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Features

Issues for the new government

Readers opening *S&PA* will know the colour of the new government. In this issue, we survey some of the subjects awaiting action in official in-trays.

The SPATalk (p.4) debates what the new government should do for science. David Caplin and Peter Cotgreave agree that the old one increased the science budget, but they disagree about the hold it had on the way the money is spent. The new government must loosen the grip of Whitehall and Westminster, maintains Peter Cotgreave: politicians are not the right people to determine the direction of science. Any government would be remiss not to encourage Research Councils and others to fund studies of climate change or genomics, replies David Caplin: these issues are of major importance to our society.

With general agreement that school science is crucial in encouraging young people into science, Derek Bell and John Holman (p.18) seem to grit their teeth as they assess the effect on science education of February's White Paper. Each finds something to be pleased about, but Terence Kealey is the only commentator with an unreserved welcome.

The old government's strategy for sustainable development is similarly contentious (p.22). It is politically impossible, says Karen Lucas; the business community will find it hard to heed, warns Jim Haywood. Meanwhile, Howard Dalton emphasises Defra's intention to base the strategy on sound evidence.

In contrast, there is unanimity from every side about the old government's response to the Royal Society and the Royal Academy of Engineering report on nanotechnology (p.24). Ann Dowling, Jim Thomas and Richard Jones are all disappointed by the government's failure to address the ethical and social implications of the technology. All wish the government had taken the chance to lead the world in introducing sensible regulation and responsible dialogue on the issue.

In advance of July's G8 meeting, the Commission for Africa report enjoys a cautious welcome with hopes that it could help science on the continent (p.20). William Kalema summarises what the Commission hopes to achieve for science, while Mohamed Hassan and Judi Wangalwa Wakhungu see ways in which its proposals dovetail with Africa's own priorities.

Official attempts to balance research with security earn some approval (p.16). Caitriona McLeish finds that new biosecurity regulations, introduced to prevent the misuse of legitimate research for weapons development, seem to be having a less disruptive impact on the practice of science in the UK than in the US.

We also return to the debate about how the public can take its place in the making of science policy. Elizabeth Rasekoala reports (p.6) on an initiative of the BA and the African-Caribbean Network for Science and Technology to open up dialogue about science to members of ethnic minorities. Malcolm Grant argues (p.11) that the Sustainable Agriculture Advisory Group, which will replace the Agriculture and Environment Biotechnology Commission, should embed the Commission's diversity and transparency in its own way of working. And Nick Pidgeon and Tee Rogers-Hayden (p.14) compare the success with which *GM Nation*? and the nanotechnology enquiry achieved successful public engagement. They conclude that moving participation upstream is unlikely to resolve all the problems.

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What should the new government do for science?

David Caplin and Peter Cotgreave argue it out

Dear ***David,***
Over the past eight years, the government has begun to reverse the decline of British science.

Investment in research and development is almost as high as it has ever been. But the world is increasingly competitive, and to maintain the technological edge that has kept the UK's economy buoyant in recent decades, the government will need not just to increase investment, but to change the way in which it handles science.

One striking fact about science funding is that clever physicists with exciting, novel ideas have seen their chances of obtaining a research grant fall by around 40 per cent. That's because, although there is more money in the system, ministers and central bureaucrats have increasingly dictated where it goes, rather than allowing the scientific community to identify the most exciting and profitable avenues for research.

The science budget comes with ring-fenced pots and lists of questions that must be answered; the Prime Minister prejudged the assessment of grants by announcing how much the Research Councils would spend on stem cell research before anyone had even applied for any money.

This kind of central interference in research priorities will only harm the nation's ability to become the best place in the world for science.
Yours, **Peter**

Dear ***Peter,***
We both welcome the recognition given to the importance of science since 1997: a vastly-expanded budget, and the support of a Science Minister who understands how scientists work. Unsurprisingly, neither of us will ever think that there is enough money.

Funding for science has to increase at a rate well above general inflation, just because of increasing sophistication of instrumentation, and the impact of large facilities such as Diamond and CERN. But this government has recognised also the importance of career structures for the young scientists at the workface, the postgraduates and the postdocs, and has promptly followed the Wellcome Trust's lead in boosting stipends and salaries. I'm sure that using some of the extra funding in this direction is uncontentious.

Let's turn to how the science budget is allocated between managed programmes and 'blue skies' research. I suggest that the Treasury cannot simply hand over a rather large sum to the Research Councils, and leave them (who??) to divvy it up. A number of mechanisms have been tried, some of them pre-dating 1997, for example Technical Opportunity and User Panels. Do you have ideas for better ways to do it, and, even more important, for gauging their effectiveness?
Yours, **David**

The uncompetitive level of salaries for university researchers remains one of the big unsolved issues of the past eight years

Dear ***David,***
Using funds to attract the best people into the science base is uncontentious. But the new government must tackle this much more vigorously than the last. The uncompetitive level of salaries for university researchers remains one of the big unsolved issues of the past eight years.

For most of the twentieth century, a great deal of money was given to arms' length bodies, and then divvied up by their scientific experts. It was a remarkably successful system. Max Perutz, the late head of the Laboratory of Molecular Biology (which has produced more Nobel Prizes than just about anywhere), said that if he had 'tried to direct people's work, the mediocrities would have stayed and the talented ones would have left.'

With the research budget rising, politicians are entitled to take more interest in where the money is going. But if we need more directed research (for example in the field of energy, where there are big market opportunities), we should fund them through the relevant government ministry. The ability to tackle unconventional and unfashionable questions, not just those prescribed by politicians, is one of the features that made the UK's science base among the world's best. We must not lose it.
Yours, **Peter**

Dear ***Peter,***
Yes, a junior academic cannot afford to live in the South-East on a single salary, but this is a generic socioeconomic problem affecting all of the public sector, with no simple solution.

The Labour Party's manifesto gave a lot of attention to science and technology, seeing it as a crucial driver for a high-skill knowledge-based growth of the economy. Naturally, there is the commitment to continue with the 10 year strategy to raise the R&D spend, but there are other important details. For example, to raise further the level of PhD stipends.

I take your point that serendipity cannot be planned. University-based research does provide more flexibility and opportunity than in research institutes; I've often set an idea rolling with a student project, and that's become more common with the increased emphasis on project work. At a more senior level, there are initiatives such as the Crucible Fellowships, run by the National Endowment for Science, Technology and the Arts (interestingly, NESTA had a mention in the Labour manifesto), bringing together diverse groups of young scientists for weekend workshops.

The government's record and the manifesto showed that the Labour Party understands how science and scientists work!
Yours, **David**

Dear ***David,***
The government cannot pick off simple problems and ignore the hard generic socioeconomic ones; more must be done to attract the best people into science. I think you are confusing the fact that a Labour government has done some useful things for science with the idea that Labour politicians understand science well enough to micromanage the science base.

Very few politicians understand how science is really done; only about 10 per cent have any kind of science degree (and most of those have never been researchers). A few Labour politicians understand science, but so do some Conservatives and some from the other parties.

But politicians are not the right people to determine the direction of science. In recent years, they have confused accountability with control. As a taxpayer, I want Parliament scrutinising the science budget to ensure we get value for money. That is not the same thing as saying the Prime Minister and his colleagues should introduce ring-fenced pots in the science budget and produce a list of questions that supposedly independent scientists much answer.

If we want a truly world-class science base, with all the economic, social, environmental and health benefits that it brings, the new government must loosen the grip of Whitehall and Westminster.
Yours, **Peter**

Dear ***Peter,***
The complaints I hear from my colleagues (in addition to the perennial ones over funding) are about decisions made by grant review panels – our peer group – not about interference from 10 Downing St., nor indeed from any other part of Whitehall.

I don't think we should be complaining if senior Ministers draw public attention to global warming or the importance of genomics, nor is it an attempt to micromanage research. These issues and others are of major importance to our society, and any government would be remiss not to encourage Research Councils and others to fund them.

The difficult problem to which I've not yet seen a satisfactory answer is how to monitor, on a broad strategic scale – not of individual researchers – the effectiveness of the different modes of funding. We must do so not only for public accountability, but also so that within the available budget, we fund as much of the best science as we can. It has to be done with a light touch, and with minimal bureaucratic overhead.

What better testimony could there be to the Labour government's record on science than your organisation's name change from 'Save British Science' to the 'Campaign for Science & Engineering in the UK'? Salvation has been achieved, but more nurture is sure to be needed.
Yours, **David**

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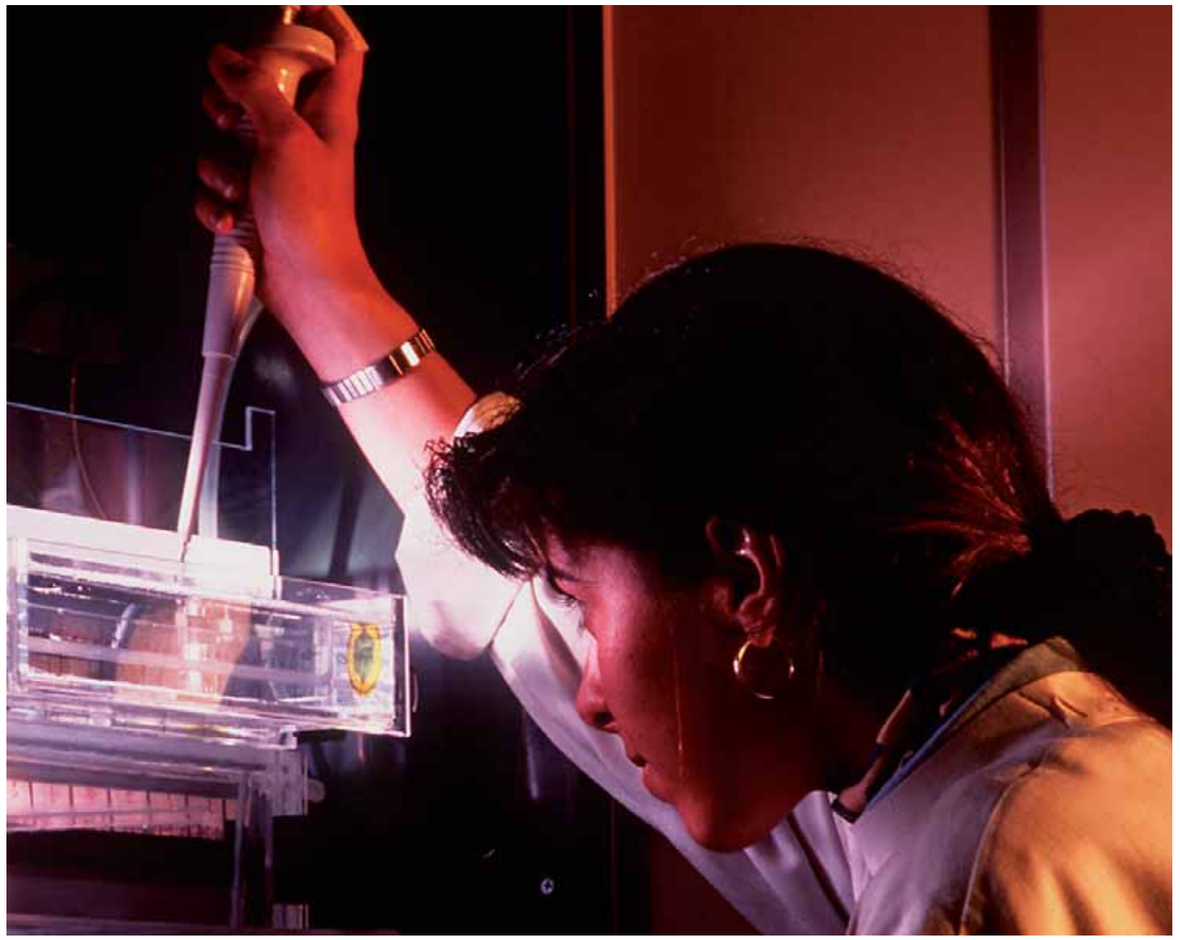
Science: in need of a new injection?



