

# Science & Public Affairs

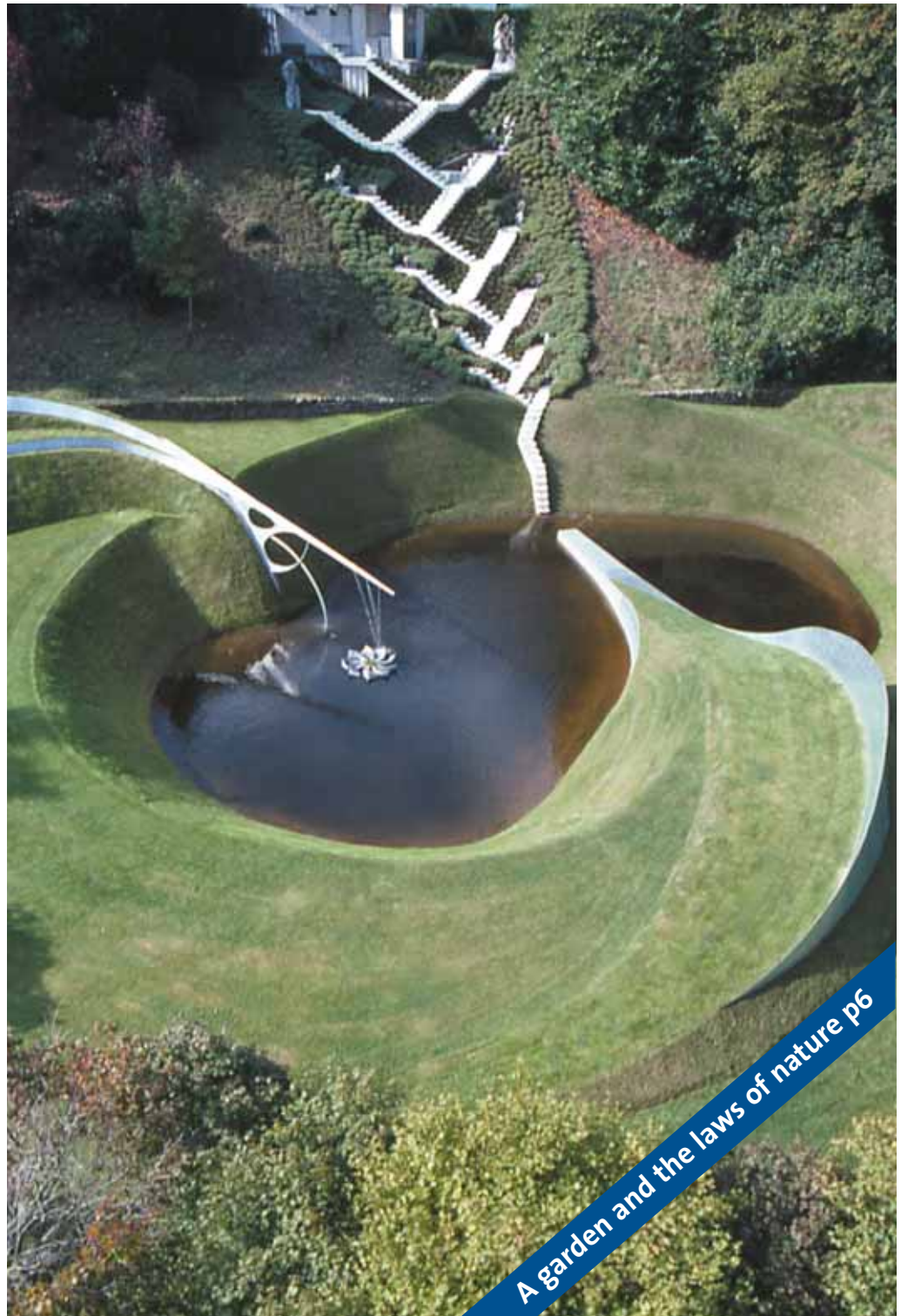
*The Garden  
of Cosmic  
Speculation*



*Further thoughts  
on GM*



*Education  
throughout life*



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# Treats from the garden

This issue of *SPA* is graced by the stunning photographs of Charles Jencks's Garden of Cosmic Speculation. It is, as he explains (p6), a landscape with about twenty areas dedicated to the fundamental units of the Universe. Each insight into deep nature becomes translated into nature and sculpture. Thus, the garden contains a Black Hole Terrace; a DNA Garden of the Six Senses; a Quark Walk, and so on. In an era when Tracey Emin and Damien Hirst are the public face of art, he says, 'these cosmic laws can give us a public iconography that is as eternal as anything there is, and more engaging than an unmade bed.'

Paul Drayson, the new Science Minister, is profiled by Joanna Carpenter on p17. The enthusiastic racing driver tells her that he's learned to handle the pressure of waiting to answer questions in the Commons through coping with sitting on the grid waiting for the race to start. He is already under pressure over his department's *Science and Society* consultation, as we relate on p9. Two of the academic authors who have written to him with their complaints explain their motives on p28.

And on p29 Tom Wakeford, whom we welcome as our Engagement Correspondent, takes a sideways look at the consultation process from the Minister's point of view.

More comment on controversy comes on p11, with Mary Midgley looking behind the Royal Society's decision to dispense with the services of their Director of Education, Michael Reiss, after comments he made at the BA Festival of Science in Liverpool. She traces the development to a desire to stir up 'a Cold War in which neither party even tries to understand the other'. But this quarrel is, she says, a 'trifling distraction' when compared with the 'vast horizons beyond', which most newspaper readers would like illuminated by the conflict, and which the protagonists fail to address.

Our SPATalk (p4) shows what we can extract from a debate about Peak Oil. Kjell Akelett is in no doubt that we should be worried about oil running out, while Mike Ryan thinks a peak is nowhere near. It's all a matter of how you estimate the reserves.

Public engagement has tended to emphasise scientists' relationships with the public. It has paid less attention to how they might influence policy. We focus on this in three pieces in this issue.

Michael Elves and Branwen Hide (p18) spell out the benefits of scientists advising policy makers. On p19, Peter Brooke makes some recommendations for the policy and academic communities to forge clearer, more coherent and more professional relationships. And on p20, Tom Webb explores how scientists can minimise controversy when their recommendations fall foul of vocal sections of the public.

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# Do we need to worry about Peak Oil?

Kjell Akelett and Mike Lynch beg to differ

Dear **Kjell**,

Current fears about oil production peaking fall into two categories: specific claims that half of the resource has been produced (based on mathematical models), resulting in an inevitable peak and decline, and more general claims that problems in the industry, political and other, will result in a peak. The latter are more difficult to address because they are so general.

Shortages of trained personnel and sophisticated equipment have certainly delayed projects and reduced available supply, but these are hardly novel, permanent or insurmountable.

The fears about resources are based on work by a handful of analysts, including the founder of the Association for the Study of Peak Oil & Gas. I disagree with their statistical modeling and oil forecasting more particularly. The methods employed have been found to work only on mature basins, and to be basin specific. But Peak Oil analysts have applied it to larger regions, where they fail to produce reliable results, because they cannot predict the discovery of new basins. More importantly, political interference is interpreted by these methods as geological results.

Actually, resources are far beyond those estimated by the models, and a peak is nowhere near.

Yours, **Mike**

Dear **Mike**,

Statistics from the oil industry show that the greater part of the reserves were found during the 1950s, 60s and 70s. During the 1960s, 48 billion barrels of oil were found each year, while consumption was then only 8 billion per year. Today, consumption is 30 billion barrels per year, while recent new finds average fewer than 10 billion per year. If we follow the trend of the last 40 years, new finds during the next 30 years will be approximately 150 billion barrels, but the estimated demand during this period is over 1000 billion barrels.

We have this amount in the fields that were found during the twentieth century, but emptying them is not like upending a can of Coca-Cola. A global average is that one can only extract five to seven per cent of existing reserves per year. This phenomenon is called depletion, and it is these characteristics that form the basis for



Are oil supplies in decline?

our research and those analyses done by Colin Campbell, ASPO's founder.

At Uppsala University, we have a best and a worst case scenario. The worst is that we will be on a production plateau at today's levels for about 8-10 years. The best gives an increase to a peak of 93 million barrels per day around 2012. The best case requires political decisions to open seven giant oil fields in Iraq. Currently global production is following our worst case.

Yours, **Kjell**

## All oil-producing nations will reach maximal production at some time. In ten years, production will be lower

Dear **Kjell**,

Peak Oil advocates tend to treat industry constants as new and argue that they now must cause a peak and decline in oil production. In fact, oil has always been finite, as have coal, gas, and many other minerals, and that has not prevented production from increasing for decades.

Depletion has been present in the industry, which has always offset it and added new supply. The problems the industry faces now are transient and do not necessitate a decline in production any time soon. Political problems in Iraq, Nigeria and Venezuela removed large amounts of oil from the market, and are responsible for high prices. Shortages of equipment and personnel hardly represent permanent obstacles.

The alleged lack of discoveries has concerned many, but represents a misunderstanding of the technical jargon. The reported size of discoveries represents an estimate of recoverable oil, and these estimates grow substantially over time.

Thus, the amount of oil now known to be discovered three decades ago is far greater than what was reported then, because we have been able to recover more of what was discovered than we anticipated at the time. Similarly, the amount of oil reported discovered in the last decade will grow in the future. The combination of discoveries and better recovery is replacing production, which is what matters.

Yours, **Mike**

Dear **Mike**,

The oil industry reports new production numbers day by day. Every month new numbers are released, and at the end of the year we will have a new figure for annual

production. We believe that this figure will increase every year until a point in time when the industry cannot increase production. It is then that we have reached Peak Oil.

The USA reached a production maximum in 1971. More than 50 of the 60 largest oil-producing nations have reached maximal production.

Everyone should understand that if all the world's oil-producing nations have one day reached maximum production, and if the production thereafter is decreasing in all nations, then global production must decrease. It is the produced oil that we buy, and if the amount available to buy decreases despite increasing demands then, according to economists, the price will rise.

Yours, **Kjell**

Dear **Kjell**,

Historically, many have warned of the depletion of the petroleum resource, as they watch fields and basins mature and decline, with every new effort seeming harder than the ones before, and voices lamenting that the industry must struggle, 'running harder just to stay in place'. But they misunderstand reserve data as being fixed, not dynamic, and mistakenly assume that if production is declining in an area, it must continue to decline. And so for three decades now, nearly every forecast has been too pessimistic about the potential supply.

And all the while, the industry has not just stayed in place, but made progress. New basins are opened up, old fields are rejuvenated, and all in all, technical progress makes the 'hard' oil accessible and cheaper. The resource base is huge, with only perhaps 10-15 per cent of conventional oil in the ground produced to date, and a much larger amount of heavy oil and oil shale still untapped.

Most of the world is hardly drilled, and the industry has repeatedly been able to find new ways to access the resource base. Today's troubles represent yet another commodity cycle which, yet again, is being misinterpreted as due to resource scarcity.

Yours, **Mike**

Dear **Mike**,

The oil industry will find more oil fields in the future. As I said, we estimate that during the next 30 years they will discover a total of 150 billion barrels. If we could continue to use as much oil in the future as we do today, then a constant consumption within the next 30 years would be 900 billion barrels. The reserves that we have today, together with what we will find, cannot produce 900 billion in the next 30 years. That includes even oil

sands and very heavy oils.

New technology is normally applied when production decreases. This makes the downward curve less steep, but one does not return to higher production levels. This is verified in a study that we just have completed for the oilfields that produce more than 50 percent of global oil production.

Mexico is an example where production is falling dramatically. There is every reason to believe that, by 2012, Mexico's production will decline to a level where they can no longer export oil.

## Today's troubles represent yet another commodity cycle which, yet again, is being misinterpreted as due to resource scarcity

All oil-producing nations will reach maximal production at some time. Those that have not yet done so must currently compensate for those nations that have decreasing production. At the moment world production is on a plateau of around 85 million barrels per day. In ten years, production will be lower. We will never see the International Energy Agency's official prediction of consumption in 2030: 116 million barrels per day.

Yours, **Kjell**

**Kjell Akelett**

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# *The Garden of Cosmic Speculation*

Charles Jencks explains why he has dedicated a garden to the laws of nature



**Over several years I have worked on a Scottish landscape called, immodestly, the Garden of Cosmic Speculation, speculating with scientists and others on the fundamental laws and forces behind nature and what they might mean to us. Using growing nature to conjecture on what is basic to the Universe is an old practice common to gardeners, but it raises some unlikely questions.**

## **Living nature and laws of nature**

Most people understand a big distinction between living nature and the laws of nature, that is, organic growth and electromagnetism, and they do not reflect that in a garden as elsewhere the latter may underpin the former. Furthermore, gardens of the last hundred years are for pleasure and relaxation, games and flowers, and not a place for public art.

A big question follows from this: what, in our fragmenting culture, could communal

expression achieve today, especially in the era driven by a runaway art market and fast change (not to mention toxic debt)? What beliefs command assent or, to shift to the public realm: which clients are brave enough to pay for a public park dedicated to a significant idea? My own experience in Italian and German parks is that to get any agreement on content is an uphill struggle, though very much worth trying.

