

Science & Public Affairs

Are leaders born
or made?



Investigating the
bombings



Genetically modified
athletes

Climate change
developments



→ SPATalk **4**
Are leaders born or made?
 Adrian Furnham and Alex Haslam debate

→ Focus **6**
Energy efficiency in a muddle
 Baroness Perry urges a clean-up

→ Shorts **8**
 Open access approaches critical mass... Surge of interest in radical carbon plan...News in brief

→ Opinion **10**
Genetically modified athletes
 Why not? asks Andy Miah

Climate change developments **11**
 UK policies need solid underpinnings, says Robert May

A sociologist in the lab **12**
 Jessica Mozersky now understands why scientists can feel misunderstood

Go for fusion **13**
 Clive Cookson wants the \$10bn ITER project to get going without further delay

→ Exchange **18**
New DTI guidelines on science in government

South Asians and health **20**

Ethical governance of UK Biobank **22**

→ Review **25**
Exhibition: The Hitchhiker's Guide
 Wendy Barnaby asks whose thumbs are up

→ Correspondence **26**
Is SPA on the right track?...The BA: consulting its members?
...Self-limiting technology

→ Sounding off **28**
Not digital but dignity
 The World Summit on the Information Society must consider human rights, argues Rikke Frank Jørgensen

→ The Jack Harris Column **29**
Kilby and Keeling
 Jack Harris recalls two remarkable Americans

→ SET in Parliament **30**
Apparatchiks first and science second
 Ian Gibson accuses the government of patronage and blackmail

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Features

Science communicators forge ahead **14**
 Vanessa Spedding tracks them through the jargon

Investigating the bombings **15**
 Barrie Mellars extols digital forensics

Secure people need healthy ecosystems **16**
 Nick Dusic points out the links

Democs **17**
 Perry Walker plays the consultation game

Designer babies: what do teenagers think? **24**
 Anita Shaw and colleagues found out with a citizens' jury



Autumn agenda

This issue of SPA reflects various events of the summer and looks forward to autumn.

The London bombers, explains Barrie Mellars (p.15), will have left security forces and the police with a huge amount of potential evidence in a variety of forms. Digital forensics is coming into its own. He argues that it must become a recognized scientific discipline.

Having won the bid to stage the 2012 Olympic Games, London will be taking more interest in sport. Andy Miah (p.10) draws attention to the latest worries about gene transfer ('gene doping'), which could enhance athletes' strength or endurance on a genetic level, perhaps impossible to detect. The Olympic Movement sees this as a critical issue, but Miah asks what would be wrong with genetically modified athletes. He suggests that, if we want to protect their health, regulation may be more effective than prohibition.

Autumn should see the appointment of a new leader of the Conservative party. In the light of the contest, and the perennial interest in the leadership of the Labour party, the SPATalk (p.4) debates whether leaders are born or made. Adrian Furnham

believes that leadership ability is largely inherited, whereas Alex Haslam sees the group dynamic with followers as the crucial factor that makes leadership both possible and powerful.

By the end of the year, forecasts Ian Gibson (p.30), we will know whether the new Select Committee on Science and Technology will maintain its previous status with the scientific community. Ex-chairman Gibson accuses the government of patronage and blackmail in deciding the membership of the new Committee, which he says serves party apparatchiks first and science second.

Climate change was one of the big issues on the Gleneagles G8 agenda in July. Following this, Robert May (p.11) flags up November meetings on climate change. He hopes the UK can help maintain pressure on the United States to agree to significant cuts of greenhouse gas emissions. He also looks forward to a review of the economics of climate change policies, announced by the Chancellor in July, and is scathing about the 'eccentric account of the current state of the science of climate change' published in summer by the House of Lords Select Committee on Economic Affairs.

November also sees the World Summit on the Information Society, whose purpose is to explore how information and communications technology can advance the UN Millennium goals for development. Civil society groups complain that the conference will stress a cyber security agenda and ignore the threats which technology poses to human rights. Rikke Frank Jørgensen (p.28) lays out the issues.

Naturally, SPA also chronicles various developments in communicating science: the annual science communicators' conference (p.14), a new game to use for science communication (p.17) and a citizens' jury with a difference (p.24).

Wendy Barnaby, Editor
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Are leaders born or made?

While the Conservatives look for a new leader, and speculation continues about Labour's leadership, Adrian Furnham and Alex Haslam debate how leaders arise

Dear **Adrian**,

Almost nobody nowadays believes that there is a simple constellation of traits or attributes that is capable of predicting whether or not someone will make a great leader.

Effective leaders are those who create, co-ordinate, and control a particular sense of 'we-ness' that they share with followers. This sense motivates those followers to do the work necessary to achieve group goals. Thus, leadership is actually a process of social identity management.

It is certainly the case that particular skills are needed to do this, but rather than being constant these vary as a function of the norms, values and collective aspirations of the group to be led. I would also argue that things like charisma are actually attributions that are a product of this particular group dynamic rather than independent inputs.

My argument is therefore not that individually great leaders do not exist (they very clearly do), but rather that the key to understanding their greatness lies in a group dynamic that makes leadership both possible and powerful. To ignore that dynamic, as you (and most others) appear to, is not only to make a fundamental attribution error, but to perpetuate a dangerous, disempowering myth. Yours, **Alex**

Dear **Alex**,

Yes, leadership is a social and dynamic process. But social influences differ from individual to individual. Their styles, some of which are successful and some not, are a function of their personality and ability.

The situationist sixties are over and we know now, through good research, that people do not change much once they have reached adulthood. Personality, ability and preferences are surprisingly stable. An extravert at 18 is an extravert at 68: people tested for their IQ in 1932 and again in 1996 were very similar.

There is now incontrovertible evidence of the heritability of many important human characteristics.

We also know that personality and ability predict an amazing number of things like physical health, including mortality; job

performance, including leadership behaviour; social relationships, including marital success and failure; educational outcomes at school and university; and mental disorders, including drug and alcohol abuse.

The characteristic of great leaders is to unite and mould and inspire all groups they find themselves leading.

The myth is that anybody can become a leader. It may be sad, unfashionable and politically incorrect, but history, research and common sense show the myth to be untrue. You need the right profile – and we know what it is. Leaders need to be bright enough to learn new things and adapt. They need to be psychologically stable. They need to be conscientious.

Yours, **Adrian**

The characteristic of great leaders is to unite and mould and inspire all groups they find themselves leading

Dear **Adrian**,

While personality is often observed to be stable, I think this can be attributed to stability in the external world rather than genetic or purely psychic factors. When the external world changes dramatically, so do people's personalities (for example, as shown in the rise in authoritarianism in 1930s' Germany).

But even accepting your idea, the crucial point relates to the predictive power of personality. All the data here suggests that having 'the right profile' is simply not enough. In order to be influential, leaders need to represent the norms and values of a group in a particular context, and so to understand leadership we need to look closely at group dynamics, not just personality.

You say that 'the characteristic of great leaders is to unite and mould and inspire all groups they find themselves leading'. Do you think that Hitler could have led Britain in World War II or that he could lead Germany today?

Your use of the term 'find themselves' also suggests that the process of leadership is a passive one, and represents the 'natural'

manifestation of inherent ability. It isn't. It's an active, creative process in which leaders and groups play mutual roles.

Yours, **Alex**

Dear **Alex**,

No... Only massive trauma changes personality, which is hard-wired.

Yes, attitudes like authoritarianism change, but people are remarkably stable. They choose and change their environments to suit their personality. What you see is what you get with most people over the age of 21.

I accept that having the right profile for leadership is not enough. It is necessary, if not sufficient – as is the ability to lead. But social and cultural events affect the way leadership shows itself and is remembered.

Of course other factors play their part, including the socio-political situation and the followers' personality and values. But choose any leader, like Churchill or Thatcher, Hitler or Stalin, and you will see from biographies how stable their characteristics were from an early age. They in part created the situations that made their leadership successful. And their hubris, which led to group-think, no doubt brought about their demise.

There is a massive change industry in clinical and business psychology precisely because individuals are so difficult to change.

Yours, **Adrian**

Choose any leader, like Churchill or Thatcher, Hitler or Stalin, and you will see from biographies how stable their characteristics were from an early age. They in part created the situations that made their leadership successful

Dear **Adrian**,

I accept that people have some choice over their environment, but this is very easy to overstate – our cultures and groups make a lot of



Leadership: personality or context?

choices for us, as do those of other people.

In organizations, for example, managers play a massive role in defining (often constraining) the groups that people are and aren't members of, and hence the sorts of leadership opportunities that they have. In contemporary organizational life it's hard to be a great leader when your group and job is restructured, or if you're made redundant.

In these contexts, it's very dangerous (and as research into the 'romance of leadership' shows, often very inaccurate) to see success as a fixed manifestation of leadership ability. It also leads to a situation in which leaders are placed on pedestals and followers relegated to the gutter

– when in fact it is only their followership that makes others' leadership effective.

Indeed, there is an important political dimension to this debate that psychological analysis all too often overlooks. Thus, despite the fact that I believe the empirical evidence for your approach is moot, it will always retain its appeal in some quarters (typically the upper echelons of society) because it appeals to particular political tastes and fulfils useful legitimizing functions. This is true of my analysis too, of course – but, unlike you, the people who agree with me tend not to have a lot of political clout.

Yours, **Alex**

The people who agree with me tend not to have a lot of political clout

Dear **Alex**,

This is not a right-left wing or powerful-powerless debate about beliefs about leadership. It is, or should be, a dispassionate evaluation of the empirical literature, which supports my case.

Interestingly, identical twins get more similar as they get older, not less similar. Despite the fact that they have different spouses, and different jobs, and live in different places, they grow more alike. Why?

First, ability and personality factors dictate how you see the world. Neurotics see the world as threatening; extraverts are optimistic, and so on.

Second, people evoke similar reactions in different people because of their beliefs and behaviours. The same people are attracted or not attracted to the same individuals. Some people like their leaders certain and bold, others caring and thoughtful.

Third, people choose and change the situations they find themselves in. So people live in a surprisingly stable world which reflects their personality and ability. They react to organisational change in predictable ways; indeed, they bring it about officially or unofficially, again as a function of their personality-based needs and values.

Yours, **Adrian**

The myth is that anybody can become a leader. It may be sad, unfashionable and politically incorrect, but history, research and common sense show the myth to be untrue

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Energy efficiency in a muddle

Baroness Perry urges a clear-up



New buildings: targets not achieved

There seems to be universal agreement that energy efficiency is desirable, offering the prospect of more secure energy supplies and lower emissions. At the G8 in Gleneagles, the leaders of the developed world described it as 'a key area for G8 action', and set out a plan to improve the efficiency of buildings, appliances and transport.

But do our leaders really understand energy efficiency? And is the current diverse range of policies and actions, at local, national and international level, really likely to deliver lower energy use and lower emissions? These were the fundamental questions that arose in the year-long inquiry into energy efficiency conducted by the House of Lords Science and Technology Committee.

This was our second inquiry into the emissions reduction strategy contained in the 2003 Energy

White Paper. In 2004 we published *Renewable Energy: Practicalities*, which subjected the nuts and bolts of the government's promotion of renewable energy to close analysis. We have now subjected energy efficiency to the same level of scrutiny, with worrying results.

Wasteful buildings

Take buildings, for instance, the source of almost half the UK's greenhouse gas emissions, served by an industry which employs up to three million people. The latest review of Part L of Building Regulations, which will come into effect in January 2006, is expected to deliver a 25 per cent improvement in energy efficiency in new buildings, and comes on top of the 2002 review which promised a similar improvement.

All this is welcome – although, according to an article in the *Guardian* on 18 July, the

proposed regulations are now in danger of being watered down. But even if they are not watered down, regulations still merely set targets, and it is clear that in reality these targets are not being achieved. Local authority Building Control sections have been largely replaced by private inspectors, who must compete for custom. There are no clear, mandatory 'pass-fail' tests for finished buildings, such as pressure tests to ensure airtightness. Even if buildings do fail to achieve standards, Building Control sections do not have the resources to launch prosecutions, and customers cannot simply get their money back. There is no ultimate sanction for builders who cut corners.

At the same time, there is an acute skills shortage in the construction industry. The Adult Learning Inspectorate estimates that the sector

needs 88,000 new entrants each year – yet the industry is struggling to cope with the 60,000 currently starting out on apprenticeships each year, of whom only a third complete their courses. Builders remain wedded to traditional bricks and mortar, preferring to rely on on-site skills rather than prefabricated parts made to factory tolerances.

Looking into the future, we were dismayed to discover that the Department of Trade and Industry has cut funding for applied construction research by two-thirds since 2000, to just £5 million. This at a time when the Office of the Deputy Prime Minister is looking to the industry to build some two million new houses over the next ten years, and when the government as a whole spends some £25 billion each year on procurement from the construction industry.

Thus there is a huge gap between theory and practice. In theory, building standards are rising and will continue to rise. In practice, the various departments and agencies simply aren't working together in the effective and co-ordinated way that is needed to deliver these standards.