Dialogue on science

Elizabeth Rasekoala on a new project to include ethnic minorities

The way that science is portrayed in school curriculum materials, science centres and museums – as well as images in the media – shows a profound lack of racial and ethnic diversity.

There is also a lack of diversity in the aspects of science presented: for example, the natural sciences predominate over the physical sciences and chemistry. The view is generally Eurocentric, with very little recognition given to the contributions (historical and contemporary) of black and minority ethnic (BME) people, and there is a profound lack of BME role models featured.

To enhance the participation and profile of ethnic minorities in science communication and science issues, the BA and the African-Caribbean Network for Science and Technology (ACNST) have recently set up a project called DISC: Delivering Inclusion in Science Communication.

DISC is working to create an effective national framework to facilitate empowering networks and sustainable partnerships between ethnic minorities and the science communication community, by engaging both groups in consultation and dialogue. We have revealed profound exclusion of BME groups in science communication and science issues. However, we have also discovered, through involving both groups in consultation events, questionnaires and regional outreach workers, huge interest and enthusiasm in working towards a partnership for change.

Dialogue on science: DISC wants less of this...

Barriers to participation

One of the most interesting and surprising aspects of the outcomes of the DISC activities so far is that the BME groups and the science communicators agree almost completely on the key challenges and barriers faced by both groups in increasing their participation in science communication.

At the moment, there is little racial diversity in the staff of science communication organisations, who thus lack the links, skills and understandings which would facilitate their inclusion of BMEs. Neither do BME groups themselves have staff with scientific backgrounds or skills. Both groups need to make the time to build trust, and to understand their different expectations and perspectives. Both groups also need to adopt clear and sustainable strategies for working together on the common agenda of getting more ethnic minorities involved in science communication and science issues. They also need to overcome the institutional racism inherent in science power structures.

As well as these organisational issues, DISC has identified other challenges to do with formats of engagement. Science communicators need to design formats which will be effective with BMEs, and be able to commit to follow up work. Currently, BMEs lack ownership of processes of engagement, and ways in which science is made relevant to them. They are also poorly informed on science communication activities and science issues.

Lack of resources is another problem. It relates, on both sides, to funding, knowledge of funding options, people with the right skills and understandings, culturally diverse science communication materials, literature, images and so on, and training for inclusion in science communication.

Both groups lack confidence to move forward. They simply don't know where or how to start. For science communicators, this lack of confidence is further exacerbated by the lack of willing scientists committed to engaging in this work, and their lack of awareness of the science occurring in developing countries. BMEs' lack of confidence is heightened by their poor access to information on science generally, their limited knowledge of science and negative experiences from their time in schools, which they see as ongoing in the current low expectations that teachers have of their children in science.

The way forward

As well as agreeing on the problems, both science communicators and BME groups agreed on effective strategies for implementing positive change.

Ninety-five per cent of BME groups and 80 per cent of the science communication organisations indicated in their responses that they view the DISC initiative as a strategic route to achieving the goal of ethnic minority inclusion in science communication. Both groups identified several priority areas of work to be taken forward by DISC.

These were to train and build capacity for working in partnership and funding joint science communication activities; to tackle organisational culture and representations of science; to carry out market intelligence; and to engage with the media to raise the profile of BME contributions and participation in science activities, debates and issues.

With additional funding from the Office of Science and Technology, DISC is working to address these priorities in its second year work programme by engaging both groups through training and capacity-building, in joint delivery of science communication activities. To this end, the project has organised two-day residential training workshops for both BME and science communication groups in the northwest, Midlands and London.

The workshops will address ways of managing change in organisations to deliver inclusion of ethnic minorities. They will look at effective strategies for promoting science communication to BME groups and communities, including information and links with BME media. They will examine ways of improving recruitment and retention of BME staff in science communication; how to build and sustain trust and partnership working with BME groups; and effective networking between science communication and BME groups. They will also think about strategies for effective outreach between science communication and BME groups; how to motivate scientists to address the inclusion of BMEs in science communication; and how to share good practice from other sectors such as the arts.

...and more of this

The residential aspect of these joint training programmes will provide a unique opportunity for science communicators and BMEs to develop personal links, to have in-depth discussions and develop shared perspectives, which will help to sustain their working partnerships in science communication activities.

Science communication organisations have an invaluable role to play in the democratisation of knowledge, social inclusion and the promotion of public participation in decisions about science and its impact on society. Through engaging science communication organisations and ethnic minority groups in consultation and dialogue, DISC has exposed the wide gulf that currently exists between both groups. However, DISC has also shown the inclusive landscape that can be achieved by the two groups working in partnership to address the inclusion of ethnic minorities. DISC is committed to working with all the key stakeholders to make this inclusive vision a reality.

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DISC has set up an evolving web-based good practice resource for both BME and science communication groups, at www.ishangohouse.com/DISC

The project is funded by Copus, the National Endowment for Science, Technology and the Arts and the Office of Science and Technology.

Science communicators and BME groups: the divide in figures

Analysis of questionnaires completed by both groups showed the following:

Fully 73 per cent of BME groups had never undertaken science communication activities

Only four per cent of science communication organisations had worked with all ethnic minority groups

Ninety-five per cent of BME groups had no links at all with science communication organisations

Only nine per cent of BME groups had ever received any information on science activities, such as National Science Week

Ninety-three per cent of BME groups are interested in undertaking science communication activities

A key communication tool for BME groups in their communities is word of mouth, as indicated by 84 per cent of respondents

Seventy-two per cent of BME groups and 86 per cent of science communication organisations have no links with BME scientists

Eighty-five per cent of BME groups have no access to funding for science communication activities

Shorts

University research: no rigid structures please

University science solution 'needs more work'

The recent Commons Science and Technology Committee report, *Strategic Science Provision in English Universities*, diagnoses the problem well but, according to the Chair of the Russell Group of universities, Professor Michael Sterling, 'stops short of a workable solution.'

The report calls for the government to 'overhaul the way science subjects are funded or risk missing out on key economic goals.' It proposes a radical solution involving a 'hub and spokes' model, in which universities would specialise and collaborate in the provision of science research and teaching at a regional level, rather than compete for research and teaching funds.

Michael Sterling, who is also Vice-Chancellor of Birmingham University, said there was much of value in the report but that the solution it recommended 'needs more work', and was possibly compromised by the limited time in which it had to be written before the general election.

'I'm not sure about how the "hub and spoke" model could work in terms of teaching – would lecturers or students move around within their regions? – nor what to make of its bearing on the RAE,' he said. Certainly, he added, anything that could drive a wedge between research and teaching would be a cause for concern. 'You need to be doing research at the cutting-edge and translating that into your teaching. Separating them negates the point of a research-led university.'

His point was echoed by Liz Allen of the university lecturers' union NATFHE. 'Although we support the idea of a regional dimension to research provision, we are concerned that the Committee's proposal could become another step towards teaching-only universities, which NATFHE strongly resists,' she said.

Universities UK expressed interest in the report but also concern about where control over any restructuring would lie. 'Collaboration is already a natural and integral part of higher education in the UK [...] and the sector is in the best position to explore how this can be enhanced and built on,' said a spokesperson. 'A rigid structure, imposed by the funding councils or government as the Committee suggested, would be not be desirable.'

Others such as the Institute of Physics, the Royal Society of Chemistry, the Campaign for Science and Engineering (formerly Save British Science) and the Royal Society, also welcomed the rethink but expressed reservations about certain recommendations. The rigidity of enforced regional partnerships and a lack of shorter-term funding to avert the immediate crisis featured in many responses.

The report is at www.parliament.uk/s&tcom

Cash for minority women in SET

A £2.8m government-funding boost for the UK Resource Centre for Women in SET will allow it to expand its services, extend its contract by a year (to 2008) and get more women back into careers in science, engineering and technology.

'Of course we are delighted that our work over the past year has been recognised,' UKRC's Director Annette Williams told *Science & Public Affairs*. 'This will enable us to fill the gaps in our existing provision and to plan for new initiatives.'

The centre, based at Bradford College, is planning among other things a national grant scheme for minority women in SET. 'Difficulties that women face [in SET] careers can be compounded by issues such as race and sexuality,' said Williams. 'Our concern has nothing to do with their achievement levels, more that any issues are not being addressed properly in terms of representation. We don't even know how many minority women are graduating in SET.'

It will also set up a national networking, mentoring and development scheme, 'Entrepreneurship for women in SET', to link women in research with entrepreneurial support networks in their region.

Can the media play fair on climate?

The Royal Society has accused sectors of the UK media of giving coverage to distorted views on the science of climate change. In a speech earlier in the year, the Society's President, Lord May, criticised those seeking to undermine the scientific consensus on climate change, observing that some UK newspapers appear to be conducting 'an undeclared campaign to deny the potential threat'.

'The views of professional contrarians should not dictate how the media report an important issue like climate change,' he said. To rebut misleading arguments, the Society has published a media guide, available at: www.royalsoc.ac.uk/page.asp?id=2986.

But David Cromwell, co-editor of the media watchdog Media Lens, said: 'Robert May is overlooking the bigger picture: the inherent corporate bias of the mass media.'

Corporate ownership and heavy reliance on advertising revenues act as 'news filters', he explained, so that 'the media rarely address the unsustainable nature of endless economic growth on a finite planet, nor the links between likely climate catastrophe and the damaging practices of global corporations and investors.' By failing to alert the public to the roots of the crisis, the media is itself part of the problem, added Cromwell.

Corporate bias: filtering science in mass media?
Acknowledgement: ***Freefoto***

European network calls for revised FP7

A new, EU-wide network of civil society organisations has instigated a campaign for a more ethical European science and technology policy. The group is called the European Science Social Forum (ESSF).

The first activity of the network has been to lobby for a change in the R&D priorities of the forthcoming EU Framework Programme Seven (FP7), which will spend €40 billion (€27 billion) from 2006-2010. ESSF is concerned that the proposed priorities of FP7 put commercial and military interests above social and environmental ones. The network has drafted a statement to this effect, which had been signed by more than 350 organisations, scientists, and citizens from 19 European countries (and 12 others) at the time of writing.

Framework 7: military emphasis criticised

A spokesperson for Scientists for Global Responsibility, the UK member of ESSF, said: 'The agenda we set for scientific research today will have considerable influence on the society we will live in tomorrow.'

The ESSF is at www.essfnetwork.org

In brief

- The Council of the Royal Society has nominated Sir Martin Rees as its candidate for their new President, to succeed Lord May of Oxford in December 2005. A membership ballot is virtually certain to confirm the nomination, the result of which will be announced in July. Sir Martin Rees is Professor of Cosmology and Astrophysics at the University of Cambridge – but will have to resign his post as Astronomer Royal.

- A study into the use of primates in biological and medical research has been launched by the Academy of Medical Sciences, the Royal Society, the Medical Research Council and the Wellcome Trust. They will examine the recent, current and future scientific basis for research involving non-human primates and are expected to report in spring 2006.