## **Landform**

It is much easier to experiment on oneself and here I have been fortunate.

My late wife Maggie and I started work on this garden around her family home in 1988 and slowly, area by area, it has grown into a landscape with about twenty areas dedicated to the fundamental units of the Universe: a Black Hole Terrace for dining on in the summer months; a DNA Garden of the Six

Senses; the Quark Walk; the Universe Cascade and so on. Each insight into deep nature, many of which are recent, becomes translated into nature and sculpture.

Landform is my generic name for this genre that cuts across art, landscape, architecture and the customary categories, and there must be something like twenty-five of them throughout the garden. Some landforms refer to theories of folding and fractals, others (when they fail) to catastrophe theory. As every gardener knows, the dialogue with nature is always two-way, and it pays to exploit the unintended consequences of nature's acts.

## **Pentagon-driven world**

Why dedicate a garden to the laws of nature? Partly because everybody relates, consciously or not, to the larger picture; we identify with nature and its various moods and states. And

**Snail Mound.** Two paths – a double helix – rise up the Snail Mound on one side and fall gently on the other so the ascent goes up and down. Various ideas were behind this: DNA, a ziggurat, the contrary movement of the giant floor-paving maze at Chartres, Tatlin's Monument to the Third International – multiple meanings that have to be decoded, slowly. *Charles Jencks*



partly because in an era of global turmoil, when Tracey Emin and Damien Hirst are the public face of art, these cosmic laws can give us a public iconography that is as eternal as anything there is, and more engaging than an unmade bed.

But the emergent iconography of the Universe (seen through the culture of science) has one big public problem. The interpreters tend to follow Emin/Hirst & Co. Hence for the birth of the Universe we get the metaphor of a 'Big Bang' (used by ninety-nine percent of scientists to describe the mother of all things). It wasn't big (the inflation of a quark-sized event), and wasn't a bang (no one heard it). Rather it was the 'hot stretch' of space that balanced the basic forces (a much more engaging idea). Fred Hoyle coined the adolescent Big Bang metaphor derisively, but it caught on for the same reason that George Bush coined 'Shock and Awe' for his

bombing of Iraq. We live in a Pentagon-driven world where scientists in charge of the public understanding of nature regularly tell us that 'selfish genes' are in charge of robot vehicles, and that 'WIMPs and MACHOs' are the ultimate stuff of the Universe.

### The importance of names

So, in the Garden of Cosmic Speculation I try out questioning metaphors, and this means that all design is really double design: that is, solving formal and functional problems, and coming up with new, appropriate metaphors (both visual and verbal).

For instance, the Black Hole Terrace shows the space-time warps of super-gravity, the event horizons and rips in spacetime. But as design was progressing in 1995, and many were discovered and thought to lie at the centre of galaxies, the metaphor was changed to 'Invisibilia,' the female generator that helps hold much of the stars, planets and gas into their rotational shape. It is not just destructive, but a creative force.

When the Chinese asked me to design a rotating black hole for the Beijing Olympics, they accepted the design with delight but asked for a name change. We came up with several including Wu-Ji, and Wu-Chi, varying from 'nameless chaos' to the 'mother of everything.' They chose Wu-Chi, with its popular overtones and relationship to the word 'energy'.

Re-naming and re-conceiving go together, and so I have come up with a series of different visual metaphors for the basic things. Fundamental to the whole garden is the 'jumping Universe,' it is portrayed in the cascade that tells the story of the cosmos over its 13.7 billion years; and a 'landscape of waves,' for the undulating and linear language that unifies everything (everything, physicists show, has its own wave-form).

### More nourishing culture

Public art must of course be understandable and moving, but I believe it also should engage with the basic insights on the cosmos. This endeavour is collective, part of what has been called The Universe Project, where no one has the last word.<sup>1</sup> A hopeful sign is that The Royal Society of Chemistry has just rechristened the Large Hadron Collider 'Halo' after running a contest to find a more appropriate moniker for the atom-smasher.

Name-changes are a minor but significant place to start for creating a more public culture, even while acknowledging that no one controls language. 'Shock and Awe' and 'selfish gene' were intended to catch on and they did, because we live in the culture of



**Hearing.** An ear gently swings in the breeze, emitting various sounds – clangs and tinkles. Suddenly the wind catches the parabolic reflector and gives it a spin, and snap go the chimes below. This oak-sided DNA rises above white flowering anaphalis and when the oak finally weathers and turns silver the whole composition, including the stones, will have a common silver-grey tone. Also planned for the future is another parabolic reflector, a hundred yards away, aimed precisely to exchange sound waves with this one. When this is finished one will be able to whisper across the garden. Waves of vibrating air are transduced into sound through the middle ear – another miracle of the senses. *Charles Jencks*

James Bond, who in Italy was first called 'kiss kiss bang bang'; and Walt Disney did say 'no one ever went broke underestimating the taste of the American public'. But it is also true that there is a large public fed up with this regressive taste, waiting to feed on a culture that is more nourishing, and true, to life.

1. The Universe Project encompasses attempts to think through the implications of the book by Brian Swimme and Thomas Berry (1992), *The Universe Story*, Harper, San Francisco

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# Shorts

## In brief

### New Department of Energy and Climate Change

Ed Miliband, Secretary of State at the new Department of Energy and Climate Change, said on his appointment: 'My job is to make sure our policy on climate change is fair for ordinary families and our policy on energy is sustainable for future generations.' Martin Rees, President of the Royal Society, commented that reducing greenhouse gas emissions should be at the heart of urgent decisions to be made on energy.

### Inspiring youth

The BA is coordinating a new National Science Competition for 13-19-year-olds. It will identify a UK Young Scientist of the Year and a UK Young Technologist of the Year to inspire other students. Entrants will exhibit the best 35 projects at the new UK Young Scientists and Engineers Fair 2009 to be held at Westminster, 4-6 March, to coincide with National Science and Engineering Week.  
[www.nationalsciencecompetition.org](http://www.nationalsciencecompetition.org)

### Community action on carbon dioxide

The National Endowment for Science, Technology and the Arts (NESTA) has announced ten finalists in its £1 million *Big Green Challenge*. The community-led projects have until October 2009 to demonstrate a reduction in CO<sub>2</sub> emissions. Projects include a Nottingham credit union providing a 0 per cent interest finance scheme for energy efficiency improvements, and a local energy company selling green electricity.

### Geeks no more

Achievement in science at GCSE level is linked to high emotional intelligence, researchers for the exam board Cambridge Assessment have found. 2000 GCSE candidates filled in a questionnaire to assess their emotional intelligence before sitting their exams. Joanne Emery and co-workers found that good empathisers were more likely to score high grades.

## Testing the off switch



Science education: failing to encourage young people

**Recent reports from the Royal Society and the Wellcome Trust have criticised key aspects of science education in the UK as failing to encourage young people to stay in science.**

### No rise in participation – 14-19

The Royal Society has published a *State of the Nation* report, looking at key trends in science and mathematics education 14-19 across the UK from 1996 to 2007. 'Its overarching message is that numbers stay sadly low, and all the interventions of the last twelve years or so do not appear to have had any dramatic effect in changing that,' Julia Higgins, chair of the working group that produced the report, told *Science & Public Affairs*.

### Attitudes to school science – 11-14

Research by Patrick Barmby of Durham University raises questions about Key Stage 3 (11-14 years old) school science. He and his colleagues asked 932 pupils about their attitudes to science. It was already known that young people's attitudes to science decline as they progress through secondary school, he told *Science & Public Affairs*, explaining, 'What we found was the biggest decline, specifically, was their attitude to learning science in school. This attitude becomes a more important influence as young people move up the secondary years on whether they will choose to participate in science in the future. So the decline is worrying.'

### Teaching to the test – 7-11

Others have raised concerns about the English school testing regime. The government has recently abolished the tests young people take aged 14, but is keeping those taken at 11. David Bolden of Durham University and colleagues reviewed 50 years of attainment in science by English primary school pupils. Their report was recently published by the Wellcome Trust. 'We found quite a large rise between 1995 and 2000, but then it sort of plateaus out,' David Bolden told *Science & Public Affairs*. However other, independent evidence suggested official test results were overstating the rise, he said. 'We suspect that children are getting used to the tests but also that teachers are "teaching to the test".'

### Testing, testing

In the second report published by the Wellcome Trust, as part of its *Perspectives on Education* series, Wynne Harlen of Bristol University charts the history of primary science and describes the effect of national tests. 'There has been a great deal of pressure to get children to achieve in the tests,' she said, explaining that schools are being judged by their results. 'In science, this is particularly serious,' she said. 'We do need assessment, but what we need to do is assess everything, and not just the narrow bit that you can do with a written test.'

Wellcome Trust twin reports: <http://tinyurl.com/6xt9xy>

Royal Society State of the Nation report:

<http://royalsociety.org/downloaddoc.asp?id=5698>

## Consultation critics

Science Minister Lord Drayson has responded to critics of the recent Department for Innovation, Universities and Skills *Science and Society* consultation, which aimed to support the development of a new science and society strategy for the UK.

'I think they make a very good point,' Lord Drayson told *Science & Public Affairs*. 'We need to excite people about science... but it can't just be about raising the profile and being enthusiastic.'

### 'False assumptions'

A group of over 30 academics specialising in relations between science and society had written to the Minister, criticising the consultation as starting from false understandings and assumptions. 'We are deeply concerned that... the current consultation document significantly misrepresents the character and underlying relations between science and society,' they wrote.

The group included Professor Brian Wynne of the Centre for Economic and Social Aspects of Genomics, Lancaster University and Professor Sheila Jasanoff of the John F. Kennedy School of Government, Harvard University. They expressed concerns that the consultation document assumed science was 'automatically a public good' and emphasised 'uncritical excitement rather than critical engagement'.

### Response from the Minister

Responding to the criticism, Lord Drayson told *Science & Public Affairs*: 'We have got to question and hold scientists accountable, particularly where science is funded by the taxpayer. I think it's very important, for scientists and for government, to make sure that the taxpayers feel that important scientific questions are properly debated. I actually welcome having a debate, as we go through the consultative process on *Science and Society*.'

### Further criticism

The academics said that the consultation document failed to learn from recent policy debates and developments that 'emphasised the importance of opening up science policy to wider public scrutiny and debate, including the crucial pre-scientific stage of framing the questions.' They called for 'a radical revision'



Uncritical excitement rather than critical engagement?  
*fiona@frankpr.it*

and recommended that the 'consultation process now take the time required to review past experiences properly, and to reflect in a more fundamental way on how to support more democratically – and technically – robust science and technology policies.'

### The consultation

The *Science and Society* consultation looked at the engagement of science with society in its broadest sense, including the use of science by society, science education and the diversity of the science workforce. It included online discussion forums, videos and an interactive consultation document to record responses. The website states that although the consultation period closed in October, the department would continue to canvass opinion on emerging ideas.

*Science & Public Affairs* has recently (September 2008, p9) reported on the launch of the Sciencewise Expert Resource Centre (ERC), a support structure to improve the government's corporate memory of how to undertake public dialogue, one part of a wider public engagement agenda.

See also Correspondence, p28, and the Wakeford Watch, p29

The full text of the letter can be found at [www.dur.ac.uk/ihrr/news](http://www.dur.ac.uk/ihrr/news)

The Science and Society consultation website can be found at <http://interactive.dius.gov.uk/scienceandsociety/site/>

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## In brief

### More physics A-level entrants

A-level physics candidates totaled 28,096 in 2008, an increase of 2.3 per cent over the 2007 figure of 27,466. Dr. Robert Kirby Harris, Chief Executive of the Institute of Physics, said, 'Students are increasingly aware that A-levels in physics are well worth all the effort when lining up for university places and the very best jobs, but more still needs to be done to entice girls into the physics classroom.'

### Naked scientist wins award

The £10,000 Royal Society Kohn award for science communication for 2008 has been awarded to Dr Chris Smith, presenter of *The Naked Scientists*, the only weekly science show broadcast on local radio stations. He said, 'I am hugely honoured to win the Kohn Award, although I couldn't have done it without the fabulous people who work alongside me at the Naked Scientists.' The show is top of the US science charts for downloads. [www.thenakedscientists.com](http://www.thenakedscientists.com)

### Social responsibilities

The General Assembly of the International Council for Science (ICSU) has published a new booklet setting out the key social responsibilities of the scientific community. John Sulston, a member of the ICSU Committee and winner of the 2002 Nobel Prize in Medicine, stated: 'We must fully accept [our] responsibilities [to fellow scientists and the public at large] if public confidence in science is to be maintained.' See <http://tinyurl.com/63lwg7>

### Student + chemistry = terrorist?

The Royal Society of Chemistry has expressed concern over a High Court ruling banning a suspected terrorist from studying chemistry in the UK. Its Chief Executive Dr Richard Pike said, 'We need to avoid depicting, wrongly, school chemistry as a starting point for attempts by potential young terrorists to produce explosives. There is nothing on the AS-level chemistry course that cannot be found easily on the web and through other means.'

