we must start producing scientists, technologists and engineers whose discoveries benefit our lives. Politicians must also understand, translate and develop the messages into delivery plans.

Climate change is a good example. The science has been there for some time and, while politicians may have picked up the gauntlet, delivery of the messages from the scientists presents a real problem. We need to move from this complacency in UK science to an ultra proactive role where science dictates the policy and policy makes demands on the science.

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