- The UK's Research Councils have established two new units. The Science in Society unit will coordinate cross-council activities related to public engagement and the Research Careers and Diversity unit will focus on awards and schemes to bring on the next generation of researchers.

- The campaign group Save British Science has changed its name to Campaign for Science & Engineering in recognition that funding for science is improving but that engineering is in need of urgent attention. CASE: www.sciencecampaign.org.uk

Public support crucial to successful science policy

The returns on the government's ten-year investment for science and innovation will be at risk if it does not harness public support for its science and technology-related policies, says a report from the Council for Science and Technology.

Entitled *Policy through dialogue: informing policies based on science and technology*, the report calls for a fundamental culture change within government to one which supports 'more systematic approaches to public engagement and dialogue [...] for science-driven issues.'

Observing that the decline in public confidence in science has 'begun to inhibit decision making', the report emphasises the need to stem or reverse this decline and calls on government 'at the highest level to adopt an explicit framework for the use of public dialogue to inform science and technology related policies.'

Food agency takes criticism on the chin

The Food Standards Agency (FSA) has 'welcomed unreservedly' a wide-ranging review of its performance since its inception five years ago. The review was undertaken by Baroness Brenda Dean of Thornton-le-Fylde, and commissioned by the FSA itself.

In her report, Baroness Dean made 22 recommendations, all of which were accepted by the board. Her most pointed comments referred to the FSA's approach to GM and organic foods. The review found that the 'vast majority' of people consulted felt that the FSA had 'deviated from its normal stance of making statements based solely on scientific evidence' when 'speaking against organic food and for GM food.'

She recommended that the FSA 'address the perceptions of consumers on its policy decisions on GM food and organic food.'

Peter Melchett, of the Soil Association, said: 'We are delighted that the unscientific and biased position of the FSA's old leadership has been exposed - and by its own inquiry.'

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Research should involve the people that matter!

John Bond recommends collaborating with people with dementia

I have been involved in dementia research for nearly 20 years, and for the last ten I have focused on the quality of life of people with dementia. As a member of the academic community, I do my research in partnership with two other groups: people with dementia and their carers.

The search for causes of dementia and means to prevent and treat the disease and its symptoms has become a major focus of biomedical research. This has been paralleled by a similar commitment by behavioural and social scientists seeking ways to improve the care and quality of life of people with dementia and their informal carers.

Focusing on overcoming dementia, the Alzheimer's Society funds research on three key areas – cause, cure and care – through its internationally acclaimed Quality Research in Dementia (QRD) research grants programme.[1]

The QRD programme is an active partnership between carers, people with dementia and the research community. At the heart of Quality Research in Dementia is the QRD Advisory network: a network of 150 carers, former carers and people with dementia who play a full role in the following areas:

- They set the priorities for research
- They provide comments and prioritisation of grant applications
- They select applications for funding
- They monitor on-going projects being funded by the Alzheimer's Society
- They tell others about the results of research.

Involving the consumer

The involvement of 'consumers' in health research has been a growing trend in recent years, but few other charities or research funding bodies have achieved such full involvement in the decision-making processes. For scientists new to this approach the involvement of the consumer may seem an unnecessary additional bureaucratic hurdle, for surely lay people do not understand science?

This view is not just one that used to be held by some physical scientists. It was one shared by some social and behavioural scientists and by some clinicians providing care. I recall in my less enlightened years thinking that surely social science was different from natural science, since in our contact with research participants we involved them by seeking their views and describing their world for others to see and understand.

Dementia: collaboration in action and research

However, as the emancipatory research paradigm led by the early feminists and disability researchers emerged, my understanding of what participation in research means has changed. In dementia research in the UK, such scientific arrogance is rapidly being expelled to history.

The benefits

As academic researchers we often get ideas that we develop and protect in isolation from the real world. We neglect to challenge their relevance and often find it difficult to communicate their obvious relevance to key stakeholders.

For example, we found that stakeholders were more willing to consider our research proposals if we referred to 'people with memory problems' rather than 'people with dementia'. Talking about memory problems is less threatening than talking about dementia, as we all have memory problems at times, and some people do not want to admit that they have dementia. Such criticism enabled us to share our ideas with people with dementia, and as a result we found that we were better able to explain ourselves and justify our funding needs to our scientific peers. The first benefit we researchers experienced was successful funding applications.

Continuing involvement through the establishment of a user or oversight panel of lay people meant that we were able to improve the quality of our research documentation and processes such as recruitment rates. Knowing, for example, that some people with dementia are more cogent in the afternoons has enabled us to ring them then, rather than in the mornings. This helps us to use the expert knowledge of our lay research colleagues to understand our data and research findings.

Academic research is so often read by very few. Many of my government-funded research reports have collected dust on the bookshelves of academics and civil servants, and have rarely influenced the real world. But our lay colleagues nag us to disseminate our results. They keep us on our toes about how important it is to draw attention to our research through conferences and the media.

Working in partnership with research participants is a challenging experience but the rewards are irreplaceable. I recommend any scientist not involving research users to take their consumers seriously!

1. See more about Quality Research in Dementia at www.qrd.alzheimers.org.uk

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Goodbye, Agriculture and Environment Biotechnology Commission

Malcolm Grant reflects on its legacy

There is a longstanding practice of governments, when faced with highly controversial and apparently intractable policy conflicts, to dispatch the problem to a specialist Commission, historically no less than a Royal Commission. Harold Wilson once observed that the purpose of a Royal Commission was to hold meetings, to keep minutes and to take years.

The remarkable controversy that developed over genetic modification in the late 1990s left the government both divided and perplexed, and coincided with problems in handling the BSE crisis that had provoked widespread public concern. The response was to set up no fewer than three new bodies: the Food Standards Agency, the Human Genetics Commission and the Agriculture and Environment Biotechnology Commission (AEBC). The AEBC has recently been wound up after five years of existence. It undoubtedly served its short-term political purpose by taking some of the heat out of the GM controversy, but its legacy is a great deal weightier than that.

The AEBC's remit was to provide strategic advice to government on biotechnology issues impacting on agriculture and the environment. It set its own work programme and was charged with considering the social and ethical implications of developments. Most importantly, and uniquely, its membership reflected the breadth of opinion on GM throughout the UK, with a range of different values and expertise. Some of us worked in ecological, social or other academic research, agriculture, the biotechnology industry or the law. Others were involved in non-governmental organisations or consumer affairs. Though powerful tensions existed, and sometimes boiled over, the dedication of the members to the project, and their commitment and intellectual strength, ensured that the Commission made real progress.

Output

We produced four major reports. The recommendations of *Crops on Trial* led to the GM public debate in summer 2003, a unique exercise that generated a remarkable public response.[1] *Animals and Biotechnology* called for a new strategic advisory body to examine the issues raised by the use of biotechnology on animals, something the government is still considering. It was an attempt to move upstream in thinking about the application of a technology still in its infancy, and where there was likely to be strong public interest. Our report on *Coexistence and Liability* is currently informing the government's approach to the question of how far and under what conditions it will be possible to maintain non-GM agriculture in the UK alongside the commercial growing of GM crops. Finally, *What Shapes the Research Agenda?*, launched at the end of April, is an in-depth study of how research agendas are set in agricultural biotechnology, with a series of important recommendations on the drivers behind research, the mechanisms used to set priorities and the involvement of stakeholders and the public in decision-making.

The decision to wind up the AEBC follows an independent review of the Commission at the end of last year. Members agreed that the Commission had fulfilled its function within its terms of reference. The decisions that the government has made about GM have been informed – technically, socially and economically – by the AEBC's recommendations. Things have moved on. There is now a new legal framework for the regulation of GM at the European level. No commercial cultivation of GM crops is expected in the UK before 2008.

Lessons

The government must learn lessons from the AEBC experiment and make sure that its diverse membership and inclusive way of working are sustained. The AEBC set out to act as a body in whom the public could place its trust. It has been clearly and demonstrably independent of government. It has worked transparently, holding all its meetings in public and making all papers available on its website. It has also ensured that engagement with the public, and with the full range of stakeholders, has been a vital part of all its workstreams. These are characteristics to which any future bodies in this arena must adhere.

Moreover, biotechnology must continue to be considered in a strategic way and not in isolation. The government has identified several bodies with this responsibility, including the Sustainable Development Commission and a new Horizon Scanning Centre in the Office of Science and Technology. It became clear to the AEBC that strategic advice on agricultural biotechnology must in future be formulated within a policy framework of advancing sustainable agriculture. The government has announced that it will establish a new Sustainable Agriculture Advisory Group. This is a welcome move in the right direction. The government must ensure that the AEBC's approach is embedded into the way it makes decisions on new technologies, agriculture and environment in the future.

1. All the AEBC's reports are available from www.aebc.gov.uk

GM maize: things have moved on

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→ Feature

Polling and probing public attitudes to science

Michele Corrado and Andrew Norton find people are positive

In recent years, science and its social and ethical implications, communication of science, dialogue, public involvement and public engagement have become key aspects of science policy. The importance of encouraging dialogue between scientists and the public is now widely recognised.

A recent report by MORI, *Science in Society*,[1] contributes towards this debate through shedding light on public attitudes towards a range of issues related to science (including engineering, medicine and technology); public engagement with science; trust in scientists; and awareness of, interest in and consultation on issues related to science and technology.

Attitudes revealed

The report reveals a largely positive attitude among the UK public about science and perception of science issues.

The report found that over 80 per cent of adults think science makes a good contribution to society and that science will make our lives easier. Looking at trends, more people now believe that science makes a good contribution to society, and that science will make our lives easier (up five and ten points respectively in the last two years). Also, strength of feeling has become more marked, with at least a quarter of adults now strongly agreeing with each statement. More than half (56 per cent) of UK adults have taken part in a science-based activity in the last year, outside work.

Trust in scientists has been high since MORI began measuring it among the general public in 1997, when 63 per cent of the public said they trusted scientists to tell the truth and 22 per cent said they did not. Recent MORI work for the British Medical Association demonstrates that it has increased still further on its baseline. Now, 70 per cent of adults in Great Britain trust scientists to tell the truth (and 18 per cent do not). The figures for the United Kingdom also stand at 70 and 18 per cent respectively.

While most people in the UK do not feel informed about science and scientific research or developments, it is notable that approaching four in ten feel very or fairly well informed, particularly in a specialist area that most people do not need to be informed about.

Eight out of ten are supportive of public consultation, and the public is keen for consultation to be followed by action on the outcomes.

The media can play a key role in informing and engaging people. Television and newspapers are the most commonly used method for people to find out about science, but seven out of ten people think the media sensationalises science. Few say they see or hear too much information on science and far more people now than four years ago say they receive too little information on the subject.

Methodology

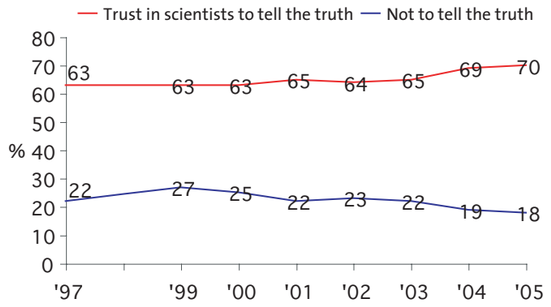
The MORI report is based on research conducted on behalf of the Office of Science and Technology (OST), Department of Trade and Industry, with input from the School of Environmental Sciences at the University of East Anglia (UEA). The research builds on two previous general public research studies for OST, as well as UEA/MORI general public work on risk in 2002 and 2003, and MORI's work for the Wellcome Trust among over 1,600 UK scientists.