# Science in an economic downturn

Nick Dusic has a plan



Asthma inhalers from the UK's pharmaceutical industry: science is critical to the country's economic capacity GSK

**The prospects for the economy are bleak. Problems that started in the financial system are now moving into the wider economy. It is critical that the UK's investment in science and engineering weathers the storm.**

## Cabinet appointment

The Prime Minister, Gordon Brown MP, responded to the economic crisis in his October reshuffle by creating a National Economic Council, which has been dubbed the economic 'war cabinet' in the media.

The newly appointed Science Minister, Lord Drayson, will sit on both the National Economic Council and the Cabinet. It is a strong signal from the Prime Minister that he sees science and innovation as central to the UK's economic capacity and a cross-cutting government priority. The Prime Minister is right on both counts.

## Sow seeds

Science and engineering are critical to the UK's economic capacity. It is impossible to predict how the City of London will come out of this crisis. What is for certain is that more attention needs to be given to high-value-added industries that are dependent on skilled scientists and engineers. The economic downturn will mean that technology companies will be making hard decisions about the distribution of their global R&D capacity.

The government needs to redouble its long-term commitment to science and engineering

to show companies that the UK is a good place to invest and to sow the seeds of the industries of the future.

The government set out its ten-year framework for science and innovation in 2004. Approaching the half-way point, the government needs to recommit itself to achieving its targets for increasing the UK's R&D intensity and science and engineering skills.

Lord Drayson will need to be a strong advocate at the Cabinet and the National Economic Council to muster the political will to make it happen. As there will have to be an election by 2010, the science and engineering community needs to push for cross-party support for matching or exceeding these targets.

## Protect research budget

Even with government commitment to investment in science and a 'ring-fenced' budget, economic crisis has in the past led to cuts in research. The Department for Innovation, Universities and Skills (DIUS) needs to protect the science budget better than the former Department for Trade and Industry, which raided it due to the collapse of Rover in 2007. Short-term expediency should not outweigh the UK's long-term investment in science and engineering.

Departments need to be made to think twice before slashing their R&D budgets due to an overspend in another area or a tight funding settlement. The Sainsbury Review

recommended that a 'robust mechanism' should be established to help ensure that this does not happen in the future. There are discussions underway in government about what this 'robust mechanism' should be. Ultimately, departmental R&D budgets need to be as close to 'ring-fenced' as Treasury rules allow.

## Pursue fundamental research

One of the jobs of the National Economic Council is to equip the country for the future by making the right investments in science. There has been a lot of debate recently about whether the government is looking for its investment in the science base to have more of a short-term economic impact.

It is important that the government maintains its commitment to the independence of Research Councils and their ability to pursue fundamental research. The research base provides the core strength of the UK's innovation ecosystem.

## More scientists into teaching

Hopefully with the Science Minister at the Cabinet-table, Secretaries of State will think more strategically about their contribution to the UK's scientific endeavour. It cannot be accepted, as it was with the Foreign Office, that science is not a cross-departmental objective. The Department for Children, Schools and Families needs to capitalize on the opportunity that the economic downturn provides by getting more scientists and engineers into teaching. The new Department of Energy and Climate Change should develop a strong science and engineering ethos and significant R&D budget to match.

It is vital that during these difficult economic times the UK continues to increase its investment in science and engineering for the future. Although it is reassuring that the Science Minister will be able to directly input into discussions at the highest levels of government, the science community needs to keep making the case for science so that it is resilient to today's economic instability.

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# Heresy at the Royal Society

Mary Midgley laments a Cold War

**Is it possible for someone to lose his job at the Royal Society simply because headline-writers misrepresent what he has been saying? In mid-September, this startling thing seems to have happened.**

Several papers claimed in their headlines (not in their detailed reports) that Professor Michael Reiss, Director of Education at the Royal Society, had recommended that creationism should be taught in school science-classes. What he had actually said was that, if this topic came up, science teachers should allow their classes to discuss it and should help them to understand how the disagreements about it have arisen.

The Royal Society's pundits, however, decided to outlaw him. Whether moved by the headlines, or by the fact that Reiss is an ordained Anglican minister, or by real horror at the prospect of such discussions, they insisted that he should resign his post.

## Stirring up Cold War

How has this happened? Headline-writers, of course, always dramatize conflicts because they are pressed to print things that will sell their papers, and what sells them quickest is always a war.

In the case of religion, this means assuming that those involved on both sides are all bigots – anti-scientific fundamentalist Christians on one side and naïve scientific atheists on the other. It means ignoring the long history of thoughtful discussions that have shown most people the folly of both positions.

More seriously, it means overlooking the fact that most readers are not bigots but are puzzled and confused people who would really welcome light on their conflicts from either side. It means deliberately stirring up a Cold War in which neither party even tries to understand the other. In the last few decades this has been done so thoroughly that today the headline-forgers are not alone in claiming to iron out the world's complexities in this way. As we see, they are joined by the Royal Society.

## Confused attacks

Why has this split developed? On the religious side, of course, extremism is not new. In the USA, where the literal interpretation of the Bible was first systematically defended in the late nineteenth century, a fundamentalist war



'The only choice is what we get to worship'

against science has long been a political issue. It is linked with many local feuds between town and country, intelligentsia and populace, innovation and tradition.

Until lately, however, these warriors lacked something that all extremists need – namely, active, colourful opponents whom they could denounce. This equipment has now been generously provided for them by Messrs. Dawkins, Harris, Hitchens *et al.*, who have obligingly attacked religion in such a confused, indiscriminating way that it is not hard to answer them nor to represent them as hostile to every kind of ideal.

(Richard Dawkins has now, very admirably, protested against the treatment of Reiss. But his books have already contributed to the main damage.)

Thus both armies can now go on indefinitely feeding on each other – quoting each others' provocations without ever having to attend to the larger issues which interest the rest of us. And this performance is so noisy that outside observers – including, presumably, the Royal Society – easily conclude that a Cold War between bigots is indeed the only way to discuss these matters.

## More interesting questions

But this is not our whole world. There are vast horizons beyond for us to think about, horizons beside which this quarrel is a trifling distraction. I can only quote here a few signposts to this enticing territory.

For instance, Albert Einstein said, 'Religion without science is lame; science without religion is blind'. Charles Kingsley, on reading the *Origin of Species*, promptly wrote to Darwin saying that, 'It is just as noble a conception of Deity to believe that He created primal forms capable of self-development... as to believe that He required a fresh act of intervention to supply the *lacunas* that He himself had made' – a view which has remained widespread among Anglicans, as witness Professor Reiss. And again, the late American writer and essayist David Foster Wallace remarked, 'There is no such thing as atheism. There is no such thing as not worshipping... The only choice we get is what to worship.'

And that is surely a far more interesting question than any that is being raised in the current Cold War.

## Mary Midgely

is a moral philosopher. Her latest book is *The Owl of Minerva: A Memoir* (2005), Routledge, London. She is also the author of *Evolution as a religion* (revised ed. 2002), Routledge, London, and *Science as salvation* (1992), Routledge, London  
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Professor Reiss made his comments at the 2008 BA Festival of Science.

# Further thoughts on GM

Against the background of climate change and rising food prices, there are signs that the government is reopening the debate on genetically-modified (GM) crops. On this page and the next, Julian Little and David Dickson set out their hopes for GM in Europe and the developing world.

## Julian Little hopes that the European public will see the benefits of GM

**The British Retail Consortium announced in September that food inflation was nearly 10 per cent. Unfortunately, there is no one solution either to food security or to food inflation; neither silver bullet nor quick fix. The key to the future lies in an integrated approach to protecting the current food supply whilst investing in methodologies to increase agricultural productivity and reduce waste.**

Plant biotechnology, including GM crops, can help as part of the solution by protecting yields and increasing productivity, thereby helping to stabilise food supplies and reduce the rising prices of milk, meat and other staple foods. Likewise, GM crops have a part to play in minimising the environmental and carbon footprint of agriculture and, in the near future, by climate proofing agriculture with crops that can survive drought and require significantly less fertiliser.

### Consumer attitudes

GM crops have been grown extensively around the world for the last 12 years without one sniff, one cough or one sneeze attributed to its commercial use. A total of 12 million farmers grew GM crops on an area of 114 million hectares (about the size of the UK, Ireland and France put together) in 2007. Fully 11 million of these cultivate a very small amount of land, typically one or two hectares, mostly for personal consumption with only a small amount left for sale to make some money.

The question for the people in the UK is: how does this help me?

A recent report on consumer attitudes<sup>1</sup> suggests that a majority of consumers do recognise benefits of GM crops: 52 per cent of those polled believed that GM can be used to increase productivity and feed a growing world population, with only 13 per cent disagreeing with that view. Likewise,

47 per cent of consumers thought that GM can help to protect crops against disease and extreme weather, whereas 12 per cent were not convinced.

However, many commentators believe that until overt, tangible, on-the-supermarket-shelf benefits are available, consumers will remain sceptical of the use of this technology in food production. So what products are being looked at and how likely are they to make it commercially? The list is long and includes improving the nutritional quality of foods, reducing allergen content and some exciting work to create a cheap and plentiful supply of vaccines.

### New products

The provision of vegetable oils with a better fatty acid profile is close to commercial realisation. Nutritionists agree that oils high in polyunsaturates are healthier than others, especially if they contain omega-3 and 9 fatty acids, and GM varieties of oilseed rape and soybeans are in development with an increased polyunsaturated content.

The problem with such a profile, however, is that they tend to be unstable when used in processed food. Oilseed rape and soybean crops have therefore been developed (using biotechnology even if the product is not genetically modified) with an oil profile having a near-zero trans-fat potential (low linolenic acid); they have been on sale in the US and Canada for several years.

Even more exciting is the development of plants containing long chain omega-3 oil profiles. Traditionally, the only source of these are fish oils, but research teams around the world have succeeded in enriching vegetable oils with this essential fatty acid associated with a healthy heart. Soybeans with such a profile will be first to the market and are nearing commercialisation.



GM rice being cultivated *in vitro* at the International Rice Research Institute *IRRI*

### GM in Europe

In the end, it is consumers who will decide whether GM is ultimately a success in the UK and the rest of Europe, but only if they get the opportunity. The rate of adoption of this technology elsewhere in world is huge, but there has not been one new trait approved for use in European agriculture for ten years. The single trait available is resistance to attack from the European Corn Borer, which damage the ears and stalks of corn. This trait is successfully used in seven countries in the European Union.

It is clear that Europe will have to increase food production. Climate change is resulting in the burden of food production being further accentuated in the Northern Hemisphere. In the future, all methods of improving agricultural productivity will have to be considered realistically and without prejudice.

1. IGD report: [www.igd.com/index.asp?id=1&fid=1&sid=8&tid=34&cid=548](http://www.igd.com/index.asp?id=1&fid=1&sid=8&tid=34&cid=548)

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## David Dickson wants a more reasoned approach

**The global food crisis and the credit crunch have landed simultaneous blows on the developing world. The price of staple foods has soared, and economic recession threatens.**

It is difficult to see any silver lining in these two crises. But there is one area that could benefit: the level of public discussion about the desirability – and potential dangers – of GM crops.

### Hype on both sides

For too long, frequently aided and abetted by the media, this discussion has been conducted in a language of hype. Critics of GM foods, frequently labelled as ‘Frankenfoods’, have been unflinching in their condemnation.

At the same time, supporters of such crops, which can include both the scientists responsible for the genetic discoveries on which they are based, and the companies responsible for developing and marketing them, have often been equally unreflective in talking up their potential. They have sometimes even described GM crops as ‘the’ answer to the world’s food needs.

Faced with such conflicting attitudes, and frequently lacking either the scientific or technology capacity that would allow them to reach an independent judgement, many

developing countries have found themselves in a political stalemate about whether they should permit GM crops to be grown and commercialised.

### Reasonable caution

It would be foolish to deny that potential problems could exist with GM crops, both to human and environmental health. It may be true that, as the US government claims, no one has suffered any ill consequences of eating foods derived from GM ingredients, which have been widely used in the US food processing industry for several years.

But this does not mean that we should not be vigilant about, for example, the possibility that consumption of GM foods could lower immunological resistance, or exacerbate particular allergies.

Similarly, introducing foreign genes into crop varieties could have implications that have not yet surfaced, particularly when genes are being transferred across species. Again this is the case for vigilance, and for ensuring that adequate funding is directed towards research programmes that seek to refine our knowledge of the potential environmental and ecological dangers.

But none of this is sufficient to say ‘no’ to the technology on principle, particularly at a time when plant biologists are finding novel ways of using GM technology to endow plants with characteristics (such as drought

tolerance) that will allow them to face the harsher growing conditions being brought on by climate change.

### Technology not politics

The mistake made by many protesters is to confuse the technology with the politics behind it. Campaigners have a strong case when they protest at the way that multinational agricultural corporations have used their powers to twist the arms of governments in order to get approval of their products.

Equally unacceptable is that way that current international patent regimes tend to give such companies absolute control over how genetic material is used (for example, in forbidding farmers from selling on seeds taken from GM crops).

Yet the political arguments need to be separate from simplistic notions of whether GM is just ‘good’ or ‘bad’. A more mature approach is required that accepts that the relevant science itself does not – and never can – place the technology squarely in one of these two categories. In practice, each GM technology has potentially ‘good’ and ‘bad’ aspects that need to be balanced out in the social arena.