Behaviour crucial

Another key area is behaviour. Better energy efficiency does not in itself lead to lower energy consumption or lower emissions. If you insulate your walls and loft, but at the same time turn up the thermostat, or perhaps use the savings to help purchase a heated conservatory, you could end up using more, not less energy. There is no doubt that modern cars are far more fuel-efficient than their predecessors, but we own many more of them, and we drive them further, with the result that energy used in transport has more than doubled since 1970.

So influencing behaviour will be essential if improved efficiency is to be translated into lower energy use. We devoted a chapter of our report to exploring behavioural issues, focusing on three broad areas: financial incentives, education and information.

Financial incentives

There is a growing consensus in favour of using financial incentives to encourage people to use less energy. The simplest incentive would be higher energy prices, either across the board, or through a carbon tax that penalised fossil fuels and favoured carbon-free forms of energy such as renewables or nuclear. This would probably

work (as it did in the 1970s), but higher prices would fall heavily on industry and on the fuel poor. As a result, various more targeted incentives – stamp duty or Council Tax rebates, for instance, offered in exchange for energy efficiency improvements – have been proposed. More work is needed to assess these options.

If behaviour is to change, it is essential that it should be in the interests of both consumers and suppliers to reduce energy demand. Extension of energy services – long-term contracts by virtue of which suppliers manage energy demand, and are rewarded for savings – will be critical in developing new profit streams for supply companies. In Berlin the city's Energy Agency grants suppliers 10 or 15-year contracts to manage the energy needs of public buildings: the suppliers invest in improved efficiency, and in return receive 70-90 per cent of any savings made. The programme has delivered major financial and emissions savings.

We also need to think about pricing. At present, the more energy that is used, the less consumers typically pay per unit, creating in effect an incentive to use more energy. In contrast, many parts of the world have experience of 'lifeline tariffs', providing a quota of cheap energy sufficient for basic needs, with the price rising thereafter. The same model, particularly in conjunction with the development of energy services, could work in the UK.

Education and information

On education, we saw an impressive scheme at a primary school in Leicester, where a wind turbine has been installed, whose output is monitored by pupils daily. More such schemes are needed. Yet in more general terms, exhortation to use less energy is unlikely to be effective. The provision of better information on actual energy use seemed to the Committee to be one of the keys to reducing demand.

At present most of us pay for our energy by direct debit and our meter readings are often estimates – in other words, we only have a very vague sense of how much energy we are using, or of the impact of, say, turning off the lights or lowering the thermostat, on either our pockets or on emissions. But the technology is already available for either 'remote' metering (which would put an end to estimated meter readings) or 'smart' metering, which could provide cheap

wall-mounted display units, allowing consumers to monitor their energy use, and its financial or carbon costs, in real time.

Good quality information can make a dramatic difference. In Gothenburg in Sweden, the municipal housing association invested in software to monitor energy demand and alert staff to aberrations from normal use, with the result that energy demand across 23,500 apartments has been cut by 15 per cent without any change in living conditions for residents. The housing association is saving some £2 million each year, and emissions are down by almost 2,000 tonnes annually.

As an official of Leicester City Council, which has invested in a similar monitoring system, told us, 'if you can't measure it, you can't manage it'. Yet the government has dragged its feet, with the result the supply companies have no incentive to provide remote metering, and no large-scale trial of remote or smart metering is planned in the UK.

Pointing away from waste

We live in a society where energy is wasted on a huge scale. Some 61 per cent of the primary energy that goes into our power stations is lost, mostly dissipated as heat via cooling towers. Of the electricity that is finally delivered to consumers, some 760 million kWh per month, producing over a million tonnes of carbon per annum, is used to power appliances that are on standby or not actually in use.

To change our culture of wastefulness needs strong, imaginative and co-ordinated government leadership, not the current fragmentation and muddle. We hope our report helps show the way forward.

As an official of Leicester City Council, told us, 'if you can't measure it, you can't manage it'

References

See <http://tinyurl.com/82dut>

**Baroness Perry
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In brief

Misuse of scientific research

Countries should work together on measures to prevent the misuse of scientific research, according to the Royal Society. Vice President Julia Higgins said, 'Minimum levels of safety regulation should be established to prevent a misguided scientist from carrying out unsafe research simply by moving to a different country.'

Animal research

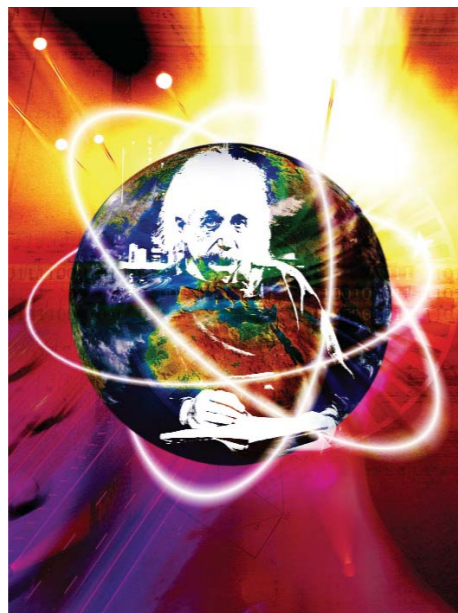
Disagreement on animal research can be reduced if the quality of the debate can be improved and the Three Rs (Refinement, Reduction and Replacement) promoted, according to a report published by the Nuffield Council on Bioethics. *The Ethics of Research Involving Animals* also urged researchers experimenting on animals to publish data openly.

FP7: environment and sustainability

The environmental and sustainability aspects of the Seventh Framework Programme (FP7) came under scrutiny at a conference organised by the Greens and the European Free Alliance (EFA) in the European Parliament. Science and Research Commissioner Janez Potocnik received sceptical responses to claims of 'green' credentials. Contentious issues included nuclear research, health, climate change and nanotechnology.

University department closures

In its response to the Department of Education and Skills's request for advice on the issue of university department closures, the Higher Education Funding Council for England (HEFCE) has recommended using national centres to keep some subjects alive. It cautioned against 'moral panic' about course closures, preferring to defer to market forces and university independence rather than recommend government intervention.



Researchers everywhere will have free access to published research Georgia King, *Research Information magazine*

Open access approaches critical mass

A proposal from Research Councils UK to make it mandatory for papers arising from Council-funded research to be 'deposited in openly available repositories (either institutional or subject-based) at the earliest opportunity' could be the tipping point that takes open access into the mainstream, according to Professor Stevan Harnad of the University of Southampton.

RCUK's position, if it becomes policy, would apply to all grants awarded from 1 October 2005.

Harnad, director of the Cognitive Sciences Centre at the University of Southampton and champion of the self-archiving approach to open access, explained the significance of proposals such as RCUK's.

Only 15 per cent of the two and a half million articles published each year in peer-reviewed journals are currently self-archived

Only 15 per cent of the two and a half million articles published each year in peer-reviewed journals are currently self-archived, Harnad pointed out. The reason that this figure is not greater, he revealed, is the attitudes of researchers. 'Many say they are busy. The fact is that their priorities are decided by their obligations. They will self-archive when their employer says they must.'

'And', he added, 'if the UK moves first, all the rest of the dominoes [meaning other countries] will fall.'

RCUK is not the first funder to use its leverage to promote open access: the Wellcome Trust – which funds £400 million worth of UK biomedical research each year – announced that from 1 October, all papers from new research projects must be deposited in the US repository PubMed Central or the UK PubMed Central (once created) within six months of publication. Existing grant holders will be bound by the same rules from 1 October 2006.

The implications of a global 'domino effect', should it happen, are far-reaching

Implications

The implications of a global 'domino effect', should it happen, are far-reaching. Not only will UK researchers have free access to much of the world's published research material, so will researchers in developing countries where institutions may struggle to pay subscription fees for traditional toll-based journals.

Melissa Hagemann of the Open Society Institute in New York agreed that open access could bridge the knowledge divide: 'Open access will allow scientists and academics in developing and transition countries to not only access the vital material that they need to conduct their research, but also to more efficiently contribute their important work to the global research community.'

Some major reshuffling will be required before global open access can become a self-sufficient system, however. The self-archiving route, however likely to offer the fastest results, still relies on the peer-review services of commercial and society journal publishers (as well as the newer, less numerous open access journals). But when funding agencies stipulate archiving in a third-party repository, they could prevent researchers from publishing in many toll-access journals, dramatically curtailing their choices.

Marika Westra of Elsevier explained. 'Most publishers' current policies, including Elsevier's, explicitly prohibit public posting to third party web sites such as PubMedCentral. Currently, a very small number of publishers allow what Wellcome is proposing ... authors will then have the choice of publishing in only one per cent of all publications,' she said.

Surge of interest in radical carbon plan

The recent government promise of a £40 million boost for carbon abatement and fuel cell technologies gives backing to a plan for cutting emissions once dismissed as impractical – and which has now fallen under the scrutiny of the Commons Science and Technology Committee.

The controversial plan, which involves the capture and underground storage of carbon dioxide (CO₂), is the central technological plank of the government's latest climate proposal. Although received with scepticism at its inception, the concept has more recently attracted the approval of scientists and engineers and even the cautious welcome of green NGOs.

More than a third of all human-produced CO₂ emissions come from burning fossil fuels for electricity generation and other major industrial processes such as steel production and oil refineries. The thinking behind the plan is that these emissions could be reduced substantially without major changes to process by capturing the CO₂ as it emerges, then transporting it and injecting it into an appropriate geological formation beneath land or sea.

Underground CO₂ storage is not new. The gas is already injected into depleted oil fields to enhance oil recovery. But the new scheme calls for deliberate storage to mitigate against climate change.

Coming into view: carbon dioxide storage, as at BP's Miller Platform in the North Sea BP



Harry Audus, Director of the International Energy Agency's Greenhouse Gas R&D Programme, said: 'Most rational thinkers accept the viability of the technical concept. In terms of economic viability it has to be remembered that it will cost money [but] the cost will decrease and [...] the economics are looking pretty encouraging. This is great win-win: the CO₂ gets stored for geological time-scales and we get more oil.'

Sceptics

But here lie the concerns of the sceptics. Some have commented that carbon capture and storage (CCS) is more about helping oil companies get funds from exhausted oil fields than it is about reducing emissions. Friends of the Earth's climate campaigner Bryony Worthington cautioned: 'Tough decisions on existing coal-fired power stations in the UK must not be ducked [...]. Some coal stations are so inefficient and polluting that they should be shut and replaced by a new generation of cleaner plants.'

For Simon Shackley of the Tyndall Centre for Climate Change Research at the University of Manchester, the issue is more about whether CCS would deter investment in renewable energy sources. 'But', he added, 'it is imperative that we develop a number of different routes towards the decarbonised society – and CCS is an important part of the armoury.'

The Commons Science and Technology Committee's inquiry is investigating the viability of CCS for the UK in terms of the current state of R&D, projected timescales, cost and geophysical feasibility, as well as government's role.

Costs are likely to be high: according to Audus, the £25 million the government has allocated to 'carbon abatement technologies' (which include efficiency and co-generation technologies as well as CCS) will be just a kick-start. 'A demonstration would cost more like £500 million plus,' he said. CCS could be up and running within a decade, according to the government.

Reference

See www.dti.gov.uk/energy for the report *A Strategy for Developing Carbon Abatement Technologies for Fossil Fuel Use*. Evidence can be submitted to the select committee inquiry until 30 September.

In brief

Discrimination

The Equality Challenge Unit has drawn up measures to prevent discrimination during the forthcoming research assessment exercise (RAE), which will be embedded in RAE submissions guidelines. For the 2008 RAE, universities must, for example, allow researchers who have taken a career break to submit fewer pieces of work to qualify for assessment.

Ethical code for scientists

The Council for Science and Technology is seeking views on the need for an ethical code for scientists. A working group has formulated the draft code, *Rigour, respect and responsibility: a universal ethical code for scientists*, with the aim of fostering ethical research and encouraging wider perspectives. Comments are welcome before 1 November 2005.

Black Caribbean and Bangladeshi populations

Black Caribbean and Bangladeshi populations are the most under-represented in science, engineering and technology beyond GCSEs, according to *Science, Engineering and Technology and the UK's Ethnic Minority Population* from the Royal Society. The report analyses data on participation in SET education and employment and is based on research carried out at the University of Warwick.

Drugs futures

A report from Foresight, the Government's science-based think tank, looks ahead to possible future advancements relating to drugs for the brain. It predicts that new treatments for disorders like Alzheimer's and Parkinson's Disease, improved treatments for addiction and the development of cognition enhancers could be less than 20 years away. The next issue of *SPA* will carry more details. 'Drugs Futures 2025' is at <http://www.foresight.gov.uk>

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Genetically modified athletes

Why not? asks Andy Miah

In the run-up to the 2012 Olympics, London has an excellent opportunity to place public engagement on the philosophy and ethics of sport science at the centre of its preparations.

At the recent International Olympic Committee meeting in Singapore, IOC President Dr Jacques Rogge re-affirmed that anti-doping is the critical issue for the Olympic Movement. The biggest problem it faces is the emerging science of gene transfer ('gene doping'), which could enhance athletes on a genetic level, perhaps impossible to detect.