MORI conducted the research programme in 2004. A separate booster survey was conducted amongst black and minority ethnic groups.

1. See www.mori.com/polls/2004/ost.html
   Hard copies of the report can be obtained from the Office of Science and Technology

Trust in Scientists

Q Now I will read you a list of different types of people. For each would you tell me if you generally trust them to tell the truth, or not?



Base: c.2,000 GB adults aged 15+ per wave

Source: MORI/BMA (1997 - 2005)

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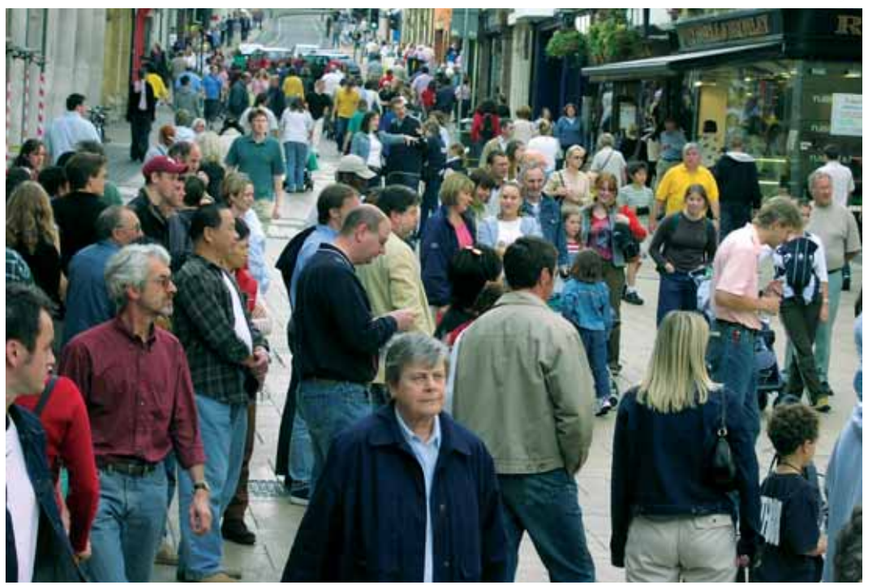

Understanding public attitudes will facilitate dialogue

Promote dialogue through understanding, urges Helen Haste

The BA welcomes the OST/MORI survey at a time when many organisations are exploring how best to develop effective communication and build constructive dialogue between scientists and the public.

The BA is at the forefront of this. As Roland Jackson spelt out in the March issue of *S&PA*, for dialogue to work we need to know what the public's concerns are; the survey tells us a lot about these.

The BA has published a review of recent work on science in society: *Connecting science*.[1] This identifies three research gaps:

- where do people prefer to gain their knowledge of science?
- what values, issues and anxieties are associated with scientific developments?
- how does dialogue work effectively?

The OST/MORI survey offers rich data on our first two questions, and evokes productive thoughts for the third. However, the survey primarily maps attitudes, and I argue that we now need to know what *underlies* these attitudes. Without understanding this in greater depth, we cannot construct effective dialogue.

Underlying concerns

A striking finding of the OST/MORI survey is that more than four out of five respondents want more consultation with scientists and with the government. We need to ask why. Between 12 and 20 per cent appear to be suspicious that things are going on which are not reported. One in seven – particularly among educated, broadsheet readers – reports that they have less trust in science than five years ago.

A substantial number of people are either cynical about whether the government or scientists will listen to their concerns, or think that consultation would be little more than a public relations exercise. To develop dialogue we must take account of these concerns.

Where should consultation take place? Although science centres and museums are popular information sources, only five per cent associate these venues with public debate and dialogue. Few appear to be aware of science festivals – only eight per cent have heard of the BA Festival of Science, though over half have heard of National Science Week. Both science centres and festivals are already working hard to be places for public dialogue about science; generating a higher profile for these activities would reap the benefits of what is already happening and go a long way to meet both public concerns.

'Consultation' is therefore a problematic concept and needs further investigation to find the most effective methods, and what the public really wants to engage with. Interactive discussion is the format that looks best, but given that television is the main source of information about science, collaboration with the media (including the Internet) to create transparent public discussion could do much.

Trust and Risk

Two other areas addressed by the survey raise questions. The first is trust, the second is risk.

Trust is multi-faceted. Public trust is a measure of a group's standing and credibility, and loss of trust must be worrying. However a high level of trust can also reflect an uncritical public which does not wish to think about issues outside its immediate concerns. But what does 'trust' actually *mean?* Is it about truth-telling, or is it about accountability and responsible decision-making?

The survey does make this distinction, but we need to know more about whether the lower trust in scientists who work for the government or industry, compared to those who work in universities, medical charities or environmental groups, applies to truth-telling or to responsible decision-making about the implications of their work. This seems to be crucial in relation to public concerns about both the consequences, and the ethical issues, around scientific developments. They have very different implications for engagement and dialogue.

The survey also shows how ambiguous is the concept of risk. It recognises that this is a major field for further research – as does the BA review. The data from both show that people are willing to tolerate quite high levels of 'risk' if the perceived benefits are also high – which suggests that a 'risk' cannot be viewed in isolation from its context. Also, people are much more sensitive to and concerned about risks that affect them directly than they are about more general risks to the environment, even if those risks are considerable. Both the principle of 'not in my backyard' and the principle of 'what do I really need to know?' apply; people will make an effort to find out scientific (especially medical) information when it is personally significant, but not otherwise.

An extended exploration of these issues is urgent for those promoting dialogue, so that what really matters to the public and to scientists can be productively explored.

1. L Whitmarsh, S Kean, C Russell, M Peacock and H Haste (2005). *Connecting science: what we know and what we don't know about science in society*
   www.the-ba.net/connectingscience

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Public engagements on GM and nanotechnology

Nick Pidgeon and Tee Rogers-Hayden weigh up the differences

We do not yet know how to achieve successful public engagement mechanisms for addressing controversial issues of science and technology. However, much can be learned through the evaluation of public engagement processes.

Here we contrast the different approaches and outcomes adopted by a downstream process – the *GM Nation?* public debate on agricultural biotechnology – and that much rarer breed, an upstream process: the Royal Society/Royal Academy of Engineering (RS/RAE) nanotechnologies inquiry held during 2004.

Downstream engagement is the norm, often only occurring as issues arise at the point of market entry. It is criticised for arriving too late to influence decisions. Upstream engagement involves consideration of a technology, and any potential social and ethical issues, before significant research and development decisions are made. By addressing issues at an early enough stage, key decisions can be influenced, while the polarization of opinion that surrounds many controversial downstream issues is likely to be avoided. That, at least, is the theory.

Downstream or upstream?

GM Nation? was an ambitious process which sought to provide genuine deliberation as well as an understanding of public views on agricultural biotechnology, before the UK government's commercialisation decision. On the face of it, *GM Nation?* was highly innovative, with over 600 open meetings attended by about 20,000 people, a website where people could gain information and express views, a questionnaire which attracted over 36,000 responses, and qualitative 'narrow-but-deep' research.

Its main conclusions were that widespread public concern exists about GM, alongside mistrust of government and industry, and little enthusiasm for early commercialisation.[1] Some commentators viewed *GM Nation?* as a success for its engagement with a large number of people about this complex science issue. However, there were significant methodological flaws in its design, so much so that it has equally been described as an expensive failure! Our own evaluation suggested that even well intentioned engagement can suffer difficulties if it comes too late in the development and controversy cycles.[2]

Nanotechnologies – the sciences of the very small – provides our contrasting case. Also commissioned by the UK government, in part in response to the worry that nanotechnologies might ultimately suffer the same fate as GM had, the year-long inquiry was conducted by an independent working-group on behalf of the RS/RAE.[3] The process was wide-ranging and innovative, and represented an important break with past practices of both organizations.

Perhaps most critically, the working-group membership included not just scientists and engineers, but a wide spectrum of other views: social science, ethics, consumer and environmental protection. Extensive evidence was also taken, in public, from regulators, business, scientists, NGOs and even science communicators. And research on the views of members of the public about nano-technologies was commissioned through a nationwide survey and two qualitative workshops.

In our own research evaluating the impacts of the nanotechnologies inquiry, we found most interviewees commended the quality of the RS/RAE report and its conclusions, as well as the processes used to reach them.

Setting objectives

A fundamental question is always: what is public engagement for? Objectives can range from gaining better information on people's views, promoting awareness about an issue, involving participants directly in a specific decision, through to sharing power with people. *GM Nation?* suffered from unclear and sometimes contradictory objectives, while the government (who had sponsored it) and the Steering Board (who were running it) seemed at times not to share the same objectives at all. It may well be that the deeply held and conflicting views about biotechnology made it particularly difficult to set clear objectives.

Intense conflict and polarization was not evident with nanotechnologies – making the setting of objectives more straightforward. However, the very upstream nature of nanotechnology presented a different dilemma. With such issues, uncertainty exists about what unanticipated scientific breakthroughs might occur, as well as the social or ethical concerns a future society might see in these. Hence, it is particularly difficult to specify what early dialogue should revolve around.

We would agree with James Wilsdon,[4] who suggests that upstream issues may need to address very different questions (what is a technology for? who benefits? whom do we trust?) from those traditionally approached downstream. If so, however, it may well be that upstream contexts will bring even greater potential for conflict over objectives, as civil society groups demand a greater say over the ethical and social trajectories mapped out by research and development decision-making, while governments and the commercial sector seek to preserve their own freedom to invest in projects which they view with the most promise. In all of this, science will find itself in an uncomfortable position for which it is scarcely prepared.

Getting the participation right

Any deliberative process has to decide whose views to include. *GM Nation?* has been heavily criticised for its failure to reflect true 'public opinion'. Those who attended the open meetings predominantly held strong positions on GM to start with, and this bias was reflected in both the questionnaire responses, and the media reporting of the debate, which overstated the strength of anti-GM feeling across Britain. While the organisers had anticipated this difficulty, they failed to sample a sufficient cross-section of uncommitted opinion to estimate the extent of any bias.[5]

The nanotechnology inquiry sought to overcome this problem by assessing public views using a representative survey and workshops – a better means of gauging attitudes. However, it faced another difficulty, in that general awareness of the technology is still extremely low, something likely to be the case with all upstream issues. This means there may be no solid 'public opinion' to gauge at all, and any views are extremely sensitive to the method by which they are elicited. While the quantitative survey found relatively positive views, the qualitative workshops were more mixed, with enthusiasm for benefits alongside concerns about long-term risks and control of nanotechnologies.

The role of knowledge and information

In the move away from old style public understanding of science, the pivotal role of scientific knowledge should not be overlooked. One can no more deliberate the societal implications of nanotechnology in the absence of information about the science, than one can resolve GM's ethical issues through the application of science alone. In all deliberative contexts, the provision of good quality information to participants will be critical.

Despite good intentions, the *GM Nation?* organisers failed to develop a balanced and properly contextualised set of materials that could be used by participants to deliberate. In the nanotechnologies workshops, by contrast, various scenarios were presented, with a scientist from the working group on hand to answer questions. However, the danger here is that deliberation can inadvertently be 'framed' by the presentation of information in a specific way; such as stressing the positions of perhaps only one, or a limited set of views.

Public engagement: what works well?

Looking ahead

The nanotechnologies inquiry was successful because it was assisted by experience, not merely because it occurred upstream. Equally *GM Nation?* did not suffer its difficulties solely because the debate came too late. Moving participation upstream is unlikely to resolve all of the known common problems with public engagement.