### Need for regulation

Partly this requires strong regulation. Developing countries in particular need support for robust regulatory frameworks that will allow them to ensure adequate precautions are taken to monitor how GM technology is used.

It also requires addressing, separately, the political factors at stake. Part of the distrust of GM crops in developing countries lies in a broader distrust of their foreign ownership and control. This can only be tackled once these countries are in a position to develop their own biotechnology industries – and are provided with both the financial support and the political environment that allows them to do so.

At the heart of each of these is the need for reasoned discussion on the best way forward in meeting the world’s food needs. If the darkening prospects facing the developing world raise the prospects of such a discussion taking place, that will be a significant step forward.

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# Reducing Waste

The UK produces over 300 million tonnes of waste every year, most of which still goes to landfill. The House of Lords Science and Technology Committee's recent report, *Waste Reduction*, recommended ways of reducing this amount of waste. Environmentalists, local authorities and the building industry give their verdicts.



Recycling wood as chips for the garden

## Designing a good clean-up

Hannah Hislop and Julie Hill welcome the report

**For too long our approach to waste has been 'end of pipe' – characterised by a lack of ambition, too few instruments to drive change and a focus on achieving least-cost compliance with European directives. We should be addressing how we can make long-term, upstream changes that instead address waste as a design flaw in our entire economic model.**

### The challenge of zero waste

Some countries, cities, regions and businesses have adopted zero waste goals in an attempt to dramatically boost recycling rates and bring greater focus to the importance of waste prevention. A completely zero waste society is probably physically and politically out of reach, but we are more interested in

the concept as a rallying cry to declaring dumping our rubbish in holes in the ground a thing of the past.

We should certainly be aiming to do better across the whole of the economy, which was why we were very pleased that the report called on government to extend its efforts on waste reduction beyond the consumer and household waste, by putting more focus both on commercial and industrial waste and the conception and design of products.

### Cradle to cradle and designing out waste

In their book *Cradle to cradle: remaking the way we make things*, American architect William McDonough and German chemist Michael Braungart argue that human industry should be modelled on natural processes.

However, our products, materials and systems of consumption are not currently designed for such recovery and recycling. There are not enough economic incentives for this.

The environmental consequences of our extract-consume-discard economy have until very recently been ignored. This is why we fully support the report's recommendations that the government investigate whether the VAT regime should be amended to introduce variable VAT rates that reflect a product's environmental impacts. We were also delighted to see the committee endorsing the concept of individual producer responsibility, whereby a company has a direct financial incentive to design goods for ease of recycling and recovery.

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# Look to the beginning of the pipe

Lee Marshall would change local authorities' priorities

**As a local authority organisation, the Local Authority Recycling Advisory Committee (LARAC) agrees with the Lords' report that we should – in its words – ‘amend the costs and targets imposed on local authorities to allow them to address commercial and industrial waste by providing support and more efficient disposal facilities to business.’**

We should be looking at waste in terms of resources to be utilised, and therefore at what sorts of resources are being produced rather than where they are coming from.

Waste from small and medium enterprises is often very similar to household waste, and existing local authority infrastructure could be used in a very effective way to collect it. However current local authority targets are

designed to remove waste from landfill. As local authorities are given a cap on the waste they can landfill, it is not in their interests to deal with other waste streams.

## Mismatched targets

At present, producer responsibility targets, especially for packaging, do not dovetail well with local authority targets. Aligning targets across the sectors so they take us to the same end point is the start. We then need to be given more flexibility to operate our collection systems in such a way that we collect a wider range of waste streams. The way that these are then funded could change accordingly, so that more private sector funding is channelled in to local authority collections,

in return for more material being collected.

However the biggest change in mindset probably needs to come in the design of products, moving to the start of the pipe rather than looking at the end of pipe solutions. Products need to be designed for durability and re-manufacture so that in effect we do not create waste at all. This is the ideal and natural conclusion of total waste minimisation.

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We need to design products to avoid creating waste

# Industrial and commercial waste

Gilli Hobbes recommends coordinated action

**A key recommendation to the government is to ‘move its priorities from household waste to the far greater problem of industrial and commercial waste.’ I agree completely with the sentiment but would also like to see common sense applied if it is acted upon.**

## Fragmented efforts

For over 10 years I have been working in the field of construction resource efficiency, another waste stream historically overlooked in comparison to household waste.

However, when the Business Resource Efficiency and Waste (BREW) programme

started funding delivery agencies to help those businesses most affected by increasing landfill tax, the construction industry quickly became the focus of multiple business support programmes. This work was not coordinated and had very little input from the industry itself. Consequently, the impact of the various support programmes was reduced.

Linked to this, the Business Support Simplification Programme (BSSP) recommended that the number of delivery bodies should be reduced to avoid confusion and duplication of effort. This will take effect next year.

## Roadmaps to less waste

Throughout this time, my main activity has been to help the (industry-led and Defra-funded) Construction Resources and Waste Platform ([crwplatform.co.uk](http://crwplatform.co.uk)). This provides a focus for construction resource efficiency with the objectives of engaging construction stakeholders in terms of what support is needed, providing evidence to support industry and policy makers and developing a long-term strategy to reduce construction waste.

The last objective was mainly met through publication of the ‘construction resources and waste roadmap’ in July 2008. The roadmap has a 10-point action plan to achieve significant waste reduction across the supply chain and product sectors.

To prioritise commercial and industrial waste, I would strongly recommend that industry stakeholders and trade associations able to represent the commercial and industrial sectors are involved at a very early stage. The objective should be to get a consensus on what should be done, by when and by whom. A possible outcome could be to produce resources and waste roadmaps for the two sectors.

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# The forensic use of genetic information

Peter Mills explains how citizens' deliberations will inform ministerial advice

The National DNA Database (NDNAD) has been growing significantly in recent years. It is now, in proportion to the population, by far the largest forensic database in the world (over 1 in 20 UK citizens are on it). Developments in genetic science, research capabilities and innovative techniques (such as familial searching) offer new opportunities to put the information to use.

## Issues of public concern

The government's advisory body on developments in human genetics and their impacts on individual lives is the Human Genetics Commission (HGC). In its view, the expansion of the NDNAD raises significant issues of public concern that have not so far been subjected to sufficient debate, either in Parliament or amongst the public.

While most people accept that there needs to be a balance between protecting the public from the effects of crime and the infringement of privacy involved in taking and keeping genetic information about individual citizens, where that balance should be struck is often keenly disputed. And, while there has been no overwhelming groundswell of opposition to the growth of the NDNAD, the assumption that lack of opposition implies general public approval needs to be examined properly.

## Citizens' inquiry

Earlier this year the HGC commissioned a Citizens' Inquiry into the NDNAD with partners.<sup>1</sup> From the outset, the commissioning group agreed that the shape of the project should be determined to a large extent by the participants: by their information needs, by the nature of their concerns, and by their preferred ways of engaging with the issues and with each other.

For six weeks, two panels in Glasgow and Birmingham, linked by video and facilitated by independent public dialogue experts Vis-à-vis RC Ltd, heard from a range of experts including representatives of interest groups, the police, database governance bodies, forensic scientists and journalists. The weekly sessions were followed by regional visits to the Scottish Parliament (to question MSPs from the main political parties) and to a community centre in the London Borough of Hackney (to hear from people with first-hand experience of having the police take biological samples).



One more for the database: taking a DNA swab

In March, the two panels came together over two weekends to discuss their experiences of the process and to bring together their conclusions. In May, the panellists travelled to London to meet the Human Genetics Commission, to discuss their findings.

## Unanimous and contested conclusions

The Inquiry report, launched simultaneously in Glasgow and London in July, provides insight into the perspectives, anxieties, and areas of knowledge and lack of knowledge that a diverse group of citizens brings to issues relating to the NDNAD. It also highlights the concepts and language through which they articulate and debate them. It gives a strong indication of the directions in which the citizens feel that action needs to be taken.

The panel concluded unanimously that there is a need for a nationwide public awareness campaign about the NDNAD that will reach all sections of the population. It wanted information about the police powers to take a DNA sample to be given to people from whom DNA samples are taken. It recommended the establishment of an independent body with broad membership, constituted by statute specifically to oversee the NDNAD. It called for independent guidance to be provided to juries in trials that involve DNA evidence before they hear from expert witnesses. It also recognised a need for education at school level to include learning about DNA and its potential uses. Finally, it recommended that, where DNA is taken from

children, a full explanation should be given in age-appropriate terms.

On other issues, such as the desirability of a universal DNA database, taking DNA samples at birth, international data sharing, retention periods for DNA profiles and recording ethnic background, the panel's opinions remained divided.

## Input into advice

The HGC focussed on issues highlighted by the Inquiry when it sought broader input on the forensic use of genetic information through a national consultation (which closed in November). Responses to the consultation, along with the Inquiry's conclusions and other evidence, will inform the HGC's final report to ministers, due in 2009.

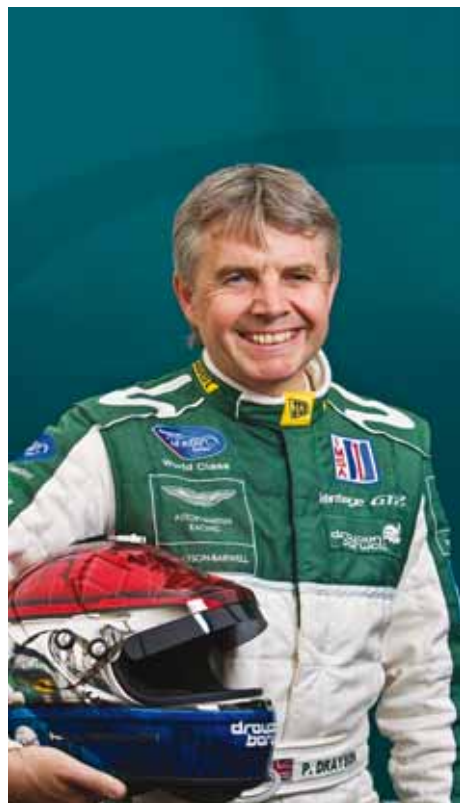
Information about the Inquiry, the citizens' findings and the HGC's consultation can be found on the HGC website: [www.hgc.gov.uk](http://www.hgc.gov.uk)

1 The Economic and Social Research Council Genomics Policy and Research Forum in Edinburgh, and the Policy, Ethics and Life Sciences (PEALS) Research Centre in Newcastle. The project was supported with funding from the Department for Innovation, Universities and Skills Sciencewise programme and the Wellcome Trust.

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# Racing his way to the Cabinet

Paul Drayson speaks to Joanna Carpenter



Drayson: the very model of a modern Minister

**'Heart beating, you want to do well, the adrenaline is racing.' Paul Drayson gets a lot out of life. The former Defence Minister resigned from the government last November to pursue his dream of international motor racing and drive in the 2008 American Le Mans Series. 'There are some real similarities to what it feels like to be sitting on the grid waiting for the race to start and sitting on the front bench in the Houses of Parliament waiting to stand up and answer questions,' he says. 'I've learnt a lot about how to cope with that pressure. I think that it's going to be helpful in my life now.'**

Despite a new job as Science Minister, with a seat in the Cabinet, he is planning to continue racing next year. 'The Prime Minister supports it,' he goes on. 'It's unusual to have a Minister who does this [but] I really do think it's important for politicians to have a hinterland, to be real people in the sense that they're not just 100 per cent encased in politics.' He's certainly not been encased in politics all his life. 'I've spent my whole life

with science and technology. I absolutely love it; I've been a science entrepreneur for twenty years,' he says.

## Vaccine company

'An interest in cars led me to an engineering degree... I then went on to a PhD in robot technology and applying robots and robotic design to other manufacturing technology, particularly the food industry,' he adds. Later he co-founded PowderJect, a very successful vaccine company, which he sold in 2003. 'PowderJect was created out of... a very innovative idea of formulating medicines as tiny particles then injecting them using a helium gas jet to penetrate the skin painlessly – the needle-free injection,' he says.

Running a vaccine company led to Westminster and a new passion for communication: 'While I was running PowderJect, I... found myself having to... explain to politicians and to the media why animal testing of medicines was vital to make sure that they are safe. I found that I really enjoyed it... and so I decided to really focus on that,' he reveals, adding, 'It's partly about being involved in public service, giving something back if you like, but it was also something I found fascinating.'

## I really do think it's important for politicians to have a hinterland, to be real people

### Priorities

His enthusiasm and enjoyment is evident as he sets out his priorities: 'We've created a renaissance in science in the UK. We've doubled the science budget, we have fixed the science laboratories so that the science estate is really quite good now. The next challenge is to make sure that the way in which government operates is based on good science across government.

'I think the main issue [in science policy] is making sure that we maintain our investment... as we go into really quite challenging economic circumstances,' he says.