Currently, there is almost no public engagement on sport and gene doping. The technique could involve introducing DNA to the athlete's body to bring about a physiological response, such as the stimulation of growth in tissue cells, to generate more muscle.

Alternatively, athletes' endurance could be strengthened by using the same method to promote their production of oxygen-carrying cells which are essential to elite performance.

There are, however, official moves against gene doping.

I want to ask what would be wrong with genetically modified athletes in sport. It may be that, if we want to protect the health of athletes, regulation may be more effective than prohibition.

In 2003, the World Anti-Doping Agency prohibited this form of performance enhancement, but there is yet no test for detecting the method. I argue that sport might be better off if they were unable to test for gene doping, since it would force a shake-up of the entire anti-doping project, where fundamental values of sport could be questioned.

The UK Sport campaign comes at a time of crisis in elite sport, where the use of performance enhancements seems set to grow exponentially

Conflicting positions

In May 2005, UK Sport launched a new anti-doping campaign, '100%ME', aimed at empowering athletes to take a stand about the value of doping-free sport. In the same week, the first Edinburgh Festival of Sport Science took place, where a range of



Sport needs a universal policy

performance technologies was presented and discussed. The UK Sport campaign comes at a time of crisis in elite sport, where the use of performance enhancements seems set to grow exponentially.

In 2002, the US President's Council on Bioethics met to discuss this very matter and the US is now beginning work to draft legislation on genetic enhancement. Its concerns and conclusions were not the same as those of the anti-doping world. It asked questions about the legitimacy of a sporting organisation to limit the choices people might make to enhance themselves. As well, it argued that sport thrives on performance enhancement and gene modification could be seen as an extension of this philosophy. Sport, it said, needs television audiences and sponsorship, so must provide extraordinary, superhuman spectacles. Enhancement is necessary.

New problems

The prospect of gene doping gives rise to some novel problems for the world of sport. What if I am the child of a genetically modified athlete? Would I be allowed to compete? Based on the current approach to 'gene doping', it is difficult to tell. Yet one could understand my feelings of injustice, if I were disqualified. After all, I would not have done anything wrong.

Even if I were to gene dope myself, should this really be seen as such a problem? Given the ways in which people now sculpt their bodies

for cosmetic reasons, is it acceptable to ban somebody from attempting a similar sculpting through genetic modification? Gene transfer might even allow such sculpting to take place in a safer form. It might be argued that permitting gene doping would set a bad example for children, which is often an argument used in relation to drug use in sport. Yet, it is only if we treat genetic modification as socially deviant, that its use by athletes would be construed as a negative influence on children.

The challenge for sport is that it cannot function without a universal policy. Agreement on the rules makes competition possible

Promoting debate

As a world, we struggle to agree on policies related to genetic technology, human cloning, stem cells, and the like. The challenge for sport is that it cannot function without a universal policy. Agreement on the rules makes competition possible. The sporting context offers a case where the entire world has a common stake in what is decided and where policies must be legally binding. This is why debate about what those rules should be is critical.

Because of these unique circumstances, we might find that sport can be a mechanism for promoting a global debate on the legitimate uses of gene transfer technology and the ends of technological development in general.

Without agreement, we may see the end of sport, as we currently know it. In such a world, athletes following different rules could be just too genetically different for competition to be fair.

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Climate change developments

UK policies need solid underpinnings, says Robert May

With so much focus on the G8 summit in July, it is perhaps not surprising that such little attention has been given to a far more important meeting on climate change due to take place this year.

At the end of November, high-level representatives from governments around the world will gather in Montreal for the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC).

With 191 signatories, the UNFCCC pledges governments to stabilise concentrations of greenhouse gases in the atmosphere, through the most cost-effective measures, at levels that would avoid the worst effects of climate change.

It was concern that the UNFCCC was not enough to prompt countries into action that the Kyoto Protocol was added in 1997, creating real initial targets for cuts in greenhouse gas emissions by industrialised nations, as a first step towards co-ordinated long-term action by all countries.

Most eyes will be on the US administration to see if the small but significant shift in policy suggested in the Gleneagles communiqué, recognising that human activities are contributing to climate change and that urgent action is required, translates into a concrete commitment to cut greenhouse gas emissions.

No agreed target

Although much of the focus will be on negotiations about targets beyond the end of the first period of the Kyoto Protocol, the

parties need to take account of a crucial issue, highlighted by the science academies of the G8 nations in a joint statement in September. As yet, there is no agreed target level for concentrations of greenhouse gases in the atmosphere. Without this, countries cannot plan an effective programme of cuts. This of course was noted by participants in February at a special meeting of climate change scientists at the Hadley Centre in Exeter, organised by the UK government to inform the G8 summit.

Although the Gleneagles communiqué did not include action on establishing a stabilisation level for greenhouse gas concentrations, it does commit the G8 partners to a 'dialogue on climate change, clean energy and sustainable development', with the first meeting due in early November. Hopefully, the UK can help to maintain pressure on the United States to agree to significant cuts in the long term.

The UK government is likely to play an important role in Montreal as well, yet will be under even more pressure to ensure that its domestic climate change policies live up to the bold declarations made in international arenas. One important contribution to the UK's response to domestic challenges is a review of the economics of climate change policies, announced by the Chancellor on 19 July.

Eccentric report

I hope that the Treasury's review will yield a more valuable contribution than the report published by the House of Lords Select

Committee on Economic Affairs' two days before the start of the G8 summit. Tellingly, this report's digression from economics into an eccentric account of the current state of the science of climate change appears to have been warmly welcomed by some White House officials.

The report is based on a rather curious selection of witnesses and some of the language is reminiscent of the controversial official US government document allegedly doctored by former White House aide Philip Cooney, before his departure to ExxonMobil, to make it seem like climate change science fits the current policies of the Bush administration.

As such, the sections dealing with science in the Committee's report would have benefited during their preparation from the expert advice of somebody involved in climate change research. However, the Committee's report had some sensible things to say about the need for good economic analyses of the impacts of climate change. It offers a valuable recommendation in suggesting that the climate change levy should be scrapped in favour of a carbon tax, a measure that has been advocated a number of times by the Royal Society as the best economic instrument for promoting energy technologies that do not produce carbon dioxide.

Such a recommendation is important because the UK faces some difficult policy choices. By the government's own admission, domestic climate change policies are not working well enough and we need to tackle head-on the problems arising from our present reliance on fossil fuels. That means considering a range of technologies, including nuclear power, renewables, carbon capture and storage, and hydrogen engines. The UK must continue to lead by example by demonstrating how to face up to the challenges posed by climate change.

Reference

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A sociologist in the lab

Jessica Mozersky now understands why scientists can feel misunderstood



Knowledge has a particular meaning inside the lab

I am a sociologist who has spent part of the last year working in genetic research laboratories to experience being a scientist.

The work has shown me why communication can be so difficult between scientists and researchers from other disciplines.

Broadening perspectives

The genetics and society PhD programme is part of the Institute of Human Genetics and Health at University College London. The programme has the ambitious aim of cross-training natural and social scientists so they can work together on inter-disciplinary projects. The goal is to broaden both science and social science students' perspectives about issues outside their respective disciplines.

Within sociology, my background is in health and medicine. I have already spent five years working on two genetics research studies – one for women with eating disorders and the other for women at high risk of breast and ovarian cancer. While many benefits arise from medical genetics, my professional experience has given me insight into the complex and difficult implications genetic information can have for individuals.

During the past year, I have taken basic science courses and had a great deal of interaction with scientists. Most importantly, I have undertaken projects in two human genetics research laboratories.

Knowledge

It feels very different to be a laboratory scientist. Knowledge can have vastly different meanings depending on where we are situated.

Science is a paradigm used to solve problems, and I learned to appreciate that it can be a satisfying and challenging viewpoint.

Inside the laboratory, it is easy to get caught up in complicated experiments. Potential social issues, whatever they may be, can seem unrelated to the work in the lab. I have felt the excitement of finding a mutation in the high risk breast cancer gene, BRCA1, in a series of samples that I had spent four weeks sequencing. How odd, given that in my other professional experience related to BRCA, this news is not received with joy but rather signals a set of difficult decisions ahead.

Some of the knowledge which may arise from genetics has unavoidable social consequences which make us question its potential harm. It is important to remember that for an individual scientist, the work can have a very different meaning.

I was also struck by the amount of knowledge scientists have to accept, its origins long forgotten. There is a great deal of tacit knowledge and techniques which can only be learned by following the example of a more experienced scientist.

In the laboratory, there is uncertainty in interpreting data, replicating results, and pragmatic decisions about which direction research should take. When my attempt to replicate a previously published experiment

failed, I was told that scientific publications often miss a crucial piece of data or modification required for replication. Scientists spend a lot of time tinkering with their experiments to get the results they want. Yet this instability, with which scientists are very comfortable, can be lost as the science translates outwards into the public domain. As a result, we may draw starkly different conclusions about the certainty of genetic information and its potential when we are not privy to the inner instability of the science itself.

Misunderstandings

Scientists can feel misunderstood by the public, whoever they may be. The issues non-scientists raise about the implications of genetics may seem misguided, unrelated and burdensome to the daily work of scientists. Scientists can feel resentful or defensive because they feel they are being hindered by those 'outside' science.

My fellow students and I have had many discussions about our differing views on the meaning of genetics, its value and our apparent inability to understand each others' viewpoints. Participating in scientific work allowed me to see that there are real differences between how scientists and 'outsiders' experience the work.

Science, it seems to me, is built on acceptance and implicit trust in what has gone before. Social science is built on critical inquiry and deconstruction. These differences are mirrored in the larger relationship between science and society, which can be tenuous and fraught. Communication is difficult as we are starting from two very different perspectives, and it is easy to lose sight of that.

Entering this PhD programme has allowed me to engage with science and scientists in a way I have never done before and has been very enlightening. Although challenging and at times frustrating, it is crucial to initiate a dialogue between scientists and society in a fruitful and constructive way; a dialogue where both parties feel valued and understood. The UCL programme may be one starting point for this rather large feat.

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Go for fusion

Clive Cookson wants the \$10bn ITER project to get going without further delay

ITER, the International Thermonuclear Experimental Reactor, has found a home at last.

The six partners in the \$10bn project, the world's costliest scientific facility after the International Space Station, chose Cadarache in southern France at the end of September, after Japan withdrew the rival candidature of Rokkasho in exchange for a generous compensation package.

ITER is the next step toward taming nuclear fusion – the reaction that powers the sun and the hydrogen bomb – to provide a clean and almost inexhaustible energy source for the second half of this century.

Political tussles

The Franco-Japanese wrangle over ITER's location has caused a delay of more than 18 months – and it was just the latest in a long series of technical, political and financial disagreements that have held up the project since a global experiment to demonstrate fusion power was first proposed around 1985.

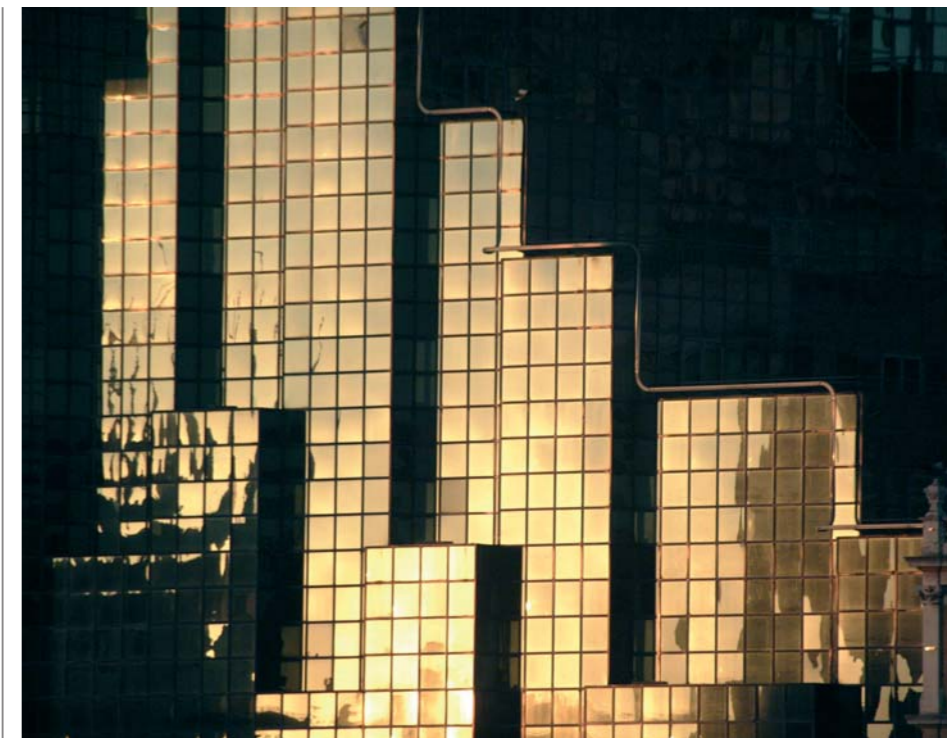
The US, Russia, Japan, Canada and the European Union began conceptual design work on the doughnut-shaped reactor in the mid 1980s and signed a formal collaborative agreement in 1992. At that point they were talking about starting construction in 1998 and finishing ITER in 2005.