A generic difficulty is to ensure that outcomes are useful. If the outputs of dialogue lack impact upon the decisions that matter, this will lead to stakeholder cynicism and fatigue (if there is to be no influence over policy, why bother at all?). But influencing decisions also means engaging with the politics of the matter, and it may well be that the scientific community is not yet capable of meeting the challenges that this will set.

Equally, upstream deliberation will bring unanticipated new challenges of its own. For example, the involvement of the private sector will be essential, and yet this may prove problematic if engagement is perceived to pose a threat to technological innovation, or to commercial interest because intellectual property enters too early into the public domain.

To understand why any science and society dialogue is likely to achieve its objectives, then, we need to take account of a range of factors: not only who participates and under what circumstances, but also the surrounding political and social context, alongside technical features of the dialogue design itself.

Deliberation needs deliberate preparation. If public engagement is indeed to become a standard part of the science policy toolkit, we need to reflect properly upon what works well, when and why.

References

1. Public Debate Steering Board (2003). *GM Nation? The Findings of the Public Debate* London: Department of Trade and Industry
2. T Horlick-Jones et al (2004). *A Deliberative Future? An Independent Evaluation of the* GM Nation? *Public Debate about the Possible Commercialisation of Transgenic Crops* Norwich: Centre for Environmental Risk. This research was supported by the Leverhulme Trust.
3. Royal Society and Royal Academy of Engineering (2004). *Nanoscience and Nanotechologies: Opportunities and Uncertainties* London: RS/RAE
4. J Wilsdon (Dec 2004). Science is moving upstream. *S&PA*, p. 11
5. N.F.Pidgeon et al (2005). Using surveys in public participation processes for risk decision-making: the case of the 2003 British *GM Nation?* public debate *Risk Analysis*, 25, pp. 467-479.

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@ a glance...

We contrast the very different approaches and outcomes of the *GM Nation?* public debate and the Royal Society/Royal Academy of Engineering nanotechnologies inquiry

Comparing the downstream debate with the upstream inquiry gives pointers about how to achieve successful public engagement mechanisms

Upstream contexts will bring even greater potential for conflict over objectives, for which science is not prepared

Scientific information is crucial in every deliberative process but there is a danger that the way it is presented can bias it

Moving participation upstream is unlikely to resolve all of the known common problems with public engagement

Balancing science and security

Caitríona McLeish finds that the UK is improving bio-security without hindering the practice of science

Stricter rules for bio-security *Getty Images*

Although biological weapons are banned by international law, they are still described as a major threat to international security. In an attempt to halt the development of these weapons, governments round the world have taken steps to stop the misuse of biological sciences. Some of these measures are, themselves, affecting the way biological research is carried out.

Governments and scientists around the world have become increasingly anxious about the threat posed by biological weapons, particularly in the hands of terrorists or rogue states. July 2001 saw the collapse of negotiations on a compliance mechanism for the international treaty that outlaws biological weapons (the 1972 Biological Weapons Convention: BWC). Later in 2001 came 9/11 and the anthrax letters, and the discovery of evidence suggesting Al Qaeda was seeking a biological weapons potential. There followed suggestions that a scientific journal had published a blueprint that could conceivably enable terrorists to create human pathogens for release on the people of the United States, and declarations that Iraq still possessed its weapons of mass destruction capabilities.

These developments gave new urgency to efforts aimed at reducing the biological weapons threat and reinforced the need for governance mechanisms capable of coping with bio-crimes, bioterrorism and biological warfare.

Problem of dual use

Most of these new governance mechanisms aim to stop technologies necessary for biological weapons development being applied for illicit purposes. The problem, however, is that most of the technologies required to develop biological weapons also have legitimate uses. The same activities, materials, information and equipment used to produce such beneficial products as vaccines, could also be applied with little or no modification to the production of biological weapons. This characteristic, known as 'dual use', shapes the nature of the security problem: the biological weapons threat does not stem from weapons (because they are outlawed), but from the diffusion of economically beneficial dual use technologies, often owned and traded by non-state actors. As these spread, they also spread the necessary technologies and capabilities required to develop biological weapons.

Developing policy solutions is extremely difficult, as any policy needs to achieve a balance between suppressing negative applications to reduce the threat from biological weapons whilst supporting development and diffusion of the technologies for positive purposes.

The guiding principle in governing dual use biological technologies can be found in the BWC, which 153 countries have currently ratified and 16 others signed. The BWC is a timeless governance mechanism: the treaty prohibits the development, production, stockpiling, acquisition and retention of any microbial or other biological agents, or toxins, unless it is done for prophylactic, protective or other peaceful purposes. In other words, the BWC prohibits purposes, not things: it governs past, present and future technologies relevant to biological weapons.

As well as a requirement to pass the principles of the BWC into national law (so that their citizens are also forbidden to use, develop or produce biological weapons), states also employ a range of other dual use governance mechanisms, such as export controls, anti-terrorism legislation and biosecurity policies.

New measures

Since 2001, governments have introduced additional policies designed to frustrate the misuse of the biological sciences. In the US, for example, legislation such as the 2001 *Patriot Act* and the 2002 *Public Health Security and Bioterrorism Preparedness and Response Act*, and in the UK, the 2001 *Anti-Terrorism Crime and Security Act* and the secondary legislation to the 2002 *Export Control Act*, has been passed.

These new pieces of legislation build upon previous measures so that behaviour in and around the laboratory is now governed more than ever before. So, in both the US and UK, work with certain pathogens and toxins, known as 'Schedule 5 pathogens and toxins' in the UK and 'select agents' in the US, is now performed under strict rules. For example, scientists working with these pathogens and toxins in the US must now undergo background checks, including having their fingerprints screened by the FBI against criminal, immigration, terrorism, and national security databases.

But, given the dual use problem, what, if anything, can be said of the impacts that the increased attention to the biological weapons threat is having on the practice of science?

New impacts

One obvious new impact from the increased attention has been the sharp increase in US investment in biodefence research. Figures for US government civilian biodefence funding between financial year (FY) 2001 and FY2005 show an enormous increase, from $414 million to $7,642.6 million (£216 million to £3990 million). Within that, the National Institutes for Health has seen its funding for biodefence increase from $53 million in FY2001 to a requested $1.8 billion (£28 million to £940 million) for FY2006.

Whilst this funding means that methods to counteract the biological threat are researched and developed, a letter published in March 2005 and signed by over 750 scientists, suggests that this prioritisation has been negatively affecting US science, causing a crisis in NIH-supported basic microbiological research.[1]

For those who do work with select agents in the US, a basic reported cost has been the increased amount of time now spent documenting compliance with these new laws. It has been argued that this increase in paperwork, as well as concerns over legal liability and loss of privacy, might create disincentives for research on select pathogens.

Anecdotal evidence suggests that such disincentives are already being experienced: researchers at Stanford, for example, chose to stop research on select agents, believing that the 'administrative and security burdens of the select agent rules outweighed the scientific need to maintain stocks on campus.'[2] The same author also expresses concerns that the costs of upgrading laboratory facilities to comply with the select agent rules may cause 'smaller universities, without substantial financial resources, [to be] "locked out" by regulations.'

Recent research performed at the University of Hamburg has produced evidence suggesting that these new US select agent rules are affecting the practice of science outside the US borders. The suggestion is that these new measures are having 'a direct negative effect on microbiological research in Germany.'[3] From results provided by 67 academic, medical and veterinary institutions, the researchers say that 47 commented on changes in cooperation with US partners since 2001, with 13 of them recording measurable impacts, such as delays in some research projects or the need to switch to different organisms or technologies. Two microbiologists reported that projects had to be stopped, or could not begin, because of reduced cooperation with US partners.

UK experience

My colleague and I have carried out a pilot study whose results suggest that, so far, UK biosecurity regulations are having a less disruptive impact on the practice of science. Indeed, 79 per cent of our sample judged the current balance between scientific freedom and security considerations to be satisfactory.[4] Although the research was performed only three years since implementation of the *Anti-Terrorism Crime and Security Act* (ATCSA) began, the results from our pilot project seem to suggest that UK policymakers may have found a formula which improves bio-security without adversely affecting the practice of science.

In our study, Dr Paul Nightingale and I systematically gathered information from a sample of UK scientists, funders of science and biosafety and security officials. We found that 41 per cent of them reported no 'major complications and setbacks' to their practice of science since the introduction of the new national controls. However, others did report experiencing 'major complications and setbacks', and their main reported difficulty was obtaining pathogens and toxins. When asked, these members of the sample believed the difficulties were as much the result of changes in US biosecurity controls as changes in UK law, lending support to findings from Hamburg[3] that national biosecurity regulations have international implications.

Our results also showed that four research projects have had to be abandoned since 2001 as a direct result of the increased national and international attention to the biological weapons/bioterrorism problem.

Governance mechanisms other than those found in the ATCSA have been introduced into UK law since 2001, but thus far no known assessment has been made as to whether they are having impacts on the practice of UK science. Such knowledge, regularly and systematically updated, is utterly essential if we are to ensure that the implementation of current, and design of any future, biosecurity measures do not impose unreasonable and unacceptable costs on the UK science base.

References

1. S Altman *et al* (2005). An open letter to Elias Zerhouni, *Science*, 307, 5714, p.1409
2. A Chamberlain (2004). Science and security in the post-9/11 environment: Select agent rules http://www.aaas.org/spp/post911/agents/
3. J van Aken J *et al* (2004). Biosecurity must be internationally supervised, *Nature*, 431, 7004, p.17
4. CA McLeish and P Nightingale (2005). The Impact of Dual Use Controls on UK Science: Results from a pilot study, SEWP no 132, University of Sussex: SPRU. This research was funded by the ESRC.

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@ a glance...

Since 2001, governments have introduced additional legislation designed to frustrate the development of biological weapons through the misuse of the biological sciences

In both the US and UK, work with certain pathogens and toxins is now performed under strict rules

One effect of the new measures has been a sharp increase in US investment in biodefence research

The increased time Americans now spend documenting compliance with the new laws may discourage research on select pathogens

The new US rules may be having a direct negative effect on microbiological research in Germany

So far, UK biosecurity regulations enacted since 2001 are having a less negative impact on the practice of UK science

We need more assessments examining whether laws, designed to reduce the biological weapons threat, are affecting the practice of science in the UK

Will the education White Paper be good for science?

The Secretary of State for Education, Ruth Kelly, published her White Paper, *14-19 Education and Skills*, in February 2005.[1] It sets out the government's response to the 2004 report of Sir Mike Tomlinson's Working Group, *14-19 Curriculum and Qualifications Reform*.[2] Terence Kealey, Derek Bell and John Holman evaluate the White Paper's effect on science education

Unpopular but correct

Terence Kealey salutes Ruth Kelly

Ruth Kelly's White Paper has been poorly received but it is a good document.

Kelly's big decision was to reject Sir Mike Tomlinson's proposal that GCSEs and A levels be merged with the many different vocational qualifications into one overarching umbrella of diplomas and baccalaureates.

The teachers' organisations, most Labour MPs, and the Tory and Liberal Democratic front benchers all supported Tomlinson, which makes Kelly's decision all the braver. Yet she was correct.

The motive behind fusing the exams is noble but it is not based on academic concerns, it is based on perceptions of social esteem. Because vocational qualifications are less regarded than academic ones, people hope that fusing the two would elide the class-based distinctions of British life. But it won't. A qualification in maths will always carry a different connotation from one in plumbing, however uniform the certificates.