'The second thing is a communication thing... One of the things I'm actively engaged

## Track record

<b>1982</b>	BSc in Production Engineering at Aston University sponsored by BL Cars at Longbridge
<b>1985</b>	PhD in Robotics
<b>1986-1991</b>	Managing Director of Lambourn Food Company
<b>1993</b>	Co-founded PowderJect Pharmaceuticals plc. Chairman and Chief Executive until 2003
<b>2003-2005</b>	Science Entrepreneur-in-Residence at the Said Business School, Oxford University
<b>2004</b>	Raised to the peerage as Baron Drayson of Kensington in the Royal Borough of Kensington and Chelsea
<b>2005</b>	Parliamentary Under Secretary of State and Minister for Defence Procurement
<b>2007</b>	Minister of State for Defence Equipment and Support
<b>2008</b>	Minister of State for Science and Innovation

in now is getting people to really consider coming back to science.

'If people are asking themselves, "What do I do with my life next?" – Come back and teach physics, come back and do that PhD... come back and start a science-based enterprise,' he exhorts. 'It's really vital that young people, particularly children understand that it really is worth going through the hard work that is involved in studying difficult science subjects at school, because of the opportunities that it provides to have a really interesting life... Look at me. I have had a blast.'

See [www.drayson-barwell](http://www.drayson-barwell) for more information on Paul Drayson's American Le Mans Series campaign.

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# Science into Policy

Public engagement has tended to emphasise scientists' relationships with the public. It has paid less attention to how they might influence policy. This page and the next describe the benefits of scientists advising policy makers, and how the two communities might understand each other better.

## Michael Elves and Branwen Hide urge scientists to influence policy

**We want to encourage scientists, engineers and technologists who are willing and able to explain their work to those in power. They need to be prepared to explain its significance for evidence-based policy making, and to provide advice to Ministers and civil servants on the science underlying proposed new policies.**

We now accept that technology transfer and economic impact mean involvement with industry. It should also involve influencing policy.

### Regulation affects research

When actively engaging in research, it is easy to become isolated and separated from developments around. New government and EU directives and initiatives are constantly being formulated, many of which have a direct impact on the research environment.

Most obvious are those which affect funding and mechanisms for distributing money for science, engineering and technology (SET). However there are, increasingly, new regulations being introduced which impact on the researcher. Examples include legislation on the use of animals or human tissues, research involving embryos and stem cells, the genetic modification of crops and animals, and the control of chemicals. Engineers are also affected by a raft of regulations, on issues like pollution prevention and control, and waste and resource management.

Other areas are of less direct concern to the scientist or engineer, but his or her research experience in the field may have much to offer to the policy maker. It is becoming increasingly important therefore that the SET community develop a better awareness of new policy developments and the policy-making processes within government.

### Incentives for involvement

Getting involved in the policy world can provide a better perspective on what the

Research Councils and funding agencies are looking for today and in the future. This can help guide researchers' activities and careers.

They may also become aware of the different avenues for funding outside the standard agencies, such as the Technology Strategy Board, various government departments, major charities and non-governmental funding bodies.

In addition to this clear incentive, getting involved in policy can give the researcher a voice where it counts – with those responsible for the direction of research policy in the UK, and those formulating policies which should harness the outputs of research.

Though some civil servants, along with a handful of MPs, come with a SET background, it has often been some time since they were actively engaged with SET and much has changed since. Understanding the policy processes, and getting involved with them, provides the active researcher with the opportunity to let key policy makers know what issues and challenges face them today, and what developments may occur in the future.

### How to become involved

Getting involved is not as difficult as could be expected. Most learned societies have an interest in science policy and actively respond to calls for evidence or provide inputs to consultations. Individuals wishing to become more actively involved can take on policy roles within their learned societies.

There are other bodies which specialise in helping researchers to understand how policy is made, and which will provide information, evidence and analysis to government departments. These include organisations such as Newton's Apple and the Campaign for Science and Engineering (CaSE), which were established to examine issues relating to science and policy and to provide support to both SET and policy-making communities.



Scientists should work more closely with policy makers

By regularly consulting Research Council, funding agency, government department and Parliamentary Select Committee websites, you can keep abreast of current policy trends, and respond directly to calls for consultation or requests for evidence. Most consultations no longer involve large pieces of work, and encourage user participation.

The Department for Innovation, Universities and Skills has even launched an online consultation in the form of a blog. Attending workshops, such as the Newton's Heirs workshops and other similar events, will introduce scientists and engineers to the policy makers themselves and also enable them to meet like-minded individuals.

### Engagement is vital

The last decade has seen UK government investment in science and technology increase significantly – it now stands at almost £3.5 billion. The government therefore should rightly expect the SET community to use the outputs of publicly-funded research to make important contributions to the health and wealth of the nation.

Engagement in the policy processes should not be seen as just a hobby or an interest but as a vital responsibility of scientists and engineers.

Newton's Apple is at [www.newtons-apple.org.uk](http://www.newtons-apple.org.uk)

**Dr Branwen Hide**  
is Chair of Newton's Heirs

**Dr Michael Elves**  
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## Academia and government can work together, says Peter Brooke

**Effective government policy must be informed by the best academic research. A healthy engagement between the academic community and government is necessary if Whitehall is to have high-quality, evidence-based advice on the major challenges facing the UK.**

This is the message from the Council for Science and Technology (CST) – the Prime Minister's top level science advisory body – to John Denham, Secretary of State for the Department for Innovation, Universities and Skills, in a new CST report, *How academia and government can work together*.

The CST is co-chaired by Professor John Beddington, Chief Scientific Adviser, and Professor Dame Janet Finch, together with 15 members drawn from a broad range of academic and business backgrounds. It focuses on issues that cut across government departments within the medium- to long-term.

### New framework

CST's report is one of eight that the Secretary of State has commissioned from groups and individuals to help develop a framework for higher education in the UK over the next 10-15 years, which he announced in his speech on higher education at the end of February.<sup>1</sup> The framework will help to ensure that our universities maintain their world-class status for the long-term.

CST was asked to advise on how to achieve better and more productive engagement between the academic base and government to support policy making. This strand of work is also feeding in to the *Science and Society*

consultation<sup>2</sup> on the vision he outlined to the Royal Society of Arts on 16 January<sup>3</sup> this year.

The CST project was led by Sir John Beringer. CST recognises that interactions between academics and policy makers are complex and take many different forms, and that there is no simple, one-size-fits-all solution. Part of the difficulty is that academics and policy makers inevitably operate in different cultures.

The report identifies several areas where work can be done to build on existing links. The key is building mutual understanding.

### Effective engagement

At present, there is some ignorance on both sides about the importance of effective engagement. Equally, both sides would benefit from appreciating the constraints that each operates under.

Government must recognise the importance of independence and peer recognition to the academic community. In return, academics should recognise the competing priorities facing policy makers. Both sides need to recognise that some of the outputs of the engagement may be easier to value and incentivise through the academic system than others. Creative solutions are needed from both sides.

The Council has therefore highlighted the importance of good communication and relationship building.

Exchange mechanisms, including prestigious internships and secondments, are vital and should be career-enhancing on both sides.

### Building capacity

Government needs to build its own capacity. CST recommends that Chief Scientific Advisers' roles are further strengthened, so they have the necessary access to Ministers and are better known within the academic community.

The Core Issues Group, consisting of departmental Chief Scientists and established by Professor Beddington, has proved vital in kick-starting the capacity-building mechanism. The members of the group recently contributed to the Gallagher *Review of the Indirect Effects of Biofuels* (conducted by the Renewable Fuels Agency, for the Department of Transport) through providing a peer review team to critique and ensure the science was as robust as possible. In addition, this group engages further with the Research Councils through regular meetings with their CEOs.

At the same time, universities need to operate more like consultancies in their dealings with government. They need to translate the successes they have had in working with business into successful ways of working with government. It will help them to compete for the £2.8 billion annual spend on consultancy services.

### Evaluating outcomes

CST also urges further thought on how these relationships are valued and rewarded, including ways of measuring quality, and whether the outputs are capable of being reviewed through the academic process or not. The report sets out some options on how each might be valued and rewarded, whilst recognising more work is needed.

By implementing these recommendations, CST believes that the policy and academic communities will forge clearer, more coherent and more professional relationships that will be mutually beneficial and good for the country.

1. See [www.dius.gov.uk/speeches/denham\\_hespeech\\_290208.html](http://www.dius.gov.uk/speeches/denham_hespeech_290208.html)

2. See <http://interactive.dius.gov.uk/scienceandsociety/site/>

3. See [www.dius.gov.uk/speeches/denham\\_science\\_society\\_160108.pdf](http://www.dius.gov.uk/speeches/denham_science_society_160108.pdf)

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# Prickly issues in translating science into policy

Tom Webb has learned lessons from hedgehogs

**Scientists are increasingly encouraged to communicate their research to wider audiences, and especially to produce policy-relevant research. We have examined how this may be done to minimise conflict in a controversial area of applied ecology and conservation biology.**

Sometimes, environmental management recommendations, even if formulated with the best of intentions and based on the very best available science, are simply unacceptable to sections of the public. This can severely impede management efforts, and can result in costly and time-consuming environmental conflicts which leave a legacy of mistrust between scientists and important sections of the public.

## Conflict in the Western Isles

We set out to consider how the acceptability of scientific recommendations might influence the effectiveness of management by considering an example in which the science was clear, but the conflict bitter: the case of the hedgehogs of the Western Isles.

Hedgehogs were introduced to the Hebridean island of South Uist from the Scottish mainland in 1974 in an attempt to control garden pests. They soon spread to neighbouring islands and began to eat more than slugs: their taste for birds' eggs led to significant declines in internationally important populations of several species of ground-nesting birds.

Scottish Natural Heritage, the government body tasked with reversing these declines, considered various options, but the scientific advice appeared unambiguous: culling hedgehogs was the most cost-effective, ecologically sound way to deal with the problem.

Unfortunately, this advice was also the surest way to generate a storm of protests from animal welfare organisations and hedgehog lovers worldwide, who were alerted to the issue by significant and often sensational coverage in the press.

The resulting conflict delayed efforts to protect the birds (a consequence that nobody involved wanted). Mistrust and bad feeling spread between groups of interested parties who all, in fact, shared a common value: that

some aspects of 'nature' (whether populations of birds or individual hedgehogs) have an intrinsic, non-monetary worth.

## Babel babble

To explore the development of this conflict, we gathered around 500 documents produced in response to the hedgehog cull by bird conservationists, hedgehog activists, and the media, and analysed them using content analysis – a technique for quantitative analysis of trends in language usage. Our results showed clearly that the pro-bird and pro-hedgehog lobbies spent most of the time speaking different languages.<sup>1</sup>

The pro-hedgehog lobby wrote emotive and informal pieces about animal welfare issues (an angle mirrored by most media coverage), whereas the pro-bird lobby wrote more scientific texts concerning wildlife conservation.

By highlighting these differences in a quantitatively rigorous way, this kind of analysis can encourage a dialogue in which all stakeholders are at least addressing the same issues. In the hedgehog conflict, for instance, all protagonists would probably share considerable common ground if a discussion was limited to bird conservation. Starting from such a point of agreement might lead to a less heated discussion of management options.

## Research to management

Academic journals in applied ecology and conservation biology now routinely require authors to formulate specific management recommendations, reasoning that translating research into practice ought to be as important as scientific excellence in determining the success of a project. Whereas academic ecologists may see production of these recommendations as the final stage in the research programme, in management terms it is really just the beginning.

Two outstanding questions are first, whether the recommendations will be implemented; and second, if they are, how they will be received. Efforts to develop more effective interfaces between scientists and policy makers seek to address the first question. But the second question receives



Lapwings and golden plovers in the Hebrides

rather less attention.

Our analysis encourages applied ecologists to give more thought to how they might present potentially controversial management recommendations to a hostile or sceptical public. Of course, scientists should not shy away from telling uncomfortable truths; neither is the 'messiness' of the social dimension an excuse for scientists to avoid engaging in political debates.

Effective environmental management requires more than simply implementing scientific advice, and managers deal with this messiness all the time. To present management recommendations without social context therefore does not represent the most effective or practical advice, and increases the chance that a damaging conflict will develop.

This work was funded under the UKPopNet project *Framework for sustainable livelihoods, biodiversity change & conflict resolution*, with additional support from the Leverhulme Trust.

1. T J Webb and D Raffaelli (2008), Conversations in conservation: revealing and dealing with language differences in environmental conflicts. *Journal of Applied Ecology* 45: 1198-1204

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# Salting away mental capital

John Field on the latest Foresight report

**How should we make the most of our lives in a fast-changing world? And how can the latest scientific developments help? The latest Foresight project, *Mental Capital and Wellbeing*, launched in October, examined how to make the most of our mental resources throughout our lives.**

Mental capital encompasses our brain's ability to learn and think and includes our emotional resources; the way we interact with others and our resilience in the face of stress. The project was concerned with the factors that might hinder or help develop a person's mental capital and wellbeing throughout their lives, from cradle to grave.

The government has a responsibility to create environments that provide opportunities in which we can all develop our mental capital and improve our mental wellbeing. However, the report also highlights the important role that individuals can play in taking up these opportunities to make the most of themselves in the future.

## Trends

Some future challenges are easy to spot. An ageing population will see more people at risk of dementia; by 2071, the number of over-65s in Britain could rise to over 21 million, with 9.5 million aged over 80. On current trends, the number of Britons with dementia is likely to double, costing the country over £50 billion a year.