In fact indecision – and a lack of political urgency – have already condemned the project to an overall delay of a decade. The US did not help matters by withdrawing from ITER in 1998 and rejoining in 2003. Canada has pulled out but China and South Korea have come into the partnership.

There is some justice in the complaint by fusion researchers that the low priority given to their field by politicians is the main reason why commercial fusion power always seems to lie 50 years in the future.

New timetable...

The related issues of energy security and global warming (emphasised by the US and Europe respectively) have finally given ITER a push toward reality. The most optimistic timetable now would see construction begin at Cadarache at the beginning of 2007. The reactor would operate for about 20 years from 2015. It aims to produce up to 500MW of fusion power – but in bursts rather than the continuous output suitable for supply to an electric grid.



Fusion: another way of keeping the lights on *Freefoto*

If all goes well with ITER, a follow-on reactor known as Demo will demonstrate that fusion can reliably run a power station. As part of their price for backing down over ITER, the far-sighted Japanese have won a commitment from the EU to support a Japanese site for Demo, which would begin its design phase in 2020 and operate from 2035, paving the way to commercial fusion plants from 2050.

...if all goes well

Even now, however, the ITER schedule could run into political and financial obstacles. The partner governments may find it difficult to raise the money they have promised for ITER's \$5bn construction phase. The EU should have no problem providing its half share as host – in fact much of this will come from France – and Japan's 10 per cent seems secure. But the other four 10 per cent contributions, from the US, Russia, China and Korea, are less sure. China and Korea in particular seem unhappy about the hosting agreement, which will see Japan playing a bigger role in ITER than them without making a correspondingly larger financial commitment.

Then comes the technical challenge of confining the fuel – hydrogen isotopes – as a 'burning plasma' at temperatures higher than the centre of the sun, letting the atomic nuclei

fuse together to release prodigious amounts of energy. The tokamak reactor, derived originally from a Russian design, holds the electrically charged plasma in place with superconducting magnets. An inherent safety feature of fusion power is that the slightest disturbance immediately cools the plasma and stops the nuclear reaction.

There is no doubting the basic physics of fusion, and experience with smaller-scale experimental reactors such as Europe's JET at Culham near Oxford suggests that the process can be scaled up to provide a clean and virtually inexhaustible power source.

Antinuclear campaigners condemn ITER as a waste of money. However, even if ITER runs well over budget, its spending level is unlikely to exceed \$1bn a year. That would be a small price to pay for even a 20 per cent chance of giving the world another energy option for a time when it will certainly no longer be possible to burn fossil fuels on today's profligate scale.

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Science communicators forge ahead

Vanessa Spedding tracks them through the jargon

Been to any science-related activities this summer?

Perhaps hung out at a festival, chipped in to a debate, chilled out at a Café Scientifique or explored a discovery centre? Even if not, you can't have missed the fact that such events and venues are popping up everywhere.

It's no coincidence that in parallel with this, behind the scenes, a small but growing expert community is gaining shape, strength and identity – a community whose mission is to involve and inspire as many people as possible in science and science-related issues and to encourage understanding and communication about the hottest topics.

The members of this group are the ones inventing and coordinating all the events – and also, sometimes, watching what we do and say at them, and reporting back to those who want to know. An opportunity to attend this year's Science Communication Conference, in May offered a great way of learning more about this emerging profession.

May meeting

The conference, organised by the BA and the Royal Society, attracted record numbers of science communication experts from a wide variety of fields including government, academia, education and PR. As conferences go, it was upbeat and friendly, full of smiling, bubbly types exuding personality and enthusiasm. It had as its rationale not just

Thinking about dialogue



to bring people together to share ideas, but to agree on some aims that the whole community could work towards over the coming year, which provided an unusual sense of focus and purpose.

Like so many expert groups, the science communication bunch cannot get by without its share of in-jokes and jargon. I didn't get any of the jokes, but the jargon provided amusement enough. The word 'dialogue', for example, has become so over-used that an entire presentation was devoted to reminding us what it meant – and by then I needed it – while other sessions were peppered with phrases like 'upstreaming dialogue' (meaning talking about it sooner) and 'participatory assessment' (still not sure what this means). The best in my book was from Professor Ian Diamond, who at one point said he wanted 'joined-up best-practice in cross-cutting areas'.

Areas for action

There were some serious issues. The ones the community will concentrate on this year are, for example, the need to 'share good practice'; the need for funding bodies to reward scientists for communicating about their work; the need to include industry; and the need to bring in social scientists and the media.

Perhaps the most interesting is the one that calls for the conference – and its concerns – to be open to input. This came out of a lively

discussion just before the close, in which it was pointed out that a community whose professional role is eliciting and responding to opinion should be especially clever at hearing the voices of its own members, and others, on how it could best operate. This point was agreed. And now comes the action.

The communicators, it appears, want to engage us on engagement – to invite comment on how they can best achieve their aims of getting as many of us involved in scientific issues as possible.

Admittedly, it's not easy to come up with simple ideas. Communication in different contexts serves different purposes. Different types of communicators want to communicate for different reasons – something that was very apparent at the conference. Some simply want everyone to celebrate science and the wonder it has to offer; some would like to bring public opinion to bear on the formation of policies about new technologies, and some think that policies should be formed by experts behind closed doors and that science communicators should convince the public that they're fine. Of course most reflect some combination of these standpoints. But putting that complication aside, it's clear that the entire community is open to input, and is calling for it right now.

What do you think science communicators could do to better include and involve the public? What activity or outcome would inspire you to take part in science, or think about the controversial aspects? What sort of framework should professional communicators build to enable a genuinely worthwhile exchange to happen? What topic should we make sure is hottest at next year's conference?

All thoughts will be welcomed. Write to Nick Hillier, Science and Society Manager at the BA, at nick.hillier@the-ba.net

Reference

For the full conference report, see www.the-ba.net/scicomm

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Investigating the bombings

Barrie Mellars extols digital forensics

After the bombings: chaos for tube travellers



The London terrorist bombings have left security forces and law enforcement with a huge amount of potential evidence in a variety of forms.

Amongst this evidence will be remains of mobile phones and digital cameras, many of which will have been badly damaged. However, the SIM and memory cards of these phones and cameras are tough and resistant to damage and could contain data vital to the identification of victims, as well as potentially useful images and videos.

Some of the mobile phone video footage was shown on television. Proper forensic examination of the video files is vital in determining the true content and indeed its veracity. Video enhancement of these files may also show details not immediately obvious.

The ubiquitous modern mobile phone, with its high quality digital camera, presents an opportunity for evidence gathering on a scale hitherto unseen. In addition, forensic interrogation of seized computers may provide police and security forces with intelligence on as yet unknown links to and from the bombers.

Digital crime

Advances in digital technology have opened up whole new horizons of opportunity for criminals to profit as well as facilitating traditional crime. The obverse of this coin is the new opportunities offered to law enforcement agencies in gathering *prima facie* evidence in a novel and valuable way.

Digital crime can be divided into three main categories:

1. Crimes on computers, such as burglary and theft
2. The use of high tech communication devices, such as mobile phones, in the commission of crime
3. Crimes using computers, such as fraud (both internet and traditional), paedophilia, identity theft and so on.

The first and second categories present law enforcement with opportunities to investigate high tech crime using high tech solutions. The third presents a broader, and altogether far more sinister, face of crime, extending from simple fraud to terrorist activities. All three areas have become the domain of a new breed of forensic scientist, the digital investigator.

The role of the digital investigator

The essence of all forensic science stems from the oft-quoted Locard's Principle which states: *Anyone or anything entering a crime scene takes something of the scene with them and leaves something of themselves behind when they depart.* This is as true today as when Dr Edmund Locard first proposed it in 1910.

For the digital investigator, the challenge is the nature of the 'something'. In traditional forensic investigation, exhibits are usually solid defined objects such as clothing or weapons. In digital investigation, the evidence is of a much more ephemeral nature, being the electronic impression left on magnetic or optical storage media which can disappear as quickly as it was created.

The evidence

It is well known that a computer's delete key does not erase data – be it document files, images, recordings, or data logs, any of which may have relevance to a case. This material remains stored in the memory of the system unless and until that section of the memory is overwritten. Even then, useful data may still be recoverable.

Along with the evidence itself comes a plethora of supporting 'intelligence' data, such as dates and times of file creation and modification, ownership of files, who accessed them and to whom they were sent. Email has proved many times to be a source of invaluable evidence, containing as it does not just the contents of the email but also the associated meta data which is not commonly seen but is present in all emails. This meta data contains information about both the sender and recipient as well as date and time information. The same kinds of information may also be found associated with image files.

Modern mobile phones are small computers in themselves that also have the ability to access a cellular-based communications system that is now almost worldwide. The call data, text messages and images sent and received from mobile phones are often valuable sources of both intelligence and evidential data. As with computers, it is vital to retrieve data unchanged and in a form that is acceptable to the courts.

Maintaining standards

Digital forensic investigation is becoming subjected to intense judicial scrutiny after a number of high profile cases involving sub-standard examiners. For courts to be confident of 'expert' evidence it is vital that certain standards are recognised and controlled by independent professional bodies such as the Council for Registration of Forensic Practitioners and the UK Accreditation Service. The entire area of digital forensics must become a recognized scientific discipline based on sound scientific principles with its theories and techniques subject to peer review and publication.

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Secure people need healthy ecosystems

Nick Dusic points out the links

Can scientists demonstrate the link between biodiversity and the economy, security and health?

That is the question government ministers and international organisations, like the World Bank, are asking. In the Millennium Ecosystem Assessment (MA), scientists gave their response by looking at all the things the planet's ecosystems do for us'. Conducted by 1,300 experts from 95 countries, the MA is recognized by governments as a benchmark for assessing how we are meeting our obligations under four international environmental treaties.²

When we eat food, drink a glass of water or enjoy a walk in the woods, we are enjoying the things our ecosystems do for us. Normally, we only notice these services when they are gone. When we over-exploit fish stocks, our economy grows more slowly than it otherwise would, due to the loss of the fishing industry. When we log upland forests, we are less secure due to the increased risk of flooding. When we pollute freshwater ecosystems, we are less healthy due to poor water quality.

The services that ecosystems provide are fundamental to our wellbeing. However, the MA found that we have not yet managed to make sustainable use of them. Over the last 50 years, we have degraded 60 per cent of ecosystem services.

We have done this mainly by changing habitats, overexploiting certain species and polluting the environment. Overall, by not managing sustainably what our ecosystems can provide, we have affected human well-being for specific groups of people. The people most dependent on their ecosystems are often the poorest and most vulnerable.

There is action we can take to use ecosystem services sustainably so that they support our well-being.

What we can do

Globally, we have seen substantial increases in the production of crops and farming of livestock. We have achieved these increases by degrading other things ecosystems provide. Governments can redress this situation by cutting subsidies for production. They can also introduce financial incentives for farming practices to support ecosystem services other than agricultural, such as water purification and nutrient cycling. In Europe, further reforms to the Common

Agricultural Policy could provide the economic incentives to farmers to support a range of ecosystem services.

We usually think that changes to ecosystems occur gradually. This is not always the case. There is evidence of more abrupt changes. The Atlantic cod stocks off the coast of Newfoundland collapsed in 1992, resulting in the loss of tens of thousands of jobs after decades of intensive fishing. They are still not recovering, despite the closure of most fishing grounds. We need to understand the thresholds past which ecosystems are no longer able to support what we have become used to.

Living within environmental limits is one of the UK's guiding principles, set out in its Sustainable Development Strategy.³ If we are going to avoid crossing ecological thresholds in the future, we need better models of how different pressures affect ecosystems. Because we are uncertain about the way complex ecological systems work, we will need to adopt a precautionary approach. This means we should reduce the way our activities put pressure on ecosystems, so that we lessen the risk of abrupt changes.

Helping poor people

Poor and vulnerable people in developing countries suffer a great deal when their ecosystems can no longer provide the things they traditionally have done, such as food, shelter and medicine. Ecosystem services play a crucial part in meeting the Millennium Development Goals⁴ for eradicating poverty and hunger, reducing child mortality, combating diseases and ensuring environmental sustainability. In taking decisions about development, people everywhere will need to consider the value of what ecosystems can provide.



Ecosystems: more than just a view

Scientists' answer

Scientists have answered the policymakers' requests to show the linkages between biodiversity, economic growth, health and security. We know that if we do not consider the huge variety of things our ecosystems can do for us, we will continue to degrade them, increase the chance of crossing ecological thresholds and make it harder for the most vulnerable to escape poverty.

We now have a clear benchmark to chart our progress towards sustainability. If our policy-making and our decisions as business people and consumers are going to include what ecosystems can do for us, then scientists need to engage in these matters as a matter of routine. We cannot wait until the next time that policymakers want to assess the state of the planet's ecosystems.