Changing qualifications, moreover, is always damaging because exams need time to establish themselves. It took time for the new vocational qualifications to acquire the credibility of the earlier City and Guilds exams; and the O levels and CSEs were fused for social inclusion but the GCSEs' credibility is probably lower than that the O levels and CSEs would have enjoyed had they been left alone. And German plumbers are trained in vocational training colleges or *Berufsschulen* that, because they are so established, and because the Master Craftsman diploma is so established, enjoy real credibility.

Exams exist not to sponsor social harmony but to provide people with credible qualifications. If society values mathematicians more than plumbers, no umbrella will elide that. But if the exams are so modularised and homogenised (and even this White Paper will foster more of that) such that neither potential mathematicians nor potential plumbers possess credible qualifications, then everyone suffers.

Target age group: 14 – 19 *UNESCO, Mario Borg*

Compulsion and dumbing-down

This White Paper has faults. We must retain the rigour of science teaching in schools, but that is endangered by the compulsory science teaching that even this White Paper would extend. To push more pupils into studying science longer, the government has provided a dumbed-down Double Science GCSE by which physics, chemistry and biology are taught during the time provided for only two GCSEs.

But the introduction of Double Science has if anything accelerated the fall in the numbers of pupils studying science at A level because, by blurring the teaching of the sciences' separate disciplines, it has alienated potential scientists. Compulsion and dumbing-down rarely work, and we should provide for the minority of pupils who want to do science in depth.

This White Paper has protected exams, but natural specialists should be allowed to specialise. Baccalaureates should not be obligatory.

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Encouraging but imperfect

Two cheers from Derek Bell

After all the build up, the government's response to the Tomlinson Report, set out in the 14-19 *Education and Skills* White Paper, seems to have been an anticlimax for many people.

For some the feeling is certainly one of an opportunity missed, while for others it appears to risk devaluing vocational qualifications even more than they are at present. Yet it is not possible to dismiss it out of hand. There is much that we can get our teeth into and work to influence the way in which the words are translated into practice.

From the perspective of science education there are several things that we would very much welcome – hence the two cheers.

Throughout the document there are strong statements about the position and role of science in the curriculum. For example, 'we continue to put science at the heart of education' (para 3.16), 'every young person will have a statutory entitlement to science study leading to two GCSEs' (para 5.3) and 'Science will remain compulsory at KS4 and it remains our firm expectation that at least 80 per cent of students should do at least two science GCSEs' (para 5.14).

There is also an acknowledgement of previous collaboration between government and the science community and a commitment to continue this as part of the revision of Key Stage 3 which is not expected to reduce the amount of time young people spend studying science in that key stage (para 4.15). Thus the place of science for students 11-16 is underlined and it is the intention to ensure *that the number of young people taking science post-16 increases in line with the aspirations set out in the government's '10 Year Investment Framework for Science and Innovation'* (para 8.5).

The downside

So why not three cheers for science education in the White Paper? Partly because of a possible overemphasis on the students, particularly post-16, being prepared for careers in science, engineering and technology (SET). It would, for example, have been good to see a reference to making appropriate post-16 science studies available for students who may not wish to embark on further SET-related studies or careers, but who might wish to extend their appreciation of science as a citizen or for interest. Partly also because of the uncertainty resulting from such a document, and how the intentions and expectations might be realised in practice. Without due vigilance, some of the proposed reforms could result in unintended consequences that make the curriculum more sterile than it is now.

We, as members of the science and science education communities, however, have a responsibility for ensuring this does not happen and that by working together we support teachers and find ways of helping them engage young people in productive and stimulating learning opportunities in science.

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A lot to welcome

John Holman swallows his disappointment

It's obvious from the White Paper that the full Tomlinson package is dead and buried, so let's move on.

This White Paper is about the curriculum and the assessment that accompanies it. We must accept that England has a regime that bites hard, with both a rigorously defined curriculum (at least to the age of 16) and high-stakes assessment. Changing these arrangements can have a big effect, so those who control the levers need to handle them with care. Even so, let's not forget that even the wisest curriculum reforms will be ineffective without measures to secure a high-quality teaching force.

Leaving aside any disappointment that the Tomlinson recommendation for a system of diplomas has been dropped, it is good to see a strong commitment to improving the quality of teachers and lecturers. It is also good to see a commitment not only to improving science results at age 16, but also to increasing participation post-16. The key to improving post-16 participation lies, as ever, with the teachers of science, and we welcome the commitment of the Department for Education and Skills to the professional development of science teachers – not least through the Science Learning Centres.

Lord May's call for scientific reasoning to be included as the 'fourth R' has been unheeded

One disappointment is the omission of science from the core of the proposed general GCSE diploma. Few would disagree with English and Maths as the heart of the Diploma, but Lord May's call for scientific reasoning to be included as the 'fourth R' has been unheeded.

There is consolation in the expectation that 80 per cent of students should do at least two science GCSEs, and the intention to keep a close eye on these levels, but clearly the world is not yet ready for the boldest step, which would be to make scientific reasoning compulsory post-16 as well. With the pace of scientific development in this century likely to be even more dizzy than in the last, there is a strong case for every citizen to continue some kind of scientific study until they move to employment or higher education.

Reform 11-14

Perhaps the most welcome signal in the White Paper concerns the phase that lies *before* 14-19, with the acknowledgement that the 11-14 curriculum, and its 'long shopping list of facts to be learnt' needs reform. If this builds on the work already done on the 14-16 curriculum, to produce a programme of study which focuses on scientific literacy, we should end up with something much more appropriate to this vital age range, in which key attitudes towards science are often formed. Even more welcome is the intention to involve the science community in this process. Members of that community should start thinking now about how we can take advantage of this open door, so the profession can play a full part in this next phase of reform.

References

1. See www.dfes.gov.uk/publications/14-19educationandskills
2 See www.dfes.gov.uk/14-19/documents/Final%20Report.pdf

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Science in Africa

The Commission for Africa's report, *Our Common Future*,[1] was launched by Prime Minister Tony Blair in March, and will be discussed by the G8 countries in July. William Kalema, Mohamed Hassan and Judi Wangalwa Wakhungu discuss what impact the report could have on the continent's science

Centres of excellence and higher education

Strengthened capacity is crucial, says William Kalema

Living standards in Africa are declining in the face of prosperity in Europe, North America, Latin America, and Asia.

It was against this background that Tony Blair established the Commission for Africa in February, 2004. Africa, it was recognised, was unlikely to meet the Millennium Development Goals for basic human welfare by the target date of 2015.

Our report argues that a stronger and more prosperous Africa will require the continent to be integrated into the global knowledge-based economy. Strengthening Africa's capacity to innovate – to create, adapt, adopt and disseminate new products and processes – is critical.

Scientific and technological capacity is concentrated in only a few regions, like South Africa, with the rest of the continent facing a dearth of skilled personnel and resources. Economic crises, political instability, conflict and a lack of investment in higher education have resulted in weak technological development and innovation.

Stronger science, engineering and technology (SET) capacity for Africa is therefore not a luxury, but a necessity.

Recommendations

We recommend key actions to strengthen Africa's science, engineering and technology capacity. Specifically, that the international community should commit up to US$3 billion (£1,600 million) over 10 years to develop centres of excellence in science and technology, including Africa's institutes of technology.

We recommend that the international community should commit US$500 million (£260 million) per annum over 10 years to revitalise Africa's institutions of higher education, which are the foundations of a flourishing SET base, and we have endorsed a joint initiative by the Association of African Universities (AAU) and the Association of Commonwealth Universities (ACU) to address the challenges to Africa's higher education system.

We also recommend that donors develop incentives for research and development in health that meet Africa's needs, and increase funding to African-led research.

Potential of science

SET and innovation have huge potential, not only to accelerate economic growth, but to provide better healthcare, improve policy-making, strengthen public administration, and address new challenges of urbanization and climate change. If Africa is to unlock this potential, investment in capacity is needed, including in medicine, agriculture, environmental, and the social as well as the 'hard' sciences.

However, the SET gap between Africa and the rest of the world is widening, threatening to perpetuate its cycle of poverty.

Science has huge potential to reduce poverty. It can accelerate economic growth by, for example, improving agricultural productivity, and stimulating innovation among small and medium enterprises. Technological breakthroughs and the better application of science and technology can eradicate or reduce the diseases that afflict the poor, increase life expectancy and nutrition levels and improve service delivery in healthcare.

Science and technology can also address the challenges of water, energy, sanitation, urbanization and climate change, all of which will impact on the poor.

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Oceanography in Mauritius: Africa addressing its own problems ***UNESCO, J. Foy***

Fitting the continent's own agenda

Africa must lead, argues Mohamed Hassan

Our Common Future **contains two critical science- and technology-related recommendations that, if successfully implemented, could have a dramatic impact on the future of Africa.**

First, the report makes a strong case for strengthening universities across Africa. Second and interrelatedly, the report calls for the creation of regional centres of excellence capable of building scientific and technological capacities across national borders.

Many of the report's recommendations have been made before. The Academy of Sciences for the Developing World (TWAS), for example, has been advocating the creation of centres of excellence in science and technology since its inception more than 20 years ago. And blueprints to help Africa escape from the debilitating grip of poverty have been a part of the developed world's 'rhetorical' aid agenda for more than half a century, if not longer.

Something new

What is new is that Africa itself is beginning to address its own problems in meaningful and effective ways, turning to science and technology as essential elements in this campaign.

That raises hope that whatever assistance is ultimately offered by G8 countries, following the G8 summit scheduled to take place in Scotland this July, will fit into Africa's own agenda for science-based economic growth.

With nearly half of the continent's population living in extreme poverty (earning less than US$1 a day) and a third of the population remaining undernourished, Africa remains the world's most troubled continent. But the progress that has been made in integrating science into the larger agenda for sustainable development – by, for example, the African Union and the governments of Botswana, Nigeria, Senegal, South Africa, and Uganda – indicates that at least some countries in the continent now have an opportunity to make headway on alleviating the deprivation that has afflicted Africa for far too long.

Following Africa's agenda

The action plan that eventually takes shape from the Commission's report should seek to advance the science-based development agenda that Africa has set for itself. That means promoting excellence in science both at an individual and institutional level. And it means aiding initiatives that nurture pan-African cooperation so that the continent's more scientifically proficient countries can help their less scientifically proficient neighbours.

The way forward will not be easy but it must be led by Africa itself. The help the continent receives from friends is indeed welcome but self-help, both on a national and regional level, will ultimately be more important. That, in the final analysis, is reason enough to build scientific capacity in the region.

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Linking institutions

The ball is in our court, agrees Judi Wangalwa Wakhungu

On the whole this report is opportune because it addresses higher education, science and technology for development, and regional cooperation.

These are three important sets of institutions that are linked in terms of development goals, on a practical level, and yet still treated as mutually exclusive, from a policy perspective in Africa.

In the past, national development strategies have treated these issues in a piecemeal manner, rather than addressing them simultaneously. The ball is now in our court to design holistic regional proposals in response to the Commission's overture.

Understanding the problem

From a twenty-first century point of view, many higher education institutions in Africa are in the Bronze Age. Some, for all practical purposes, are obsolete. These conditions have contributed to alarming levels of brain drain, lack of interest in science, mathematics, and engineering, and they also attest to the influx of foreign universities establishing campuses throughout Africa in order to fill this gap.

Because the future is bleak, the ideas proposed by the Commission have provided African governments with an opportunity to overhaul their higher education and training policies. Ideally, such an exercise cannot be conducted in the usual perfunctory manner. It requires making hard decisions that include rehabilitating some institutions, overhauling others, and shutting down many more in line with the region's research and development strategy.