Mental ill-health is already a significant problem. An increasingly competitive globalised economy will put new pressures on individuals and organisations to develop new skills as business and services seek to innovate, raise standards and reach new markets. Around 16 per cent of adults and 10 per cent of children suffer common mental disorders such as depression and stress at any one time, with huge costs to individuals and their families as well as the country as a whole.

## Findings

The report's main findings are, first, that early intervention is crucial in developing and maintaining mental capital and wellbeing. Whether it is a matter of identifying and tackling learning difficulties among children and young people, or developing suitable biomarkers to diagnose the onset of dementia in older people, early interventions

are the most productive with impacts throughout life.

Second, there is enormous scope for improving our approaches to mental ill-health. This is not simply a matter of improved treatment for those who experience common mental disorders, but also of investing in co-ordinated interventions to reduce the factors that place people at risk of mental ill health – factors such as debt.

Third, there are huge pay-offs from integrated approaches to wellbeing. Rather than focusing, for example, solely on medical interventions, the project demonstrates the importance of other interventions, such as education and social networking, in improving people's mental capital and wellbeing throughout life.

## Costs and benefits

In order to assess the potential cost effectiveness of the project's proposals to tackle some of these future challenges, the team sought advice from economists. They costed a number of the interventions, and also identified the benefits.

In most cases, the balance was a positive one. More difficult is the fact that many of the initiatives may involve spending by one government department, while the benefits accrue to another. So responsibility for providing resources in the future to enable earlier identification of learning difficulties in children might lie with the Department for Children, Schools and Families. However, the benefits of such interventions, such as decreases in anti-social behaviour and savings for the criminal justice system, could accrue to the Ministry of Justice. What is clear is that this ambitious, world-class report will help government to understand these relationships better.

## Thorough review

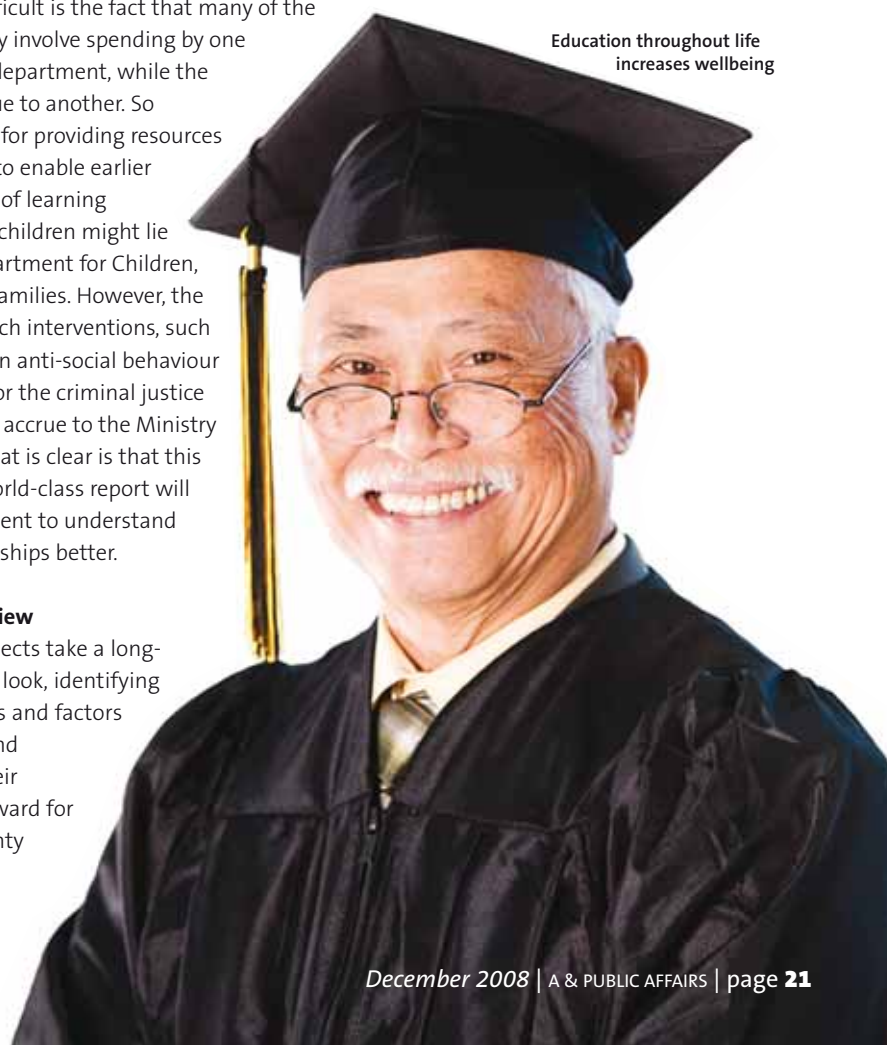
Foresight projects take a long-term forward look, identifying current trends and factors for change, and projecting their influence forward for the next twenty years.

This project drew on 80 reviews of existing research in five areas: work and wellbeing; education and learning through life; learning difficulties; mental health; and the neuroscience of mental capital; as well as expert views from scientists and policy makers as to how we address challenges we face in these areas.

It was led by the government's Chief Scientific Adviser, Professor John Beddington, and sponsored by the Department for Innovation, Universities and Skills. Taking two years to complete and involving over 400 experts from 16 countries, the extensive evidence base has provided much food for thought.

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Education throughout life  
increases wellbeing



# Light bulbs, hiccups and inspiration

Jim Al-Khalili talks to Liz Newton

**As a Professor of Physics at Surrey University, member of the BA Council, senior advisor on science and technology for the British Council, supervisor to two PhD students and leading expert on the structure of neutron halo nuclei, Jim Al-Khalili is a busy man.**

Despite this, he continues to devote a large proportion of his career to public engagement, holding the University of Surrey Chair in the Public Engagement of Science, and an EPSRC Senior Media Fellowship. His public engagement work has been recognised with such prestigious accolades as the Institute of Physics Public Awareness of Physics Award and the Royal Society Michael Faraday Prize for Science Communication.

## Desire to promote science

So what is it about public engagement that entices a successful physicist away from his research? Jim admits that his own reasons are not entirely altruistic. 'I like to see the light bulb go up above people's heads,' he explains. 'I guess that's what every science communicator wants. I get as much of a buzz out of getting people enthusiastic about science as I do out of my own research. I'm inspired by science, and I can't understand why not everyone wants to know the answers to all the big questions.'

It is this desire to promote science that has

driven Jim to engage with the public on a large scale – through the media. As well as being the author of a number of popular science books, he has written several columns in national newspapers, has been a regular contributor on Radio 4 and was the presenter for the successful BBC4 television series *Atom*.

## LHC hiccup

Most of Jim's media work is, unsurprisingly, physics-related. The setback to CERN's Large Hadron Collider, launched in September amidst unprecedented media interest, occurred while the project was still very much in the public eye.

Far from seeing this as a tragedy for science public engagement and the reputation of physics, Jim takes the view that all publicity is good publicity. 'The coverage can be nothing but positive – it got the public interested and engaged with science. The story as a whole has captured the public's imagination, which can only be a good thing.'

## Informed decisions

Is it really important to devote valuable airtime and column inches to abstract subjects like space and particle physics, when there are far more pressing issues facing both scientists and society today?

'There are certain things society needs to know about science – to help them make informed decisions,' explains Jim. 'They need to know whether nuclear power is right for us, they need to know whether nanotechnology's going to be harmful, and whether GM's necessary.'

'But quantum mechanics, cosmology – those "sexy" subjects are important to inspire,' explains Jim. 'There's a whole load of kids who want to become scientists because they want to be astronauts, or they want to discover a new particle. I see it when students apply to university – invariably they start off saying, I want to be an astronaut. And why not? If that's what gets them interested in physics, great.'

## So what?

Does it really matter if Joe Blogs knows his hadron from his positron? This is a question which people often ask Jim, as it affects scientists, policy makers and educators as much as it affects the public.

'They're absolutely right – so what?' he says. 'So what, if we don't know who painted the Mona Lisa? So what, if we don't know who wrote Romeo and Juliet? But actually, it is important. In a civilised, cultured society there are certain things that are important to know, and isn't the most important thing for us to know our place in the Universe?'

Jim is clearly passionate about his work as a science communicator, and he even has plans to turn his hand to Chemistry for his next big television project. However, his career as a researcher in nuclear physics is one that he continues to take seriously, and he's certainly not going to drop his research in favour of public engagement alone. 'I've found a comfortable balance,' Jim says. 'I want to be a practising scientist who presents on TV – I'm happy with that.'



Jim Al-Khalili: LHC coverage 'got the public interested and engaged with science'

Liz Newton

is a Science Communication MSc student at UWE, and a researcher for Tigress Productions, a television company based in Bristol. [liznewton@tigressproductions.co.uk](mailto:liznewton@tigressproductions.co.uk)

# Changing Horizons

Andrew Cohen wants a broad audience

**What is the purpose of science on television? It's a question that I ask myself on an almost daily basis, and a question that sits at the heart of my job as the Editor of *Horizon*.**

*Horizon* is BBC Television's flagship science documentary strand, now in its 44<sup>th</sup> year. Since I took on the job three years ago, it's been clear to me that, at the heart of *Horizon*'s remit, sits a stubborn paradox.

Unlike almost every other genre on television, science has to straddle a huge variation of knowledge in the audience. From science-hungry specialists, to the science abstainers – the conflict at the heart of *Horizon* is quite simply: Who is it for?

## Scientists' view

Many people I meet in the science community are very clear on this issue. They often seem to believe that the population at large are naturally interested and engaged with science. They like the idea that *Horizon* should follow an agenda set by scientists, that we should survey the cream of scientific publications and turn them into documentary film. They want *Horizon* to be full of 'real scientists' talking about 'real science', without any gimmicks, flashy graphics or music. They want the content to be rich and challenging, avoiding the pitfalls of 'dumbing down' at all costs.

I understand and appreciate the passion behind this view, but increasingly I believe that this perspective does a considerable disservice to the communication of science in this country.

## Public ignorance

Stand on any high street and ask a passerby one of the following questions. Does the earth go around the sun? What is DNA? What is an atom? In my experience the answers to these questions are incorrect or uncertain. Study after study has shown that when it comes to public understanding of science we have a lot of ground to catch up.

Television has a vitally important role to play in this, but obviously television only has worth if people are watching. It's the job of *Horizon* to reach as many people as possible, to enrich their lives with a sense of the world



Comedian Danny Wallace presents 'Where's my robot?' *Horizon*

around them and the questions and knowledge that science generates. That means finding ways of reaching an audience who would not naturally tune into a science documentary. This ambition is not about 'dumbing down'. For me, it's about doing something far more worthwhile.

## Reaching a wide audience

If a programme is too heavily labelled with science, we risk alienating a large part of the potential audience. This is the paradox of producing *Horizon*. We are proud of the science journalism and content that we generate, but we often have to sugar coat the science if we are to communicate it to a wider audience.

I don't want *Horizon* to be like a niche science section in a bookshop, visited only by those already interested in science. I want it to be at the front of the shop, putting science side by side with the rest of the bestsellers.

To do this, we need to embrace the modern methods of television: production methods that enable an audience to feel comfortable with the delivery of often difficult content. Celebrity presenters, computer graphics, constructed formats and emotionally engaging human stories: these are the devices that may feel irrelevant to the science purists

but are essential for a mainstream audience to engage with a factual programme.

## Let's talk

Of course, not everything we do is about viewing figures. Many of the *Horizon* films are commissioned purely on the basis of the importance of the subject. From the LHC to GM foods, from epigenetics to fusion research, *Horizon* still covers the biggest stories in science. But with all of our films I am convinced that the greatest service we can give to the country is to bring our passion for science to as many people as possible.

Although there are many scientists in Britain who support this ambition, I still find stiff resistance amongst many parts of British science to embracing this aim. The only way to improve this is for science and the media to talk more about the issues and objectives we share. I am convinced this would be a crucial step in increasing the public engagement in science.

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is the Editor of *Horizon*  
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# International Year of Astronomy 2009

The Universe is yours to discover, says Steve Owens

**In 2009, the world will celebrate the International Year of Astronomy to commemorate the 400th anniversary of Galileo's use of a telescope to study the night sky. Within the UK, a constellation of events, activities and programmes will run throughout the year, allowing everyone to engage with the Universe, and to rediscover their place within it.**

## Galileo's observations

Beginning in 1609 Galileo, observing from Italy, saw things that nobody had ever seen before: the phases of Venus; the four largest of the moons of Jupiter, now known as the Galilean satellites; the beautiful rings of Saturn; and the mountainous and cratered imperfect surface of the Moon. These



Dr Tim O'Brien, from Jodrell Bank Centre for Astrophysics, enabling delegates to the Labour Party conference to view the Sun safely through a telescope fitted with a solar filter

observations overturned the world order and established our place on Earth amidst a much wider cosmos.

One of the main aims during 2009 will be to get as many people as possible to see what Galileo saw, both through telescopes and with their naked eyes, and to begin to ask questions about their place in the Universe.