References

1. The Millennium Ecosystem Assessment reports are at www.maweb.org
2. The UN Convention on Biological Diversity, the Ramsar Convention on Wetlands, the UN Convention to Combat Desertification, and the Convention on Migratory Species.
3. The UK's Sustainable Development Strategy, 'Securing the Future,' can be found at www.sustainable-development.gov.uk
4. The Millennium Development Goals can be found at www.un.org/millenniumgoals

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Democs

Perry Walker plays the consultation game



Deliberative meeting of citizens

Piotr Kossobudzki, Kopernik Science Centre

We want to make it easy for people to work out, share and express their views on public policy issues. To do this, we have produced a game in kit form, called Democs – an acronym for Deliberative Meetings of Citizens.

It allows a group of around six people to find out about an issue, discuss it, seek common ground and give their views, all in a couple of hours or so.

Democs encourages learning and a search for common ground. Information is given, so no prior knowledge is needed. The game structure makes it safe and enjoyable. It links to live issues, and can include a form for people to submit their views to government.

How it works

The example below relates to the inquiry of the Human Genetics Commission (HGC) into whether genetic testing kits should be sold over the counter. In January 2003, we held six events attended by 47 people, of whom 14 were members of the HGC Consultative Panel.

The game begins with cards of scenarios illustrating the personal and social dilemmas that the topic throws up. It continues with dealing hands of question- and fact-cards on the topic. Everyone has the chance to read out a card they think important or to ask a question, and to use their fact cards to answer others' questions. Everyone contributes from the cards in their hand: everyone gets to ask basic questions without looking stupid.

The fact cards chosen as most important are then combined with issue cards that raise general issues on the topic. People then discuss the main issues and work out what is really important for them.

The HGC games

The players' arguments fell into six main groups. These were the impact of a test on the recipient and her/his family; the rights of individuals; the overall effect of the test on resources; various dilemmas (for example, who should make the decisions about the result for a third party?); the quality and accuracy of the tests; and regulation.

The participants voted on the policy positions: see Figure 1 (they do not sum to 47 in all cases, showing that one or two people forgot to vote).

A large majority managed to identify dilemmas in their thinking and feeling

Position 1 was almost wholly rejected. More people found position 2 acceptable. Almost three-quarters of the participants were prepared to support position 4, but position 3 was most heavily supported. Several people remarked that their ideal was somewhere between positions 3 and 4. This is pretty close to the HGC's ultimate recommendation, published in April 2003.

The effect of playing

To the end of January 2003, nearly 350 people had taken part in around 60 games.

- Half the participants ended up with an increased understanding of views different from their own, and a quarter became more sympathetic to them
- A large majority managed to identify dilemmas in their thinking and feeling, and just over a quarter resolved them

• 70 percent felt 'slightly clearer than before' on the rights and wrongs of the issue and 12 percent felt much clearer.

Politicians are fond of calling for national debates on issues of science and otherwise. We think that a national debate should be just that. We also think that Democs provides one of the means by which that may become a reality.

What the players say...

'A terrific way of getting unspoken views into the open and enabling a richer discussion.' '[I was impressed by] the swiftness with which it enables a grasp of wide issues and the way in which it challenges you to look at other points of view.' 'Apparently different views can be closer than at first appears after there is more understanding of the concerns that are being expressed.'

	Not acceptable	Acceptable	Support	Abstain
1. No strict regulation	40	3	1	1
2. Voluntary regulation with no restriction on types of test	29	12	21	14
3. Voluntary regulation with restriction on types of test	5	21	20	1
4. Strict regulation	11	14	18	1

Figure 1

Reference

1. See Charlotte Augst (June 2003). 'Over the counter genetic tests', *Science & Public Affairs*, p. 20
- We would like to acknowledge funding from the Wellcome Trust under the Medicine in Society programme (grant number 065282) and from COPUS.

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Science in government

The government is revising the guidelines on scientific analysis in policy-making, which set out how the government should collect and use evidence to make better-informed decisions.¹ The guidelines were first published in 1997, and last revised in 2000. The new version will be published in the autumn. Michelle Frew lays out the groundwork, and Roland Jackson and Sue Mayer comment.

Securing science in policy-making

Officials need reliable evidence from credible sources, says Michelle Frew

The current draft of the guidelines emphasises the need for government departments, and the individual policy makers within them, to:

- think ahead, and identify early on, the issues on which they need expert advice and early public engagement;
- get a wider range of advice from the best sources, particularly when there is uncertainty; and
- publish the evidence and analysis and all relevant papers.

The latest revision also encourages the use of evidence from a wide range of disciplines. The balance will obviously depend upon the issue in question, but it is clear that policy must take account of socio-economic as well as natural scientific or statistical evidence, particularly in areas of public concern.

The consultation on the guidelines invited comments on the principles and all the text in the draft, but it also addressed a number of specific questions relating to what they should say about peer review. It also covered how departments' use of the guidelines should be measured, taking into account the considerable amount of evaluation that already exists for government departments.

The end product

We would hope that, as with previous versions, the final version of these guidelines will increase the awareness of policy makers of how to seek good quality evidence from the most credible sources at the most appropriate time.

This is absolutely crucial at a time where we have seen the level of public interest in evidence-



BSE and other science in government: preparing for the future

based issues increase. The recent MORI poll commissioned by the Office of Science and Technology showed that our society has an increasingly sophisticated understanding of science and technology issues, and the current review of these guidelines will help ensure that we have the best framework to help deliver the best advice to government.

Reference

1. See www.ost.gov.uk/policy/sapm/index.htm

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Consultations not enough

Roland Jackson wants continuous exchange

I welcome this revision of the guidelines on scientific analysis in policy-making, recognising as it does the need to accommodate improvements over recent years in risk management and public engagement.

The two consultation questions asked cover peer review and evaluation, but I should like to take a wider view.

The new draft guidelines refer both to the excellent report *Policy through Dialogue* of the Council for Science and Technology (CST)¹ and the OST's own guidelines for public dialogue, published in the government's response to the nanotechnology report from the Royal Society and Royal Academy of Engineering.² Implemented in their full spirit, these will lead to the real change of culture that the CST wishes to see.

Consultation is not enough

However, if the government is to take public input seriously, it needs to do more than simply seek specific consultation on particular policy issues, important though that is. The structure of the consultation on the Energy White Paper³ was a good example of such a specific approach, and the ambitious attempts

of the Committee on Radioactive Waste Management (CoRWM)⁴ illustrate its difficulties and complexities.

Processes such as horizon-scanning now inform the wider policy background. Just as they provide intelligence about science, we need intelligence about public opinion, attitudes, values and knowledge. This simply does not exist now, and it should be continuously collected, collated, interpreted, and openly shared.

Understand public knowledge too

It is just as important to understand public knowledge as public values and priorities. Policy-making that is out of step with public knowledge is doomed to lack of understanding and likely to lead to loss of support and trust.

Take, for example, climate change and energy policy. In a Scottish Executive representative survey in 2002, just 37 per cent of respondents said that coal and oil power generation produce greenhouse gases, and 29 per cent thought nuclear power stations do likewise. I worry that we severely underestimate the communication that is needed with the public on the relevant science and technology.

There is little incentive for people to explore their understanding and improve their knowledge if consultation is seen to be sporadic and limited. If the understandings and views of policy-makers and the public are to be brought closer together, we need a more widespread and continuous discourse than currently takes place. We also need much clearer communication and explanation of policy decisions, demonstrating how they take into account public knowledge and perspectives. That requires a national infrastructure for public engagement and communication that we do not currently possess.

References

1. See www.cst.gov.uk/cst/reports/#8
2. See www.ost.gov.uk/policy/issues/nanotech_final.pdf, Annex B
3. See www.dti.gov.uk/energy/developpe/
4. See www.corwm.org.uk/content-o

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Let's do an audit!

Sue Mayer calls for evidence of progress so far

The introduction of the government's guidelines on scientific analysis in policy making was an important response to the BSE and other crises where scientific advice and its use was poor.

Their regular revision is also important, and the proposed new guidelines reflect some important new thinking – especially about public engagement. They emphasise the need for public engagement to be real and to help in framing the risk issue. This is very welcome.

In some places, the proposed guidelines could go further. They emphasise the need to publish the evidence and analysis and relevant papers, but most scientific advisory committees still meet in secret. Opening this part of the process up would help a new culture of accountability to emerge and is likely to ensure assumptions and framings are considered.

But what is really missing is an audit of how the government has dealt with scientific advice in the past five years – the extent to which this

has followed the guidelines and where any problems have arisen. Building such an 'evidence based' approach (to use the jargon of the document) to the process would make it much more robust.

GeneWatch's response

Therefore, GeneWatch's main response to the consultation is that, before finalising the guidelines, the Chief Scientific Advisor should ask government departments to explain the impact the guidelines have had on their practices in the past five years – how have they sought expertise, what evidence is there that it represents a wide range of knowledge and views, any difficulties and so forth. He should also commission independent assessments of three or four cases studies, drawn from different areas, to see where any weaknesses exist in making the laudable aims of the guidelines bite.

GeneWatch UK's proposals for the science advice case studies would be the UK Biobank,

TB in badgers and the latest GM contamination case with Syngenta's Bt10 maize. There's likely to be good and bad practice among these and plenty of lessons to be learnt. The audit process should itself be based on the guidelines.

Without an audit, the guidelines may just amount to a lot of fine words which we further refine and polish or they may be failing to address key problems. We simply don't know – let's examine the evidence!

Reference

1. See www.ost.gov.uk/policy/sapm/index.htm for a draft version of the guidelines

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South Asians and health

People from India, Pakistan and Bangladesh are roughly 50 per cent more likely to die from coronary heart disease and up to six times more likely to have type 2 diabetes than white Europeans. A Grosseteste Dialogue in Nottingham heard John Kalk, Musaraf Hussain and Chris Packham investigate the physical causes, religious defences and healthcare responses

Asians have more body fat

Obesity in Asian populations is underestimated, explains John Kalk

Recent research provides some insights into the high prevalence of both diabetes and coronary heart disease in the south Asian communities of the UK, which can also be applied in a practical way.

Asian populations tend to have more body fat than apparently similar European and North American people. Much of this extra fat is inside the body, especially in the belly, where it can predispose to diabetes and adverse changes in the cholesterol profile. Because 'western' standards for overweight are in current use, the frequency of overweight and obesity has been underestimated in Asians, and new, smaller, definitions should be used to define normal weight and overweight in this population. If this is done, more individuals will be identified as being at risk from the complications of overweight and obesity.

Overweight commonly starts in childhood, especially in south Asian children, who also tend to be physically under-active in the UK. Moreover, there is new evidence that the adverse metabolic changes which predispose

to heart disease and diabetes frequently start in children as young as 10 years, especially if they do little exercise.

How can this new information be used to improve the health of UK south Asians?

Parents should encourage more physical activity for their children. If children are lean and active, their healthy 'metabolic profile' continues into young adulthood.

Routine screening for diabetes and heart disease risk factors (high blood pressure, cholesterol profile, smoking) should start in young adulthood, rather than in middle age as is usual practice. If abnormalities are found they should be vigorously managed to meet the targets set by professional associations.

In my view developing healthier children will be the key to long term health improvements.

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Diet, exercise, faith: getting to grips with heart disease

Faith lowers stress

Islam emphasises good relationships, says

Musaraf Hussain

Religion is more concerned with the safety of the soul than the health of the body, yet it recognises that souls have to live in bodies and those have to be healthy.

This is in fact one of the very important teachings of Islam. When you look at the underlying causes of many health problems, such as high blood pressure and cardiovascular problems, we know that 50-70 per cent of that is really due to stress, fears, anxieties and psychological problems. That is one area where faith can play a very important part.

A lot of research that has been done on the link between faith and health also points to this. Faith can make an enormous difference in solving a lot of these stress problems which is one of the underlying long term causes of a lot of cardiovascular diseases in particular.

Islam is primarily concerned with relationships, with oneself and with one's Creator. These relationships are largely about acquiring moral values such as forgiveness. There is a strong link between being forgiving, light-hearted and kind, and being healthy. Doctors have recognised two types of people, the aggressive and the forgiving.

Religion is all about promoting the wellbeing of people at an holistic level. Your relationship with others is about social obligations. There is so much attention to it that you really do have to care about others. In fact the Prophet went so far as to say that if you want to live long lives, build good relationships with your relatives in particular.

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Partnerships are tackling the problem

Chris Packham outlines local health initiatives

A wide range of partnership projects in Nottingham focus on Asian communities and cover heart disease, diabetes, mental health, sickle cell and thalassaemia.

Projects promote health via local radio in Asian languages, activity advisors and mentors, Asian language booklets and videos and cook and eat demonstrations. Special targets include Asian women and Pakistani youths.

Primary Care Trusts (PCTs) and local government are working closely with the voluntary sector and are trying to identify other partners. PCTs are appointing ethnic minority

women into a range of positions to communicate via appropriate languages.