Regional cooperation

While national research centres are strategic and have a role to play, the current global trends behoove African countries to invest in regional cooperation. In this regard, the Blair Commission complements the efforts of the New Partnership for Africa's Development, which highlights establishing centres of excellence for science and technology research and training.

But there are concerns that this may be interpreted as creating new institutions, rather than establishing these centres in existing institutions. Regional scientific institutions are not new in Africa. For example, in East Africa, the Universities of Daresalaam, Makerere, and Nairobi were established as regional centres of excellence, and these worthy traditions ought to be supported and enhanced.

The Commission presents the African milieu with many challenges. The most fundamental of these is learning to think holistically and working cooperatively. We can no longer operate in our business-as-usual paradigm that separates development goals, science and technology research and development, and higher education into turf entities each of which has to carve up a piece of a small pie. Rather, we must think more critically about the strategic skills with which we imbue our graduates and how these skills apply to our national/regional research and, ultimately, development goals.

1. See www.number-10.gov.uk/output/Page7310.asp

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Sustainable development: hope or hype?

The government has released its sustainable development strategy, *Securing the Future*,[1] which emphasises community engagement as a way of influencing people's behaviour. Karen Lucas and Jim Haywood comment on how effective this strategy is likely to be, and Howard Dalton looks forward to Defra's collection of the evidence which will underpin its development

Sustainable development is politically impossible

Karen Lucas bids farewell to the planet

The UK government has released its new sustainable development strategy. The aim is to strike a better balance between economic prosperity, social equity and environmental protection and enhancement.

It recommends a fundamental step-change in the behaviour and lifestyle choices of governments, businesses, communities and individuals, if we are to address climate change, reduce energy use and waste and protect our natural resources. Professor Tim Jackson at the University of Surrey has advised the government that the best approach to achieve this is direct negotiation at the community level.

To this end, the strategy announces a new community action programme to inspire and support people to pursue more sustainable lifestyles. The main focus of the programme is awareness raising and improved community access to funding for sustainable development projects.

However, as the document rightly identifies, achieving success will involve tackling numerous highly complex factors relating not only to people's current behaviour, but also their aspirations for the future.

Sustainable transport?

Take transport, for example. Policy-makers agree that one of their greatest challenges is continuing to cater for the public's preference for the car, whilst reducing its impact on people's health, the local environment and climate change. The government has both international and domestic commitment to reduce carbon emissions: however, in 2002, the transport sector (excluding international aviation) accounted for 24 per cent of greenhouse gas emissions, and it is predicted that this will grow by nine per cent between 2000 and 2010.

UK transport policies contribute to social exclusion. Whilst bringing huge benefits to most of the population, increased car use has eroded opportunity and choice for the third of households in the country who do not own a car. Years of under-spending have left the public transport network in crisis, to the point where it is generally no longer a viable alternative to the car. More traffic means less safe and more polluted local environments, so that many people are afraid to walk and cycle.

However, the last time the government tried to do something to control people's car use through the fuel tax escalator, there were widespread protests and public dissent. Similarly, when put to public vote in Edinburgh, the majority of people (even those in non-car owning households) were against the proposed city centre congestion-charging scheme.

Government has reached an impasse. The policy rhetoric is commendable, but there is probably not enough political will to resist the opposition its enactment wil provoke. Bye bye, planet!

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A tough call for business

Jim Haywood lays out the problems

We shouldn't be surprised if the call to arms to support sustainable development is not unequivocally or unquestioningly heeded by the entire business community.

Driven by short-term gain and rapid return on capital expenditure, a number of business leaders may regard some of the longer-term investment associated with sustainable development as unnecessary and lacking the sort of commercial savvy needed to keep shareholders satisfied.

The paradox is that sustainable development is about acting now to secure the future. For issues such as climate change, whilst there may be immediate cost savings through energy efficiency, it may take much longer to realise all the benefits of reduced risk through using cleaner energy sources. Business may be asked to make decisions based on sustainability scenarios which might appear uncertain. For many, this will be a tough call.

And yet there seems to be increasingly compelling evidence that business does need to make changes, to adopt new practices, to adapt old ones. In short, to shift from a position of 'business as usual' towards doing business more cleverly and more sustainably.

Climate change

Of the four key priority issues identified in the UK sustainable development strategy, climate change has probably had the greatest popular exposure. There is general scientific consensus and concern about the rate of increase of global warming. Warmer, wetter winters, hotter, drier summers and more severe extreme weather will be the norm.

However, the results of Business in the Community's latest Environmental Index suggest that, whilst most businesses are now actively managing their carbon inventory, less than one in ten have assessed the business risk (and, presumably, the opportunities) associated with climate change. Mitigating the effects of climate change has to remain a clear priority for all businesses worldwide. However, too few businesses seem to be thinking also about adapting to mid- and long-term changes which – in their own way – contribute to sustainability. This longer-term thinking will need to be picked up if the strategy is to be delivered at grass roots level.

The sustainable development strategy is a clarion call for collective, collaborative action, yet it does not pull any punches in describing the government's own responsibilities for leadership. Delivering it will require many behavioural changes and 'bigger picture' thinking from business, government and other stakeholders alike. Investors may have to accept longer pay-back periods for investment and capital expenditure. The ability to adopt new thinking and adapt old practices is likely to be a critical skill-set for business.

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Community recycling: action on the ground

Knowledge will underpin policy

Howard Dalton charts the way ahead

Defra is the department for the essentials of life. At the heart of this lies the concept of sustainable development, as defined in the recently published UK government sustainable development strategy, *Securing the Future*.

For this to be successful, we need to engage with governments, agencies, businesses, the community and voluntary sector and the public at local, regional, national and global levels, not least to continue to identify and research new challenges we will face in the long-term both in the UK and globally, and new opportunities to act sustainably. This will help all of us to ensure that we can apply one of the key guiding principles of sustainable development – using sound science responsibly.

Evidence and innovation

Over the past six months, Defra has been working to map out in detail what knowledge (including from natural and social sciences, economics and engineering) we need to put sustainable development into practice. This project, which is being informed by consultation on our report *Evidence and Innovation: Defra's needs from the sciences over the next 10 years*[2] is currently being developed internally, prior to external engagement later in the summer.

Defra spends well over £300m a year on science and other forms of knowledge development, but we are already seeing that further work will have to address areas such as:

- Developing sustainable consumption and production. Under this broad programme we need to develop our understanding of the environmental limits and life cycle impacts of goods and services, as well as how to enable behaviour change. We need to understand how to regulate to achieve environmental outcomes whilst maintaining competitiveness. We also need to work with businesses and others to promote innovation for improved resource efficiency.
- Strengthening our understanding of how to tackle climate change and energy sustainability.
- Improving our ability to manage impacts on natural resources, for example through developing a whole ecosystems approach.

Our new strategy for evidence and innovation will be a major catalyst for better coordinated action to build the evidence base and support innovation to deliver the goals of the sustainable development strategy.

During this summer, we will launch consultation on our new evidence and innovation strategy, to gain additional perspectives and to promote more joined up delivery of our public policy needs for evidence and innovation. We hope to work with the Sustainable Development Commission and the Sustainable Development Research Network, both of which have an important role to play in advising government on how sustainable development can be put into practice, as well as a wide range of other organisations and stakeholders, as we work to turn the sustainable development goals into reality.

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1. HM government (2005). *Securing the Future: delivering the UK sustainable development strategy* Cm 6467 www.sustainable-development.gov.uk/publications/uk-strategy/uk-strategy-2005.htm
2. See www.defra.gov.uk/science/forwardlook

Few plaudits for nanotechnology response

Last July, the Royal Society and Royal Academy of Engineering published a report on nanotechnologies.[1] For Ann Dowling, Jim Thomas and Richard Jones, the government's response[2] was an anticlimax

The government had a chance to lead...

...but missed it, says Richard Jones

The government-commissioned report on nanotechnologies that the Royal Society and Royal Academy of Engineering delivered last summer surprised many observers.

Rather than the anodyne document that cynics expected, the report offered a penetrating analysis of some potential problems that might arise in the commercialization of nanotechnologies, and made a number of rather specific recommendations. This gave the government an opportunity to put the UK in the lead in establishing a sensible regulatory framework for the development of nanotechnology in a way that maintains public confidence.

The government, in its response to the Royal Society report, has largely missed that opportunity. This has caused some disappointment, not just from nanoscientists and environmental groups, but also from pro-business voices. It was telling that the only coverage of the government's response from the mainstream press was in the *Financial Times;* good regulation in potentially controversial technology areas can be a source of competitive advantage.

Of course, the government's response expresses many perfectly fine sentiments about the need to coordinate research, to engage with the public and to develop an appropriate regulatory framework. But, in response to some rather specific recommendations, there was very little in the way of actual action.

Research agenda rejected

The report recommended the establishment of two dedicated research centres, one for the study of potential nanoparticle toxicity and the behaviour of nanoparticles in the environment, and one to look at more general social and ethical issues. The government has rejected both recommendations. Toxicological and environmental research will be commissioned by a Research Coordination Group, comprising representatives from Research Councils and government departments. What's wrong with this isn't just that no new money is on offer; it is that without a strong focus there is a danger that research capacity won't materialize in what is perceived by many to be rather an unfashionable branch of science.

On social and ethical issues, the government simply makes a lukewarm general commitment to 'delivering the science and society agenda'. It is clear that the government is content that this be left to the Research Councils to sort out, but there's a strong steer that the research should be geared to providing practical guidance on policy making and regulation. We can only hope that the Research Councils will exert their operational independence a little and fund some research on some more interesting, and in the long term more significant, broader issues.

The UK government had a chance to lead the world in introducing sensible regulation and responsible dialogue about nanotechnology, but it has not taken it. For the cost of a few million it could have defused the nanoparticle toxicity issue, but it has chosen to let it slide on, obscuring the many more interesting and serious issues that will arise as this technology develops.

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References

1. See www.nanotec.org.uk/finalReport.htm
2. See www.ost.gov.uk/policy/issues/nanotech_final.pdf

Thermal baths at the German spa town of Wörishofen. The tiles are fixed with mortar using materials at nanoscale structures, to give particularly powerful adhesion *Degussa*

Short on detail

Ann Dowling is disappointed

On the regulation front, the government's response to the Royal Society and Royal Academy of Engineering's report on nano-technologies shows that it is taking the implications of this emerging science seriously.

The government accepts, for example, that safety testing on the basis of a larger form of a chemical cannot be used to infer the safety of its nanoparticulate form. It also recognises that we must urgently fill in the knowledge gaps about the toxicity and exposure pathways for nanoparticles and nanotubes, and to develop the instruments to monitor exposure in the workplace and environment.

However, while we believe that an interdisciplinary research centre is the most effective way to carry out the research which is so necessary to underpin appropriate regulations, the government has instead signalled that it will create a Research Coordination Group. This will be chaired by Defra, and funded from existing departmental budgets rather than being allocated any new money. We will not see the details of the research programme until autumn of this year.

And many of the government's responses to our recommendations, while agreeing in principle, are short on the detail of what, how or when action will be taken, or how much money will be available.

For example, it is good news that the government has committed to a public dialogue on nanotechnologies which will inform both the direction of research and development and progress on such regulation as is necessary. Again, we will have to wait until later in the year for further details about how this will be delivered. We are particularly keen to see a commitment to work with other stakeholders to develop and deliver a public dialogue programme.