## Brit beat Galileo

The UK has, of course, a strong reputation as a world leader in astronomy, and a British astronomer can actually lay claim to beating Galileo to being the first person to observe the night sky through a telescope. Thomas Harriot, observing in the summer of 1609 (several months before Galileo), made detailed drawings of the surface of the Moon, complete with craters and mountains, which he had observed through his small x6 magnification 'Dutch Spyglass'.

The fact that he did not publish his findings means he is a relatively obscure figure in the history of astronomy. However, his achievements will be celebrated on 26 July 2009, the 400<sup>th</sup> anniversary of his observations, during an event entitled *Telescope 400*, which will be held in Syon Park, the London home of the Duke of Northumberland, the location Harriot observed from. This all-day event, for all ages, will include exhibitions, demonstrations, observations and presentations, and is just one example of the kinds of events you will find happening around the UK next year.

## Moon watches

There are many different projects, events and activities planned in the UK, from those being run by local astronomy enthusiasts in your nearest town, to regional and national activities happening around the country. These will occur throughout the year, but some specific dates have been established to focus activities: Spring MoonWatch (28 March to 05 April) and two Autumn MoonWatches (24 October to 1 November and 19 to 29 November; the latter being intended for schools). These dates will give a good opportunity to view the Moon, along with Saturn (in Spring) and Jupiter (in Autumn).

## Stellar events

The UK will enjoy major projects. *Dark Skies Awareness* will encourage people to travel out

of the towns and cities to see a dark sky, work within urban communities to highlight the issue of light pollution, and educate about the effect that light pollution has on the UK's heritage of dark skies. *From Earth to the Universe* is a touring exhibition of stunning astronomical photographs to engage and enthral audiences in venues around the UK. *She is an Astronomer* will engage with women and encourage young women to consider science and astronomy as a career. *Cosmic Diary* will be an online blog from amateur and professional astronomers around the UK, talking about their passion for astronomy, as well as their day-to-day lives. *Telescopes for Schools* will provide 1000 telescopes to 1000 secondary schools throughout the UK, along with resources showing how to set up and use them, and contact with a local astronomer who can help set up a school astronomy club.

**One of the main aims during 2009 will be to get as many people as possible to see what Galileo saw**

These projects are just a small selection of the myriad of activities that will happen in 2009. To find out more, and to get involved yourself, visit the UK website at [www.astronomy2009.co.uk](http://www.astronomy2009.co.uk) and sign up for our newsletter.

Also on our website you will find our interactive online map, letting you search for events local to you or further afield, and our calendar of UK events. These are always expanding, so make sure you bookmark us and check back regularly to keep up to date with what's happening in the UK during the International Year of Astronomy 2009.

The UK's programme for IYA2009 is supported by the Royal Astronomical Society, the Science & Technology Facilities Council and the Institute of Physics

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# Dialogue of the deaf

Maarten van der Sanden wants clarity in communications



Communicating with a lay audience: what to target?

**Dialogue has become a buzzword in science communication. Many governmental initiatives involving information transfer use dialogue as a selling point. We have, for example, a dialogue on genetic manipulation, a dialogue on the scientific future of Europe, a dialogue on food safety.**

Dialogue has almost become a communication target on its own, beside such things as public understanding or awareness of science. However, it is simply one way of enquiring into ideas; and science communication would benefit from making it clearer.

## Facts and concepts

Dialogue is important in different ways to public awareness and engagement, on the one hand, and public understanding of science, on the other.

Take, for example, communicating with a lay audience on predictive genetic tests. If the public is informed and interested, one could have a dialogue on how lay people might use or abuse test results, or on the technical details. It would be a dialogue on facts. However, if the audience is not well informed, or even hostile to genetic tests, a dialogue might be needed on the credibility of the industry producing the tests, or on concepts like the ethical role of the industry within our society.

Dialogue on public understanding is about the facts related to a scientific development, and the use of those facts. With public awareness of science, however, dialogue is about concepts and constructs like credibility.

There is no use in just starting a dialogue

for the sake of a dialogue, even when the European Parliament is asking for it. We need to be careful in choosing whether to concentrate the dialogue on facts or concepts. Lack of clarity about this often results in a dialogue of the deaf.

## Ideas and emotions

Several authors have studied the subject of knowledge from a psychological viewpoint – the ideas and emotions that people bring to knowledge – as well as from a philosophical point of view.

The literature on ideas and emotions about medical science, for example, describes three basic cultural axes which could play a role in science communication. These are natural/artificial, tradition/change and health/disease. These primary axes allow audiences to relate to an unfamiliar subject.

Taking the example of communicating about predictive genetic tests again: a lay audience might be positioned near the natural, traditional ends of these axes. It would then be prejudiced against trusting all artificial medicine and medical techniques. Communication with such an audience is more effective when it targets the feeling of distrust instead of the technical information of the predictive tests. There is no use in giving more information or repeating the message when the audience is not willing to listen.

Science promotion using dialogue maintains it is possible to ‘change’ an individual from a believer in tradition to a believer in change. However, the effect of such a communication process is difficult to measure.

## We need clarity

Science communication professionals and researchers should sort out these and other differences if they are to be more effective.

Before starting to design a science communication process, one should ask questions about four parameters. The first is the background of target audiences: the psychological dimension we described above. This will affect the way the audience uses scientific knowledge and the credibility it gives it. The second is which method to use: would science promotion or science education be better? The third is the aims of the communication, for example engagement or understanding. The fourth, as we’ve also touched on above, is whether dialogue should be about concepts or facts. Is it to be a dialogue on distrust of medical technology, or a dialogue on the technical details of a new medical technology? If these questions go unanswered, the communication might be less effective than expected.

Our current research at the Delft University of Technology, and the VU-University Medical Centre, is about developing an instrument which supports science communication professionals in making such decisions, and in turn supports science communication researchers in learning about the questions from practice.

This article is based on: Maarten C.A. van der Sanden and Frans J. Meijman (2008) Dialogue guides awareness and understanding of science: an essay on different goals of dialogue leading to different science communication approaches. *Public Understanding of Science*, 17(1): pp.89-103

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# Copyright and creativity

Wendy Grossman learns how to save the read-write culture

Lawrence Lessig (2008), *Remix: Making Art and Commerce Thrive in the Hybrid Economy*, Avery Publishing (The Penguin Press, USA)

**They say perspectives change when you have kids. Stanford Law Professor and Creative Commons co-founder Lawrence Lessig's two sons are at least part of the driving force behind *Remix*, his fourth book, his third specifically about the copyright wars. He doesn't, he says, want behaviours natural to his children's generation to be criminalised.**

If you have ever taken a photo you've found and composited it with another, or posted a video clip of your two-year-old dancing to nearly inaudible commercial music to YouTube, or written a short bit of fiction using characters from your favourite TV show, you'll understand what he means. If you haven't done any of these things, your children or your children's children will. Do you want them to grow up with contempt for the law?

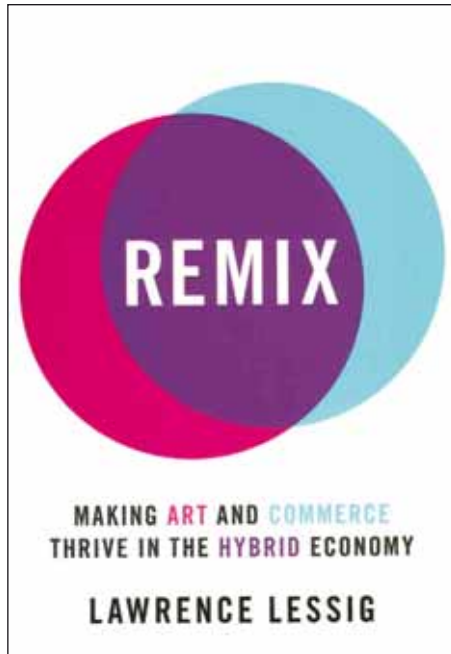
## Costs of copyright

*Remix* is not the rehash of Lessig's previous books that the title might lead you to expect. They (*The Future of Ideas*, *Free Culture* and *Code 2.0*) dealt with various aspects of computer networks, copyright law and technology architecture. *Remix* is about the collateral damage of the copyright wars. How much, Lessig asks, are these really costing?

The cost includes criminalising a generation. But also, Lessig argues, we lose the very thing that today's technology makes possible: creative culture at all levels. Yesterday's passive consuming culture (watching TV, listening to recorded music) was 'read-only'; today's technology enables 'read-write' (RW) culture, in which everyone can participate as creators, even if only as amateurs. Rightsholders have more direct financial interests, and about a third of the book is a look at the three types of economies – commercial, sharing, and hybrid – that surround intellectual property on the Net.

## Five changes

Lessig concludes by proposing five changes to the law intended both to encourage RW culture and to preserve the viability of commercial economies: exempt non-commercial use; require copyright owners to re-register works after 14 years; simplify



## How to stop losing creative culture

the law regarding fair use; regulate uses of copyrighted material, not copies; decriminalise file-sharing.

## If you haven't done any of these things, your children or your children's children will

Working from last to first, the reason to decriminalise file-sharing is simple: fighting it is about as successful as the war on drugs. Ten years of law suits, shuttered sites and services, and court cases have utterly failed to shut down file-sharing. There is absolutely no question that not only are there far more ways to share files than there were a decade ago, but that the range of material freely, if illegally, available online has vastly increased. Lessig suggests adopting either a tax on Internet use or individual subscriptions to compensate artists.

Regulating uses rather than copies also makes sense. For example, every time I view a web page on my computer I'm making a copy of it, however temporarily; it would

be nonsense to charge users for that copy (although Europe at one time considered it). 'Copying,' Lessig writes, 'is as common as breathing.' Instead, charge for commercial uses. Most artists would agree with this: if there's money to be made from their work, they want some of it.

## Re-registration

Requiring re-registration is meant to speed the entry of works without commercial value into the public domain. One of the consequences of the current default, that all work is copyrighted from the moment of creation until 70 years after the author's death, is that it takes a century or more for new work to enter the public domain. The vast majority of material does not retain commercial value for that long; re-registration would ensure that only commercially valuable work would remain protected.

Under such a regime, artists, creators, and rightsholders would still have their period of protected monopoly in which to profit from their work. JK Rowling renews her copyright after 14 years and continues to pull in £5 a second. But the mother posting the video of her two-year-old dancing to a garbled Prince song doesn't get sued.

In the end, Lessig blames the useless and damaging copyright wars on the simple fact that kids don't have as much money to fund political campaigns as Hollywood does. Neat segue into his next project, announced early this year: ending corruption in Congress by getting rid of 'earmarks' (special interest funding). The story continues at [www.change-congress.org](http://www.change-congress.org).

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# 'Science boosterism' versus public engagement with science

Nicola Buckley cautions against inflation

**I think we need to continue to build our public engagement programmes from an understanding of the interests and concerns of the public, and not just those of the scientists and policymakers.**

I find that my role coordinating the Cambridge Science Festival involves a constantly-shifting balance between 'science boosterism' (the term, which means promoting one's domain to improve its public perception, comes from a report on New York's recent World Science Fair) and aiming for broader public engagement in issues of scientific interest and concern.

## Necessary but trivialising

Science boosterism is working to some extent: the public face of scientists seems slightly less these days the arrogant, aloof white-coated image, and seems rather closer to that of a clever person who might help tackle climate change, or find out more about the building blocks of the Universe. There has also been great investment in science teacher training, curriculum reform and enrichment opportunities for young people, with some initially encouraging results in including more young people in science education provision.

However, boosterism can trivialise science. As I heard Brian Trench of Dublin City University say, 'You can tell an area of study is in trouble when you see the bright T-shirts.' I plead guilty to bright T-shirts. Our Science Festival T-shirts in recent years have been orange, green, pink and turquoise. He might have added that a subject is really in trouble when stickers are printed with leopard-skin pants on them saying: 'Smarty pants' to promote physics.

Yet boosterism is necessary. Without it, I'd find it nearly impossible to raise the £90,000 or so in sponsorship and grants our festival needs each year from a mix of public bodies and companies to offer our free events to 30,000 members of the public. But it's crucially important for practitioners in public engagement with science to notice when we're doing boosterism and when we're attempting instead to begin with the public's questions, passions or concerns and develop dialogue from that starting point.

## Public-engagement wash

We should be cautious about propagating a kind of 'public engagement-wash', in the way in which some institutions have been accused of 'green-wash' as they use a veneer of concern for the environment to improve their image while conducting business very much as usual. There have been some good examples of public engagement in science feeding into policy<sup>1</sup> but, as the Nanotechnology Engagement Group urges, we need to be clear with funders, organisers and participants about the purpose of a public dialogue initiative, and strategies created to meet those needs.<sup>2</sup>

Like many public engagement practitioners, with input from outstanding scientists and communicators, I organise and market public discussions and events on topics like nutrition and mental health; science and technology in international development; how to measure your carbon footprint and the possibilities of more of the UK's energy coming from renewable sources. Many such events are organised without having a mechanism to feed public views into policy, and I think that

is right and understandable – public discussion events, interactive websites and exhibitions all help to make science part of culture, with efforts made to attract harder-to-reach audiences. These activities also help to inform scientists about the public's views.