Nottingham City PCT has recently supported Masters level research into the role faith plays in health promotion. We recognise that we have a lot to learn from ethnic minorities about how to develop partnership.

There already exist a number of partnership initiatives, for example the Health and Well-being Development Officers who work in specific geographical localities seeking to engage local diverse groups, communities and service providers to improve health and reduce

health inequalities.

The PCT runs a Healthy Schools programme in partnership with Nottingham City Council to make sure that all schools have the opportunity to promote health through education and activity.

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Resources

The British Heart Foundation (BHF) is currently revamping its booklet with healthy Asian recipes. BHF also has a booklet about looking after your heart containing a lot of culturally appropriate tips. BHF also runs the 'Walking the way to health' initiative in partnership with the Countryside Agency, and Artie Beat Club for children.

Every year QUIT and the Muslim Health Network (MHN) run a National Smoke Free Ramadan campaign, partnered by the Imams of many mosques and others, to publicise the dangers of second hand smoke to the family. MHN advises government and others on how to communicate with Muslims in a culturally sensitive manner. Asian Quitline uses minority languages to encourage people to give up smoking.

Audience reaction

'I think there should have been more explanation about what we should cook and what we should give our children and what we should eat. Somebody should show us how to cook, how much oil we should use and things like that. I did find some useful information from the event, such as that you should go walking and that exercise is a good thing. We can teach our children to do exercise.' – Zeena Shah.

'I thought the event was informative, although I already knew a lot of what I was told. One thing I did like was that they were going to do a follow-up rather than just talk about these problems, not just go home and forget about it. I liked the idea of setting up a group within the local area to tell us about healthy Asian cooking. I'd like to see something for children, getting them kick-started into doing something.' – Amnah Shah

Cultural predispositions

Many Asians seem to have a fatalistic approach to their illness, said an Asian speaker at the Dialogue: 'They just say, "Oh well, I've got diabetes", or "sugar" as it's known in the community. There is a lack of understanding regarding self-management for diabetes. A lot of people think it is something the doctor has to take responsibility for, not the patient themselves.'

Diet plays a large part in Asian cultures, and very high fat foods are often offered as part of hospitality. 'People need to be encouraged to maintain a healthy balance, look at what they are eating and how it is prepared,' said the speaker.

These opinions were aired at one of the five East Midlands Grosseteste Dialogues between Science and Faith in spring 2005.

These Dialogues were supported by a COPUS Grant, funded by the Office of Science and Technology, and the Royal Society. For more information visit www.the-ba.net/grosseteste

Ethical governance of UK Biobank

Autumn 2005 sees the beginning of the second preparatory phase of UK Biobank, the DNA database being set up to identify genetic and environmental factors that impact on human health and disease.¹ As the project gathers pace, there are concerns about the way its ethics will be assured. Alastair Campbell defends the arrangements, while Sarah Wilson and John Gillott question them.

UK Biobank ethics and governance framework

An innovation in ethics governance, declares Alastair Campbell

A project as massive as UK Biobank presents unique ethical challenges.

Half a million people will be enrolled and the resource could be used for up to thirty years or more. There are ethical issues throughout, from identification of participants and adequate consent, through security of the data, rigorous assessment of the uses of the resource and procedures for withdrawal. Following extensive consultation, the funders have drawn up an Ethics and Governance Framework (EGF) – but this alone will not be enough. Who ensures that the Framework meets the challenges of the project as it develops and that it is fully implemented in the details of the project? This is where the Ethics and Governance Council comes in.

The Council is an independent body set up following public advertisement and with external assessors on the appointing committee, with members drawn from a range of professional and community perspectives. Its task is to act as a guardian of the Framework, advise on its revision, and monitor and report publicly on UK Biobank's conformity with it. This means that the EGF is not merely a statement of good intentions, nor is it a set of purely abstract principles. It is a working document.

Information and feedback

Two potentially contentious ethical areas are the details to be included in information sheets, given the very broad consent required from participants, and the question of feedback of information to participants at enrolment and later in the project.



Pilot study: recruit completing a touch-screen questionnaire with team member at UK Biobank assessment centre in Nottingham Biobank

In both cases the Council is involved in giving advice and commenting on draft policy documents and protocols. To carry out its task, it has full access to all relevant committees and documents of UK Biobank, and can request updates on the progress of the project at any time.

Trust is crucial

The central feature of the UK Biobank resource is that it is dedicated to the public good, by providing a rich data set for research into the interactions between genetic, environmental and life style factors in health and disease. Those who enrol in the project are consenting to an unspecified range of research projects, few, if any, of which will be relevant to them directly. This demands a great amount of trust in the project, a belief that their data will be used only for the stated purposes of the resource. The Framework and the Council are key to honouring that trust.

Some have suggested that the Council should have the power to veto projects if they fail to conform to the Framework – a bite as well as a bark. But UK Biobank *itself* holds the responsibility for ethical stewardship of the resource. If it fails, the Council will report that publicly – and such loss of public trust will vitiate the whole enterprise. The bark will certainly suffice.

Reference

1. The latest briefing on Biobank is at www.ukbiobank.ac.uk/news/briefings.php

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Access and accountability

Sarah Wilson has doubts

Recent research comparing the governance frameworks of several European Biobank projects points to weaknesses in the governance structures of the UK project.

Countries such as Iceland and Estonia have developed legislation specifically to safeguard the information in the databases, and to address key issues of access. In contrast, no such legislation exists here, and the UK Biobank will be overseen by an independent Ethics and Governance Council. Whilst existing UK law will obviously apply, there is no direct legislation governing the project, which will instead operate to a set of standards agreed by the Council.

Police access

This mode of operation gives cause for concern, particularly in relation to state and commercial access. There is no outright ban on access by the police (as there is in the Estonian Biobank) and it is possible that the police may obtain identifying information through a court order.

Whilst the governing framework of the Biobank spells out that such a request would be strongly resisted in the courts, precedence has been set for confidentiality to be breached

in a similar case. The group responsible for the initial Ethics and Governance framework 'didn't perceive any special vulnerability to police interest for UK Biobank as compared with... other databases.'

In practice it may be that the special vulnerability of the Biobank lies in the sheer size of the project, making it an easy way of checking a large number of DNA samples at one time. Similar concerns exist in relation to insurance and employment, where there is the potential for discrimination.

Bark not bite

These concerns are compounded because the committee responsible for overseeing the Biobank's ethical framework has little power if it identifies a breach of ethical practice, even though the White Paper on genetics had suggested the oversight Council should have the power of veto. The existing powers of the Ethics and Governance Council are limited to an advisory capacity, with the strongest action being formal resignation and public denouncement by members of the Council.

Early in the process of developing the framework, it was recommended that 'the

option of seeking legislative support be kept in mind' and this should be re-considered.

Greater powers of sanction, and clarity in matters of access, would answer some of the criticism levelled against the UK Biobank, and may ultimately contribute to a more successful project.

Reference

1. Anthony Mark Cutter, Sarah Wilson and Ruth Chadwick (Sept 2004), Balancing Powers: Examining Models of Biobank Governance, *Journal of International Biotechnology Law*, Vol 1, Issue 5, p187-192.

The support of the North West Genetics Knowledge Park and the Economic and Social Research Council of UK, is gratefully acknowledged. The work was part of the ESRC Centre for Economic and Social Aspects of Genomics (CESAGen).

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Worries and plaudits

John Gillott has mixed feelings

There are a number of issues that give me cause for concern: feedback, wider family data storage and use, and withdrawal.

On feedback, it is my understanding that some basic data such as blood pressure may be given to participants, but that other data, specifically genetic information, would not be fed back. It seems likely that some genetic tests for highly predictive genes will be done on samples, if for no other reason than to avoid such factors obscuring the search for genes of smaller effect.

It may be possible for UK Biobank to maintain its existing policy of no feedback, but such a scenario suggests at the very least that participants will need a very thorough discussion of the issues if they are going to waive what many would see as reasonable expectations under a duty of care. Has this been fully planned and considered?

Consent is satisfactory

UK Biobank is seeking broad consent from participants to 'participate in UK Biobank'. As stated in the public draft: 'Given that it will be impossible to anticipate in advance all the uses to which the resource will be put, consent will be based on an explanation and the understanding of, amongst other things: the purpose of UK Biobank; the fact that UK Biobank will be the legal owner of the database and sample collection; the kinds of safeguards that will be maintained; and the policy for making decisions on research access.'

This approach has met with criticism from a range of scholars and campaigners who fear that it contradicts contemporary ethical and legal standards that emphasise *informed* and *specific* consent, and amounts to giving *carte blanche* to researchers. It is suggested that

this problem is particularly important on account of the sensitivity of the data (including genetic data) concerned.

In contrast I would endorse the approach taken by the project on this central question. Not only is it eminently practical, it is also consistent with what we know about the views of prospective participants, many of whom are reasonably happy to give a general consent and do not see genetic data as especially sensitive.

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Designer babies: what do teenagers think?

Anita Shaw and colleagues found out with a citizens' jury

How far should we venture with 'designer' baby technology? We ran a citizens' jury for 16-19 year olds, and found out what those who will be directly affected by new policies – today's teenagers – actually think about the issues.

The publication of the Commons Science and Technology Committee's report *Human Reproductive Technologies and the Law* has put the question in the public arena.¹ The report recommends that parents should be able to choose the sex of their child. The Human Fertilisation and Embryology Authority (HFEA) has also decided to change its policy on the use of pre-implantation tissue typing.²

We ran our citizens' jury in September 2004, in response to the Human Genetics Commission's (HGC) consultation document, *Genetics and reproductive decision making*.³

A citizens' jury is analogous to a legal jury in that expert witnesses present evidence for and against a question, but are then questioned by the jury. The jury ran for three and a half days, which included a half day team-building with the moderators (an experienced team from Children in Wales) to lay the ground rules.

Aims

Our aims were to

- find out what mattered most to 16-19 year olds in this area
- facilitate discussion and debate between jurors and witnesses with experience in this field
- support jurors in the presentation of their verdict to policy-makers.

Our jury's question was 'Designer babies: what choices should we be able to make?' We chose it after surveying post-16 biology students in north and south Wales to find out what issues were most relevant to them in the area of genetics and reproductive technology.

Four sub-questions were identified:

- should we be allowed to 'design' babies for medical reasons?
- should we be allowed to 'design' babies for non-medical reasons (such as sex selection)?
- should we be allowed to 'design' babies to save a sibling?
- what regulations, if any, should govern these areas?



Saviour siblings Yes! – Sex selection No!

The jury was representative of the 16-19 year olds in south-east Wales.⁴ Through contacting over 300 local employers, youth forums, local authority bodies and community groups, we targeted interested people and invited them to an introductory session, at which we described the project and asked potential jurors for input into the process. One of the important ideas that emerged was that they wanted to hear from ordinary people with direct experience of some of the issues to be discussed.

Outcome

The jury agreed overwhelmingly with the following statements:

- People should be allowed to 'design babies' to prevent genetic conditions from being passed on
- People should be able to 'design babies' to save their siblings
- People should *not* be allowed to design babies for the sole purpose of sex selection
- The Human Fertilisation and Embryology Authority should have some members under the age of 20
- The term 'designer babies' is *not* a useful phrase.⁵

A majority of the jurors believed that the ability to design babies will increasingly offer the opportunity to prevent serious inherited conditions being passed on, and that it is acceptable to design babies to cure existing children with serious medical conditions. The majority opposed designing babies for no medical reason; while the relief of suffering may be sufficient justification for interfering with natural processes, they felt that to do this for other reasons is to imply that the designed child is a possession of the parent. The majority believed that the process of creating designer babies was much better described as the 'selection' of embryos with (or without) particular features.

The jurors presented their verdict to the HFEA, the HGC and the Welsh Assembly Government.

We are currently working with teachers to develop resources for A level biology, RE and general studies to support the teaching of social and ethical issues of contemporary science.

A citizens' jury is an effective model for engaging young people in current issues in science and this project demonstrates that they have valuable and interesting things to say about genetics and reproductive decision making. It provides a forum for the discussion of complex ideas with experts and, in this project, with those with direct personal experience of the issues. Further, it gives participants increased confidence in discussing contemporary science, and it serves as a framework to present those ideas to policy-makers.

We recommend that policy-makers specifically canvass young people's concerns when discussing matters of science and technology policy in the future, particularly those which will directly affect this section of the public.

References

1. The report is available at www.publications.parliament.uk/pa/cm/cmsctech.htm
2. See www.hfea.gov.uk/PressOffice/Archive/1090427358
3. www.hgc.gov.uk/Client/Content.asp?ContentId=262
4. For the jury's demographic composition, see <http://www.wgp.cf.ac.uk/CitizensJury.htm>
5. *Ibid* for details of the voting and the verdict

If you would like a hard copy of the verdict, please contact Anita Shaw.

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Exhibition: The Hitchhiker's Guide

Wendy Barnaby asks whose thumbs are up

Not everyone loves the Science Museum's current exhibition, *The Hitchhiker's Guide to the Galaxy*.