## Democratise science

But we should not lose sight of the goal to further democratise science and involve members of the public in helping to set research strategies. For example, a growing international movement of community-based research, loosely co-ordinated by the Living Knowledge network, encompasses a number of science shops in Europe and elsewhere. These aim to involve civil society in setting research agendas, often initially addressing local topics of concern, environmental or social.<sup>3</sup>

At the University of Cambridge, we are starting a small-scale community knowledge exchange which will ask civil society organisations whether they have research questions which could be posed to students for projects in subjects including engineering, IT, geography, sociology and business.

As we prepare for further challenging interactions between policy makers, scientists and the public over issues like GM crop trials and new nuclear power stations, we need to be highly conscious that the public can see through 'public engagement-wash' and realise that doing too much science boosterism will divert us from listening and entering into meaningful dialogue with the public.

1. The Sciencewise Knowledge Hub has a useful collection of reports by government agencies and other policy makers in response to public consultation exercises, in areas from stem cell research to atomic weapons: <http://www.sciencewise-erc.org.uk>

2. K. Gavelin, R. Wilson, with R. Doubleday (2007), *Democratic technologies? The final report of the Nanotechnology Engagement Group*, Involve, London

3. [www.livingknowledge.org](http://www.livingknowledge.org)



A demonstrator discusses nanotechnology with a visitor at the Cambridge Science Festival

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# Science and Society consultation: Go back to the drawing board!

In July, the Department for Innovation, Universities and Skills (DIUS) launched a consultation on science and society policy. It invited comments on its *Vision for Science and Society* – with its goals for public attitudes and targets for the scientific workforce: ‘A society that is excited by science, values its importance to our social and economic wellbeing, feels confident in its use, and supports a representative, well-qualified scientific workforce.’

The vision has already attracted a number of critical responses. The Academy of Social Sciences has pointed out that much relevant social science is left out of the strategy ([www.acss.org.uk/news.htm](http://www.acss.org.uk/news.htm)). Academics at University College London have questioned the value of lumping a wide range of policies under one vision: ‘tensions that exist between strands of the government’s science and society agenda need frank recognition and honest discussion.’ ([www.ucl.ac.uk/sts/sts-observatory/](http://www.ucl.ac.uk/sts/sts-observatory/))

In addition to these responses, an international group of social scientists published an open letter to Lord Drayson expressing serious concern about the vision. We were part of the group who drafted the letter. What most troubled us was that a critically important area of policy seemed to be moving backwards.

Over the past decade much good work has been done by the UK government and scientists of all stripes to put into practice the hard-won lessons of the 1990s. The BSE crisis, disputes about GM foods, and controversies over the science of climate change have all played a part in shaping policy. It is increasingly recognised that transparent and diverse expert advice as well as more rigorous democratic participation are of central importance for science and technology policy. The vision seems to replace this detailed work of institutional innovation with vague aspirations about public attitudes.

Our letter calls attention to the important

work that DIUS can do to support critical public engagement with particular sciences and technologies – rather than with ‘science’ as a whole. But as the vision is so focused on uncritical excitement rather than critical engagement we have called for DIUS to go back to the drawing board. In our view a vision for science and society must include a conception of how public values will be incorporated into the governance of science.

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## We’re all guerillas now

Your piece on the SciBarCamp in the last issue caught my eye. Innovative, unconventional, and – best of all – fun events like that which dispel the all-too widespread public impression of science as stiff, elitist and – worst of all – boring are sorely needed.

Fortunately, they are becoming more commonplace, including our own Guerilla Science Camp (GSC) at the Secret Garden Party music festival this summer.

Housed in a ramshackle army tent near Huntingdon, with hay bales for seating, we sought to surprise, fascinate and entertain revelers over four days at the end of July. In its

second year, the camp seeks to ‘promote public understanding of science in an original setting,’ in the words of founder Richard Bowdler.

### Lots to do

The GSC hosted more than two dozen talks by academic scientists and professional science communicators, ranging from explanations of string theory and quantum mechanics, to climate change proofs and solutions, fractal patterns and fluid dynamics, to the neuroscience of memory and the evolution of music. Attendees were also able to test their telepathy skills in a double-blind experiment,

learn how to beat-box (use their voice boxes to make instrumental sounds) with a laryngeal expert, and create gooey scale models of nanomaterials, as well as groove to the tunes of science-themed music.

We estimate that more than 1,000 people attended the camp, many of whom had never expected to discover – in a music festival of all places – how puzzling, beautiful and fun empiricism can be. Festival goer Carolyn Puppet told us: ‘I stopped studying science after GCSE but I loved Guerilla Science. As soon as I woke up each morning I’d go straight there. My favorite talk was the one where you hear the planets speak.’

Fewer students are taking science A-levels, and there is an indisputable need for greater public understanding of science, especially climate change, evolution, and vaccination. Opening people’s eyes when they least expect it – covered in sparkles in a sunny field – is an original and, we feel, inspired way to do it.



Vinegar + baking soda = balloon at the Guerilla Science Camp *Zoe Cisco*

**Mark Rosin**  
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# Practising public engagement

Following the end of the government's public consultation on Science and Society, Tom Wakeford has been a fly on the wall in a ministerial office.



**Minister:** Have you got a minute to discuss the consultation, Ms Gupta?

**Gupta:** Of course, Minister.

**Minister:** It's just that I'll be seeing the Select Committee tonight and I wondered whether the use of all that public money is going to help us meet our targets?

**Gupta:** Do you mean our targets for enthusing the public through engagement?

**Minister:** That's it. Are the public keener to accept all these new technologies – new nukes, nano-particles and third-generation...wotsits?

**Gupta:** GM crops, Minister.

**Minister:** That's the ones. Are the public any happier about science these days?

**Gupta:** I'm not sure, Minister, but RCUK did commission a poll of two thousand people that said the average person is three percent keener on science than they were five years ago.

**Minister:** Good....Eh?...Did you say opinion poll? But, Ms Gupta, I spend my life telling journalists not to take any notice of pollsters!

**Gupta:** And social researchers are pretty sceptical about them as well. They tend to ask things to bored people in shopping centres who are generally relieved that they are not being asked to sponsor a sick donkey.

**Minister:** What about focus groups? Old Tony got us into power by using them, so they should tell us something, eh?

**Gupta:** The thing is Minister, when you give them a few minutes to think about it, most

people are sceptical that the government or scientists are actually taking on board what they say.

**Minister:** Oh?

**Gupta:** It was only five years ago that you told people their views would influence government policy on GM crops.

**Minister:** But...

**Gupta:** And they've hardly been seen to have a say on nanotechnologies, have they?

**Minister:** Why not?

**Gupta:** Well your research councils jointly commissioned the UK Nanojury - a citizens' jury on nanotechnology a few years ago.

**Minister:** Did we?

**Gupta:** Yes, co-sponsored with Greenpeace.

**Minister:** Oh, God, not them!

**Gupta:** It actually made it a more balanced process than what we normally do, Minister. Everyone thought so. You know my colleague Malcolm? He went to the jury's launch and promised a response from your ministerial predecessor.

**Minister:** That was a bit rash! What did it say?

**Gupta:** We never wrote the response.

**Minister:** Ha! That'll teach them. Can't just be making policy statements willy nilly.

**Gupta:** Yes, we certainly missed that target. But it's different when you are the one who actually commissioned the public consultation, Minister.

**Minister:** Come again, Ms Gupta?

**Gupta:** In fact you had to carry out the same consultation twice. Remember? Nuclear waste?

**Minister:** We only had to do it twice because of bloody Greenpeace!

**Gupta:** Twice because the first process was judged unlawfully bad by the High Court, Minister.

**Minister:** Pah – judges! Second one hit the target though, didn't it!

**Gupta:** Only because you got Malcolm to get the market research company to change its PowerPoint the night before the meeting. Then a member of the public blew the whistle and everyone looked ridiculous.

**Minister:** But...

**Gupta:** That's the trouble with public engagement, you've got to let people come up with answers you might not like. That's democracy.

**Minister:** No, Ms Gupta. There you are wrong. Democracy is about voting. Marking your cross every five years. That's quite enough, thank you.

**Gupta:** So why are we doing public engagement?

**Minister:** To make sure they don't stop progress of course!

**Gupta:** So why don't we just call it marketing and education?

**Minister:** People wouldn't sign up for that, would they?

**Gupta:** Of course not!

**Minister:** Well, then? Goodness, is that the time? Probably about time I joined the committee – it's a presentation by nanotechnology experts before dinner.

**Gupta:** No citizen scientists there then?

**Minister:** Citizen scientists?

**Gupta:** You know, people like the members of the Nanojury, who've spent weeks getting a balanced picture of the future of the technology.

**Minister:** Do you mean that these folk should be given the levers of power? They're just Joe Public. Can't have them altering our targets.

**Gupta:** And aren't you just an elected member of the public?

**Minister:** Very clever, Ms Gupta. Now, I think I can hear my driver in the lobby.

Tom Wakeford

is SPA's Engagement Correspondent and Director of the Newcastle-Durham Beacon of Public Engagement. [www.ncl.ac.uk/beacon](http://www.ncl.ac.uk/beacon). He is among the signatories of the letter to Lord Drayson referred to on page 9.

# Thieving sock gnomes

Ian Gibson is not impressed with Sarah Palin's science



During the 2006 campaign for Alaska Governor, Sarah Palin was asked about teaching creationism in schools. 'Teach both', the *Anchorage Daily News* quoted her as replying. 'You know, don't be afraid of information. Healthy debate is so important, and it's so valuable in our schools. I am a proponent of teaching both.'

We will know by the time of publication if there is a real possibility that, in the next few years, Sarah Palin could become President of the United States.

**'I'm not an Al Gore doom-and-gloom environmentalist blaming the changes in our climate on human activity'**

## Creationism

Those of us with a greater knowledge and understanding of science are aware that there is no debate. The truly worrying indication here is that Palin fails to recognise that creationism or intelligent design is not a scientific theory.

Creationism is no more a theory than the theory that every time one closes the sock drawer mysterious gnomes appear and steal one's socks. Although the 'gnome theory' does explain a few things, it would be absurd to teach it in a classroom.

It becomes more disturbing to find that government policies have allowed creationists

to own our schools and set the curriculum through the city academies programme. Even the Royal Society has had to accept the resignation of a senior professional appointment to one of its committees. Great Britain along with many parts of the States is facing a creationist onslaught.

## Climate change

We have concern too when we consider that the greatest threat our planet faces is global climate change. Our only hope in the face of climate change is global cooperation to address the way we live and interact with the planet.

So what does Palin think about climate change?

'I believe in science,' Mrs Palin told the ABC Network after she had received the Republican nomination for Vice President. Yet just last year as Governor of Alaska, she told *Fair Banks Daily News*: 'I'm not an Al Gore doom-and-gloom environmentalist blaming the changes in our climate on human activity.'

Mrs Palin's stated policy is to increase American production of oil and gas. At the Republican Convention this summer, she promised that 'starting in January, a McCain-Palin administration, we're going to lay more pipelines.' However, her expertise in this area is as wanting, and amounts to justifying her stance with: 'Take it from a gal who knows the North Slope of Alaska: we've got lots of both.'

## Polar bears

Palin is currently suing the Bush Administration over its decision to award polar bears 'threatened status' under the Endangered Species Act. Palin is undertaking the law suit on the basis the threatened status will 'deter activities such as... oil and gas exploration and development'. The decision to award polar bears threatened status was made on the back of studies submitted by the US Fish and Wildlife Service. They found that Arctic sea ice, the bear's natural habitat, fell to its lowest level ever recorded by satellite in the year 2005-06.<sup>1</sup>

Palin then commissioned 'scientific research' of her own. Palin's paper, *Polar Bears of Western Hudson Bay and Climate Change* came up with starkly different conclusions from the US government. On closer examination of those involved in the paper, this is not surprising. The *Guardian* reported

this month that three of the seven academics that contributed to the paper have directly or indirectly been funded by Exxon Mobil, and another by the American Petroleum Institute.

Ironically, Palin ran for Governor on an anti-corruption ticker. She even resigned from the state's Oil and Gas Conservation Commission in protest at what she described as the corruption of fellow Republicans. Yet now, through her oil-funded pseudo science, she is advocating policies which will have a devastating effect on endangered species and on climate change if the oil companies are allowed to drill in Alaska.

**Although the 'gnome theory' does explain a few things, it would be absurd to teach it in a classroom**

## Biology

When it comes to biological and medical science, Palin fares no better. She totally opposes abortion under any circumstances, including rape and forced incest.

Her staunch pro-life stance also rules out the possibility of support for embryonic stem cell research. The debate in the UK before the summer demonstrated we must not rule out embryonic or adult cell sources to produce stem cells up until 14 days. It looks likely that hybrid animal/human cell mixtures will be strictly regulated.

I expect to see a more pro-science platform among UK politicians, but the dangers are there. Just look at the debate on mixed embryos and abortion. Scientists need to engage more proactively with the public and not just a few politicians.

1. US Fish and Wildlife Service – press release on polar bears 14 May, 2008, <http://tinyurl.com/69qo9b>

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