'It hasn't dazzled me,' said Jon, a Hitchhiker fan visiting from the US Midwest. 'I was expecting something more interactive.' His companion, Diane from Borehamwood, agreed. 'It's a good idea to have these cases on how you can build your own planet, but when you try to press the buttons, you realise they don't do anything,' she said. 'I'd like fewer props and more ideas. It would have been nice to have something on the ideas from the radio series that have permeated our culture. And it's not funny enough.'

Jon and Diane are serious fans with seriously high expectations. Both met Douglas Adams, author of *The Hitchhiker's Guide*.

But spare a thought for the Science Museum. It has gathered together the original props from the film of the book, and arranged them in a suitably dislocated series of chambers. The interior of Arthur Dent's ordinary house gives way to the forms of the surreal story that began when the Earth ended – demolished to make way for a hyperspace expressway. The heartless Vogons, bureaucrats of the galactic government, are there, with their judges' wigs, turned-up piggy noses, cavernous landscapes of vile grey skin, fraying cardigans, revolting mouths and tiny hands. The clothes worn by the film's characters are there: flowing capes, towels and dressing gowns all. The Heart of Gold spaceship, the super-computer Deep Thought, Slartibartfast's model of Earth's surface, and Marvin the paranoid android: they're all there.

When – so the story goes – the drunken young Douglas lay in a field in Innsbruck, staring up at the sky and thinking, 'Someone should write a hitchhiker's guide to the galaxy', he didn't know what a cultural icon he would produce. From the 1978 BBC radio series to best-selling novels, TV series, record album, computer game, stage adaptations and now, since his death, the film, the *Guide* has been a touchstone in the cultural landscape of the '60s generation. No wonder it's hard to do justice to the fans' expectations.

View from the Museum

The Museum's expectations are less complex. '*Hitchhikers* is one of a line of perception-busters,' said Museum Head Jon Tucker. 'We know from our research that there's a group of people out there who think science is boring and museums are boring – so how boring are we going to be at the Science Museum? How can we break that perception? All the temporary exhibitions we've done, like *Lord of the Rings*, *Bond*, *Grossology* and now *Hitchhikers* – all are aimed at new audiences who wouldn't normally come and see us but who think, "Oh yeah, that looks interesting – I'll go and look at that. Maybe they're not quite as boring as we thought".'

Once lured in, many of the new visitors go on to have a look at other parts of the Museum. A quarter of a million people came to see the *Rings*, and more than half of them went on to other galleries. This perception-buster resulted in over 15,000 new visitors coming back to the Museum within 12 months – and at no cost to its normal budget.

The Heart of Gold spaceship, the super-computer Deep Thought, Slartibartfast's model of Earth's surface, and Marvin the paranoid android: they're all there

Although entry to the Museum is free, all the temporary exhibitions must be self-financing. *Hitchhikers* costs £7.95 for adults and £6.95 for children and concessions. Visitors Jon and Diane didn't think they'd had value for money, but Tucker is uncompromising: 'We can show it and charge, or not show it and not charge.' The perception-busters have either broken even or made the Museum some money which is ploughed back into its exhibitions. They are clearly a successful part of its strategy to broaden its clientele.

The Museum's desire to broaden its visitors' knowledge results in panels which connect Adams's galaxy with contemporary science. The exhibition has panels on topics such as parallel universes, the existence of God, teleportation



Up close to a Vagon Science Museum

and robotics. These are written by Michael Hanlon, author of *The Science of The Hitchhiker's Guide to the Galaxy*.¹

The next perception-buster will be *The Science of Aliens: Are we alone?* Opening in mid-October, it will, says the Museum, explore our enduring fascination with aliens and look at astrobiology and what life on other planets could be like.

In spite of the fans' disappointment, I was absorbed by *Hitchhikers*. I might well give the Aliens a go.

See if I don't.

Reference

- M Hanlon (2005), *The Science of The Hitchhiker's Guide to the Galaxy*, Macmillan Science

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Is SPA on the right track?

SPA readers are expressing strong views about the magazine in their letters to the website, www.the-ba.net/spa. Below is an edited version of the debate

Dear Editor,

I think that the journal is becoming too much of a talking shop for science issues with a barbed overtone. That is not what I think it should be. It should have more on actual scientific questions and go back to having more leading figures contributing articles and not attempt to be hard-questioning journalistic in ways that I do not think help.

I never, for example, have appreciated Tom Wakeford's articles. They are too opinionated and not always based on sound scientific knowledge. At the very least they should be counterbalanced with alternative views.

Sir Walter Bodmer FRS
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Dear Editor,

(A warning to readers: this reply may slip into a hard-questioning opinion and the occasional practice of journalism. It will err on the side of good judgement rather than officially sanctioned facts).

Some may be surprised that it has taken Sir Walter so long to object to the overhaul undertaken by the Editorial Board and Editor of SPA. In the years since I began as a columnist in 1998 they have transformed SPA from a glossy jolly-good-chaps journal to an innovative and highly readable magazine full of trans-disciplinary analysis from people with a diversity of perspectives.

May I respectfully suggest that Sir Walter's argument is based on an outdated concept of who are the leading figures at the interface of science and public affairs? Perhaps he would like to experiment with his own parallel publication based on the quaint old division between facts and opinions? However, I fear his venture would not attract as much support from practising scientists or policymakers as he would have hoped.

Tom Wakeford
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SPA: too much of a talking shop?



Dear Editor,

We are constantly reminded that criticism and debate are the life-blood of science. They are all too rare in the teaching situation, and most debates in research fields are too technical for general readers. Hence it is important to publicise the lively debates on science policy issues, at which SPA excels.

Of course that means that some incorrect views will be promoted; but the advancement of science depends on the promotion of views which are generally considered incorrect at the time. Similarly for passion in debate; if scientists

were all dispassionate calculators, no serious novelty would ever be achieved.

It is a great skill to preserve a dynamic balance between opposing views argued with passion but courtesy. On this SPA has built its reputation. Long may it flourish, as a demonstration that science can indeed be an exciting pursuit for independent minds.

Jerry Ravetz
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Dear Editor,

As an occasional contributor to SPA, I would like to say that Tom Wakeford's fiery pieces often cause one to stop and reflect on science and technology in ways which would not necessary otherwise happen. Of course such questioning needs facts but in complex areas understanding is shaped as much by interpretations as by facts.

Sir Walter opines that the journal should have more pieces from senior scientists rather than what he calls 'journalists', but why is this a good idea? Additionally what is the problem with a 'talking shop' - is not one of the major purposes of SPA to provide a window on how issues within science impact on public affairs and provide room for discussion?

We need more than ever to fully understand and the complex interfaces and meeting points between science, politics and our place in society. Who asks these questions is far less

important than how they are discussed and where the public (whoever they may be) voice is heard and what the outcome of such discussion is. SPA plays an essential role in this process.

We are disenfranchised if all of us, scientists or otherwise, do not participate in the governance of science. Significant sums are spent in the name of each one of us for the support of science, engineering and technology and a healthy democracy stimulates the kind of questioning that goes on in the pages of SPA - long may this continue.

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BA members: not consulted?

Dear Editor,

While the article from Dr Roland Jackson is most welcome ('Open, accessible, responsive science', SPA, March 2005) I would suggest that it is served up with a large dollop of hypocrisy. The BA doesn't even consult with its own membership prior to offering advice on their behalf to government inquiries, which is both unrepresentative and also not very scientific.

I would suggest that when Dr Jackson writes, 'it is time for a culture change that embeds dialogue as a natural and continuing process and that results in support for science and trust in its governance because it is seen to be open, accessible and responsive', that he actually applies that logic to the BA before he tries to foist it upon an unsuspecting world. I've been a member of the BA for some considerable time now and I'm not aware of the BA ever surveying its members to assess their views on any topic whatsoever.

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Dear Editor,

The BA does stand for open discussion and welcomes views from members at any time. This magazine is of course a good place to express them, whether they are critical or supportive of the BA itself or of any other organisation.

As far as government enquiries themselves are concerned, which is Mr Mulholland's specific point, the most significant input to government by the BA in recent years is the advice given in November 2002 on Science in Society. This is published at www.dti.gov.uk/ost/ostbusiness/puset/society.pdf and there was a subsequent open public consultation by the government on its response, which is also

published on the OST website, together with the subsequent action plan. In the very short timescale for this work (about six weeks) the BA consulted widely within the science communication community, many of whom are of course BA members. Time and resources did not permit a formal consultation of all members.

There is always going to be a real challenge here in terms of effort, cost and timing and I would certainly appreciate members' views on which sorts of enquiries they might welcome being consulted, if the BA has the resources to make a response.

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Self-limiting technology

Dear Editor,

Is technology too complicated to be interesting?

There's a persistent paradox in social attitudes towards science and technology: the more technological our culture becomes, the harder it seems to be to interest people in science and technology. Numbers of students taking science A levels continue to fall, and while university admissions soar, physics and chemistry departments at leading institutions close for lack of good students to teach. In the attempt to account for declining interest in science and technology, many point the finger at external factors. There is never any reference to the changing nature of science and technology itself.

This is a shame, because by focussing on external factors we miss what I believe is the heart of the problem, neatly summed up by Clarke's Law (Arthur C Clarke, the science fiction author): Any sufficiently developed technology is indistinguishable from magic. And the problem with magic is that it is not meant to be understood, except by a minority of initiates.

If you doubt Clarke's Law, look around you at your computer, your digital watch, and your mobile phone. Do you really understand how these things work?

Consider the digital clock and its mechanical predecessor. If you take the works out of a mechanical clock you can pretty much discover how the thing works from first principles without needing much prior knowledge - John Harrison, the inventor of the Marine Chronometer taught himself clockmaking in pretty much this way - but take the back off a digital clock and you can stare at its circuit boards and chips from now till Doomsday and be none the wiser. Granted, the digital clock will keep better time, but how it does it is, and for most people always will be, a mystery.

This suggests that technology (and science) might actually be self-limiting, in that as they become more complex they become comprehensible by, and interesting to, an ever decreasing circle of people until a point is reached where the next technological leap is stalled for want of sufficient skilled people to carry it forwards.



We don't understand how mobile phones work
Courtesy of LGC

Richard Ellam
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Not digital but dignity

The World Summit on the Information Society must consider human rights, argues Rikke Frank Jørgensen



Information technology in developing countries: social justice as well as technical infrastructure UNESCO

The so-called information society has been subject to global political negotiation for the last couple of years. Civil society groups have been fighting hard to get human rights on the agenda.

Groups such as European Digital Rights (EDRI) believe that information and communication technologies should be used not only to advance development, but to promote freedom of expression, access to information, the right to privacy, access to education and health services, gender quality, inclusiveness of marginalised regions and groups, and so on. Currently there are numerous violations of human rights in areas related to information and communications technology (ICT): imprisonment of cyber dissidents, state blocking and filtering of online content, illegitimate registration and surveillance of online users and activities, discrimination against groups and regions, restrictive intellectual property regimes, etc.

Human rights at the Summit

On 21 December 2001, the UN General Assembly asked the International Telecommunications Union to prepare a World Summit on the Information Society (WSIS).¹ The purpose of the WSIS is to explore how ICT can advance the UN goals for development: eradication of extreme poverty and hunger, universal primary education, gender equality and so on, as stated in the Millennium Declaration of 2000.

Governments, industry and civil society were encouraged to participate in the preparations for the Summit, which has two phases. The first was held in Geneva in December 2003, and a second is to be held in Tunis in November 2005.

During the preparations for the Geneva Summit, civil society groups involved in the process fought hard to get human rights on the agenda, and to broaden the focus from technical infrastructure to social justice and development. 'It's not about digital but about dignity' was one of their slogans. In November 2003, civil society groups announced that they would stop contributing to the official documents and write their own declaration.

The civil society declaration, *Shaping information societies for human needs*,² was presented at the Summit, together with the official WSIS declaration (The declaration of principles) and the accompanying *Plan of action*.³ Some governments opposed a reference to the Universal Declaration of Human Rights in the text, but the official documents confirm that the development of the information society must be built on the existing human rights framework.

This is both good and bad news: good because the reference to human rights is in there, but bad because so much time went into debating already-existing human rights commitments that hardly any energy was left for the interesting part. This is to use ICT to advance human rights at the local level. The WSIS promises are formulated in the most general language, and the negotiations carefully avoided touching violations of human rights such as the ones outlined above.

Furthermore, the documents stress a cyber security agenda, focusing on threats to national security and the need for stronger initiatives in this field, while ignoring the massive threats which technology poses to human rights standards for privacy, integrity, fair trials and so on.

Preparing for November

In the run-up to November, most energy has been spent on two issues which were unresolved after the first Summit. One is how to finance bridging the so-called digital divide. The other is negotiations on internet governance: the administration of the internet's core resources (domain names and IP numbers), which is currently run by an American organisation (ICANN) on contract to the US government. In contrast, not much political energy has been devoted to actually enforcing the plan of action from the first Summit.

The fact that the second Summit will take place in Tunisia is itself a sore issue, since the country is known for its bad human rights record – not least with regard to freedom of expression. Two missions to assess the situation and the 'WSIS readiness' of the country have been conducted so far.

At the next global preparatory WSIS meeting in September, civil society groups will assess the situation with regard to Tunisia, and more generally discuss strategies for making the Tunis Summit more than hot air.

Human rights violations

At the WSIS meeting in February 2005, a group of Chinese, Iranian, Tunisian and Maldivian cyber-dissidents and bloggers testified to violations of online freedom of expression in their countries. In the Maldives two Internet users have been sentenced to life imprisonment for criticizing a dictatorship. In China, failure to register blogs with the government can result in sites being shut down, and jail time for those failing to comply. In Tunisia and Iran, a number of cyber dissidents remain in prison.

References

1. See UN resolution 56/183
2. See www.worldsummit2005.org
3. See www.itu.int/wsis/

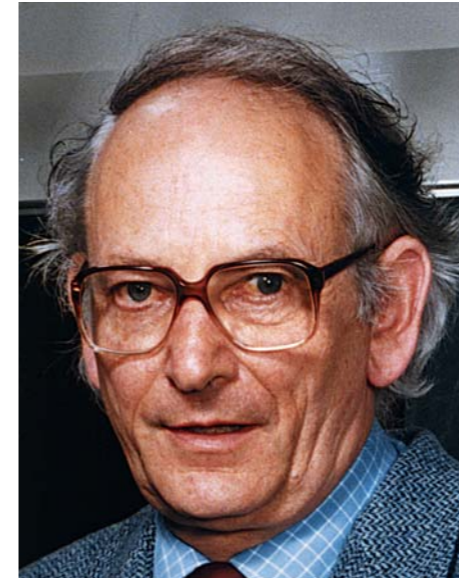
For more on EDRI, see www.edri.org

For more on the WSIS Human Rights Caucus: www.iris.sgdg.org/actions/smsi/hr-wsis/

Rikke Frank Jørgensen is senior adviser at the Danish Human Rights Institute, and co-chair of the WSIS Human Rights Caucus. She is board member of European Digital Rights (EDRI) founded in 2002 to defend civil liberties in the information society rfj@humanrights.dk

Kilby and Keeling

Jack Harris recalls two remarkable Americans



Either side of the longest day of the year, two outstanding American scientists departed this life – Jack Kilby on June 20th and Charles Keeling two days later.

The following day, 23 June, Kilby's obituary appeared in the *Times* and Keeling's in the *Guardian*. As I take both papers I naturally read both obituaries, and I was struck by the important impact each had, or should have had, on the world community.

Their differences are more interesting than their similarities. To start with, Kilby was a Nobel Laureate whereas Keeling wasn't, but should have been. Kilby's discovery had an enormous impact on contemporary life whereas Keeling's hasn't, though it should have. Kilby's discoveries indicate a comfortable and prosperous future for mankind, whereas Keeling's findings predict change and insecurity.

Kilby's circuit

On 12 September 1958 (the obituary was strangely specific) Kilby invented the integrated circuit, commonly known as the microchip, which replaced the transistor, which in 1947 had replaced the radio valve. The integrated circuit brought transistors down to atomic dimensions and permitted huge volumes of information to be transferred in a very short time in micro-sized components.

Computers became portable and universal, mobile phones ubiquitous and information technology was born. The microchip is

transforming our lives. Microchips also use little energy and in later life Kilby became interested in developing silicon chips to convert solar energy into electricity – so he has some green credentials.

Keeling's CO₂ measurements

Keeling first took an interest in the chemistry of the atmosphere as a post-doctoral researcher at the California Institute of Technology in the mid 1950s. He became frustrated that measurements of carbon dioxide levels showed no consistent value, but were affected by local factors and poor instrumentation.

Meanwhile, at the Scripps Institute of Oceanography, Roger Revelle demonstrated that the oceans were incapable of absorbing all the human-generated carbon dioxide, so this impurity might accumulate in the atmosphere. During 1957-8, the International Geophysical Year, Revelle recruited Keeling and charged him to carry out accurate measurements of atmospheric carbon dioxide levels.

Revelle could not have made a better choice. Keeling set about making more accurate instruments and from measurements in the Antarctic soon began demonstrating that global carbon dioxide levels were indeed rising. However, his most famous achievement resulted from data obtained from the carbon dioxide measuring station he set up on top of the volcanic peak Mauna Loa in Hawaii.

Kilby's discoveries indicate a prosperous future for mankind, whereas Keeling's findings predict insecurity

With remarkable persistence, very accurate measurements of atmospheric carbon dioxide levels have been made from 1958 to the present time – approaching half a century. Each year there is a variation on a yearly basis as photosynthesis in summer is replaced by foliage decay in winter. The striking result though is a steady increase in carbon dioxide level with the passage of years, from 315 ppm in 1958 to about 375 ppm today. His plot of carbon dioxide content versus time is now known universally as 'Keeling's Curve' and it has become perhaps

the most famous curve in science, and the most menacing.

Near misses

The *Guardian* obituary draws attention to the fact that, earlier this year, Keeling was the only American atmospheric scientist brave enough to speculate on the significance of the fact that, for the first time since records began, the carbon dioxide content of the atmosphere had risen by two parts per million for two years running. The silence of Keeling's colleagues has been attributed to President Bush's determination to rubbish any scientific evidence which supports the occurrence of anthropogenic warming.

On the other hand, President Bush did award Keeling the 2002 National Medal of Science – the highest American award for a lifetime of scientific achievement. Perhaps no one explained to the President what Keeling's achievements actually were!

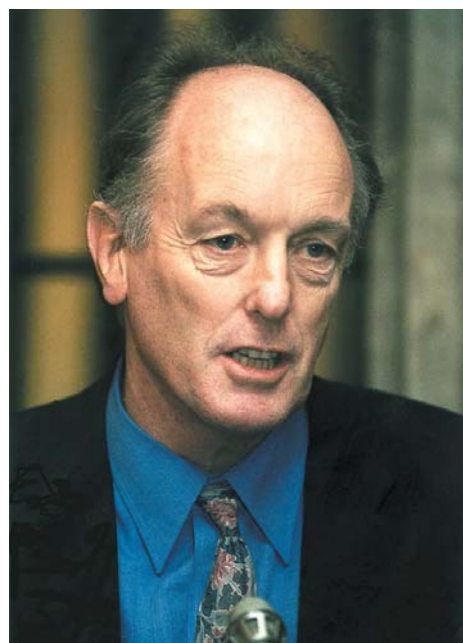
In 1966, when he was an undergraduate at Harvard, Al Gore was so inspired by a lecture by Roger Revelle on 'The Future of the Earth' that he became an environmentalist. This may explain why, as Vice President Gore, he enthusiastically signed, on behalf of the US, the 1997 Kyoto Protocol on Climate Change. This was later rescinded by President Bush.

It is a sobering thought that, but for a few votes lost in Florida, or the intervention of the green candidate, there would have been no war with Iraq and America might have ratified the Kyoto Protocol.

Jack Harris is vice-chairman of British Pugwash Jack.harris@lineone.net

Apparatchiks first and science second

Ian Gibson accuses the government of patronage and blackmail



The work of the Select Committee on Science and Technology is clearly not a priority as far as the government is concerned.

I was a member of the Committee 1997-2001 and chaired it from 2001-2005. The governing Labour party have given it, traded or however they wish to describe it, to the Liberal Democrats as part of their increased allocation of chairs of Committees. This effectively means that the Liberal Democrats form a minority party membership on the Committee and yet have the chair.

This was presented as a *fait accompli* in Parliament. The appointment carries an increased stipend and pension of £13,000 per annum and a seat on the Liaison Committee, whose most important function is to decide on the debates of Select Committee reports and to interview the Prime Minister for two hours twice a year.

As the last chair, and wanting to retain the position, I felt powerless at the decision of the government chief whip. Furthermore, what made a bad situation worse was the chief whip's use of blackmail. I and other key Labour members of the Committee were called to her office and told that we would lose membership of the committee unless we supported her decision.

So, despite our work in the last Committee, and despite the members of the Labour party being the best attendees of the group, I was

relegated from chair to member, and the principle that it is the Committee, and not the whips who decide who is chair, was thrown out of the window.

The reasoning

The Chief Whip argues that her decision was not personal. However, she may be the only one who believes this. Many others see my removal as chair as punishment for speaking out on student top-up fees, Iraq and foundation hospitals.

It is also very peculiar that I was the only chair not permitted to serve two terms. This could either mean that I am not well liked by the powers that be in the party, or it could mean that the government feels that giving the science and technology committee away was the least painful trade-off they could make with the opposition parties.

Neither reason gives a favourable impression of the government's continuing commitment to science.

Committee's record

Now to be fair, Labour has done a lot for science, but I would argue that the new environment of support for science is due in large part to the Committee's work in recent years.

I and other key Labour members of the Committee were called to her office and told that we would lose membership of the committee unless we supported her decision

The Committee has brought science to the fore. Its work has gone beyond the mere scrutiny of policies in several government departments where science plays a role (health, education, international development, food and rural affairs and so on), and has helped to shape and fashion policy. It played a big part in setting up the National Cancer Research Institute, the appointment of a scientific adviser for the Department of International Development, work into light pollution, and so on.

The Committee's successes are many and welcomed by the scientific, technology and engineering communities. In recent times it has earned the respect of the media, and through these channels has helped give fresh confidence to the scientific sector.

And yet there is so much more to be done – not only in following up on our reports to the government, but in maintaining the dreaded scrutiny of research councils and other sectors of science. The Committee was driven by Labour in ideas and activity in the face of indifference of the other political parties to science.

My worry is: will all this continue under the current policy of patronage and blackmail to serve party apparatchiks first and science second? I shall remain on the Committee to ensure that those whom I suspect would like to see the Committee scrapped do not get their way.

The first six months will tell if the new Select Committee is to maintain its previous status with the scientific community and to take up relevant and interesting studies. One can only hope.

The new Committee:

Mr Phil Willis (Liberal Democrat, Harrogate and Knaresborough) (Chairman)
Adam Afriyie (Conservative, Windsor)
Mr Robert Ffello (Labour, Stoke-on-Trent South)
Dr Ian Gibson (Labour, Norwich North)
Dr Evan Harris (Liberal Democrat, Oxford West & Abingdon)
Dr Brian Iddon (Labour, Bolton South East)
Margaret Moran (Labour, Luton South)
Mr Brooks Newmark (Conservative, Braintree)
Anne Snelgrove (Labour/Co-op, South Swindon)
Bob Spink (Conservative, Castle Point)
Dr Desmond Turner (Labour, Brighton Kemptown)

Dr Ian Gibson
is MP for Norwich North
gibsoni@parliament.uk

the BA activities for young people

connecting science with people



BA Award schemes for primary schools

BA First Investigators, for 5-8 year olds, and **BA Young Investigators**, for 8-13 year olds, are membership schemes for teachers. Each member receives a pack of easy to use activities appropriate for the age of the children. As the children successfully complete the activities they can apply for awards.

The awards are intended to help young people to develop their sense of curiosity into an ability to investigate in a systematic way and thereby learn and enjoy the basic approaches of science and technology.



the BA crest awards

BA CREST awards are open to all students between the ages of 11 & 19. They encourage students to explore their own interests, help develop problem-solving skills and motivate students of all abilities. A mentoring scheme builds links between schools, universities and local industry and provides insight into science in the 'real world'.

The new **BA CREST CD-ROM** and online resources are designed to excite teachers and students about topics within science and technology that can be developed into innovative BA CREST investigations.

www.the-ba.net/crest



science communicators

BA Science Communicators is our brand new award scheme for ages 11+, aiming to inspire and engage young people with scientific issues. Imaginative activities help students develop text-based, live presentation and practical science communication skills. The activities complement many areas of the school curriculum, including Citizenship, Key Skills and PSHE.

Science Communicator awards provide a framework for students to develop a broader understanding of the role of science and technology in today's society and the ability to communicate relevant issues in an informed and confident way.

Contact Us

For more information and to join our membership schemes:

Tel: 020 7019 4943

Website: www.the-ba.net

e-mail: ypp@the-ba.net

BA and ESRC Science in Society Seminars: Linking scicomm practitioners and the social science community

The ESRC Science in Society programme explores the rapidly changing relations between science and the wider society, while the BA seeks to help develop a national strategy for science communication. The two organisations have joined together to develop a seminar series that brings together practitioners and academics committed to improving public engagement, in order to disseminate social science research and build relationships between science communicators and social scientists.

The series is aimed at people engaged in science communication, including policy makers, professionals, academics and students from a broad range of organisations including government departments, science centres and museums, research institutions, universities, industry, NGOs, education, funding organisations, learned societies and PR.

The first three seminars in this series will be held in November at the Dana Centre in London.

Thursday 3 November 18:30 – 20:00
How do we communicate uncertainty and risk?

Thursday 10 November 18:30 – 20:00
How do we communicate nanotechnology through the media?

Thursday 17 November 18:30 – 20:00
How does industry access and use public knowledge?

Places are **FREE** but must be pre-booked

For further information visit www.the-ba.net/scicomm or email events@the-ba.net