Leadership needed

Social and ethical issues could play a vital role in determining the future of some of these technologies, and it is therefore important that all scientists and engineers engaged in these fields should consider the wider implications of their work. We are therefore disappointed in the government's response to our recommendation that ethical and social implications of advanced technologies, such as nanotechnologies, should form part of the formal training of all research students and staff working in these areas. Rather than providing important guidance and leadership, the government appears to be leaving it up to the research community and individual universities to deliver in this sensitive area.

In commissioning the study by the Royal Society and Royal Academy of Engineering, the UK government has shown international leadership on the responsible development of nanotechnologies. However, in failing to provide more concrete details of how it will take forward some areas, the government has not completely allayed concerns that these issues could fall off the political agenda. Clearly it is up to the government to prove otherwise.

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Close our eyes and hope for the best

Jim Thomas isn't impressed

I've read the reports. I've run through the rhetoric. As far as I can see, UK nanotech policy remains 'carry on regardless' – a depressing, reckless and ill-judged stance.

Depressing, because the Whitehall technocrats have reverted back to type – instinctively trying to close down meaningful discussion on governance of a new technology rather than open it up. Ann Dowling's RS/RAE committee may have erred in confining their recommendations to strictly 'scientific' matters, such as metrology or toxicology, but at least they acknowledged that real societal problems could stem from the patterns of ownership and control of nanotechnologies.

The emergence of a nano-divide, nano-patenting, nano-enhancement of the human body and nano-surveillance, all figured in the RS/RAE report. The UK government has unhappily ignored all of this. Despite a proposed review of health and environment regulations, there is no thought to review monopoly law, corporate governance, civil liberties and so on. An as yet unexplained 'public debate' will be carried out by Sciencewise grantees – presumably at a safe arm's length from the decision-making process. Yawn.

Why this failure to address societal impacts? Lord Sainsbury's response is perhaps the most telling. According to the minister: 'We don't know what the social implications will be, therefore I see little value in considering them.' Drawing a comparison with information technology, he said that in 1947 we would have severely underestimated how transformative computing would be. 'We don't even know a half or a quarter of what [nanotech] applications will be,' he said. His message was clear: we are just going to have to close our eyes, hope for the best and see where this next technology wave takes us. It's a breathtakingly reckless attitude from the most senior figure in British technology policy.

Peril of ignoring the politics

History suggests that when disruptive technologies hit societies, the rich and powerful (like Sainsbury himself) harness the wave to their advantage but the poor and the marginalised are left vulnerable, caught in the turbulence of changes beyond their control.

Reckless or maybe naïve, Sainsbury's unbridled techno-optimism symbolises a widespread political blindness to the politics of new technologies. Nanotech policy is infected by a simplistic assumption that new technologies are a societal good unto themselves (like the free market or economic growth).

I suspect that the government, lost in this dogmatic technophilia, has made a significant error. The dilly dally and delay of internal reviews and underfunded research means that hundreds of untested nanoparticle products will enter the market in the next three or four years in advance of regulation. The government refuses to put a moratorium on these, despite official recognition of nanotoxicity problems.

This is untenable and liable to spark public anger. If so, stand back – a much more explosive debate about how government handles and mishandles the introduction of new technologies may be about to blow.

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Female brains to the rescue!

Science needs them, argues Kathy Sykes

Disadvantaged: science, not women

The male brain is better suited to science. This explains why there are few women working in science and maths at top universities.

At least, that's what Harvard's President, Larry Summers, is claimed to have said at a private conference on the position of women and ethnic minorities in science and engineering. His comments provoked outrage: women stormed from the room, students waved placards, a heated international debate ensued, and a threatening cloud hovered over his job.

I agree with him – partly. Men's and women's brains seem different. And men largely *do* fare better in science. But I think that Larry Summers has missed the point. He's talking about science as it currently is, not as it should be.

It's hardly a surprise that a scientific establishment that's led and managed mostly by men should value and reward the more typically male skills. But this leads to a limited definition of science that is by now well out of date. I'd argue that science will get into ever-greater trouble unless it manages to involve, reward and harness more 'female' skills.

The problem is with science, not with women. If anyone's brains are at fault, it's the narrow-minded ones – too often at the helm of science – not valuing people who think differently from them. Brains, perhaps, like the one belonging to Larry Summers.

Brain sex differences

Male brains are slightly larger. Brain scans show women tend to have more neural connections between the left and right sides of the brain. Boys tend to do better in spatial tasks, girls at social tasks and learning to read earlier. Men seem to be better at separating cognitive and emotional issues.

Simon Baron Cohen argues[1] that male-type brains tend to understand and build systems, while female-type brains are better at empathising and communicating. He suggests that autism and Asperger's Syndrome are examples of the most extreme form of male brain.

I accept that better spatial skills and being able to focus on a problem, without letting emotional issues, or other humans, distract you, can be helpful. So a more 'male' brain (whether actually a man or woman) might be an advantage at times in science.

But aren't some of the big issues in science due to its very 'maleness'? Or rather, its inability to encompass 'female' strengths. More 'female' thinking – better communication, empathy and collaboration – could really help science, right now.

Science needs female skills

Better communication and collaboration could help to move research out of silos and further multidisciplinary work, which governments and funders of science all recognise is key if science is to tackle climate change, aging and growing populations. Currently the 'silo' mentally makes it hard for experts to stray outside their fields. If women tend to be better at social skills and collaboration – bring them in.

Better collaboration and less aggression might also mean less time wasted in the 'boxing ring' and more energy available for collaboration and teamwork, which would surely make for more effective science. Science at times feels hugely competitive. Of course, scientists must be able to discard theories when they're shown not to work. But pointing out a flaw in a theory should be about helping someone to think clearly; it too often seems more like wielding an ego.

Women can have big egos, and be competitive and arrogant. But I've met many women who have decided to leave science because they simply want to work in an atmosphere that feels more constructive. If we could create more 'female' science, we'd have a working environment where women would be more likely to want to take part. This should set up a positive feedback loop that not would only change the culture but also encourage more women into science.

Public mistrust

A greater ability to empathise, listen and get to grips with others' perspectives should help scientists have more constructive interactions with the public and media about controversial science. If scientists keep entering public discussions without being prepared to listen to others' perspectives, and continue to argue in combative ways to 'win', we risk *increasing* public mistrust. We need more scientists who listen better, understand other perspectives and use their social skills to have conversations, not fights.

So, Larry and any others who appoint people to top positions: think about valuing female qualities, whether in men or women. They could help break down the silo mentality, nurture multi-disciplinary research, communicate with and listen to the public and help to recruit people from a wider range of backgrounds. And they could even make science a more fun place to be.

1. Simon Baron Cohen (2003). *The Essential Difference: The Truth about the Male and Female Brain* New York: Perseus Publishing

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Controlling science

Ian Lloyd laments the lack of dissent

Review of Don Braben's book, *Pioneering Research* (London: John Wiley & Sons, 2004)

Few subjects have a greater relevance to our modern societies than the future of science and whether, how and by whom it should be controlled. In this profound and provocative volume, Braben presents the arguments for and against various systems.

The essence of Braben's case, which is a masterly survey of the science that has had the most dramatic and far-reaching effects on humanity, is that the one factor which virtually all these examples have in common is dissent. But such is the scale and significance of the modern scientific establishment that, in Braben's words, 'dissent is being stifled by bureaucracy, much of it well-intentioned and strongly defended by the advocates of peer review.' This procedure, he argues 'is inimical to new science'.

Even authoritative defenders of peer review are aware of this danger, for Lord May argued in his 2002 Presidential Address to the Royal Society that 'dissenting opinion should be sought and considered' and that 'uncertainties in science should be openly acknowledged.' He quoted with approval the opinion of Max Perutz, that 'younger colleagues should have their heads, unencumbered by bureaucracy or hierarchy.'

This opinion is strongly supported by another distinguished American physicist, Luis Alvarez, who argued that the peer review system, 'in which proposals rather than proposers are reviewed' was 'the greatest disaster to be visited on the scientific community in the twentieth century.'

Growth rates in decline

Some of the data presented by Braben will surprise even those who regard themselves as reasonably well informed on this topic, for example the fact that the number of scientific journals published globally in anyone year (a rough indication of the number of practising scientists) has gone from a mere ten in 1700 to 10,000 in 1900 and the phenomenal number of 100,000 in 1975. The US National Science Foundation has published figures which reveal that the number of doctoral science and engineers employed in that country alone is now just under 250,000.

Braben then draws the significant conclusion that, despite this vast increase in scientific and technological activity, annual real growth rates of world GDP per capita show a significant decline since the mid 1960s. He attributes this to the declining scale of 'unfettered scientific exploration' which is 'the primary feedstock of genuinely new technology.'

Balancing authority and decision

This profoundly interesting analysis does not entitle us to conclude that there is no perceptible or defensible political process which will address, let alone solve, the problem. No democratic government will willingly abandon any attempt to influence the broad thrust, even if it should not attempt to define the detailed direction, of scientific research and development. The balance of authority and decision is one which, however difficult, has to be drawn between support for the eccentric, the orthodox, the conventional and that which may eventually prove to be either unproductive and wasteful or the work of an inspired genius.

The challenge to society is to devise an acceptable and practical distribution of opinion, authority and decision between the general public, its elected representatives, the bureaucracies with which they interact, the 'peer review' hierarchies and those who have the imagination, courage and skill to ensure that the eccentric scientific genius is not stifled by orthodox opinion and procedures.

Saving scientists from condemnation

Pioneering Research is a wide-ranging and well informed analysis of this question, which is unlikely to have featured in the manifestos of any political party. But the survival of civilisation and democracy itself may well depend on recognition of the fact that the question is, arguably, unlikely to be within the scope of what is today defined as 'the public understanding of science'.

Where I would regretfully disagree with Lord May is his statement that 'a substantial fraction of the total population can really be engaged with this issue.' But unless the problem is successfully addressed, Braben would doubtless agree with Sir Martin Rees that the twenty-first century could well be our last. In the judgement of many it is the most important issue facing democracies today.

I would hazard the personal opinion that no solution will be acceptable unless there is total confidence in the integrity, impartiality and relevance of scientific opinion on any major issue. If science becomes polemicised, scientists cannot complain if the media classify their judgements in the same arena as those of politicians, the condemnation of whose reputation has become virtually obligatory.

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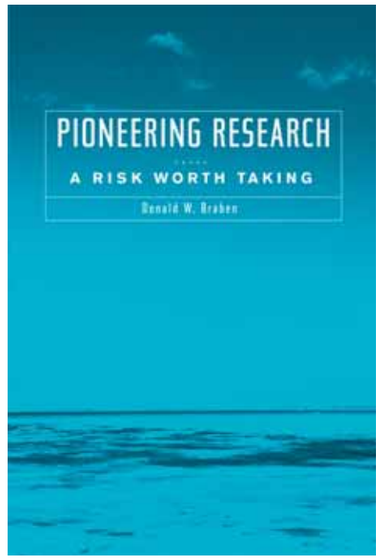

We need confidence in the integrity of science

Different science minister, please

Tom Wakeford wants more accountability for scientists

Lord Sainsbury, during his seven years in power, hit the headlines for many reasons: his huge donations to the Labour Party (shortly followed by his elevation to the House of Lords and appointment to the government); his fervent faith in plant biotechnology and his failure to persuade the public in the 2003 GM debate. But I am more interested in what he did about the wider relationship between scientists and society.

John Battle was New Labour's first minister for science. His experience of speaking up for the hundreds of his constituents affected by the appallingly regulated asbestos industry gave him a more nuanced understanding of new technologies than his successor. At the events at which I saw him speak, Battle talked of the need to 'democratise science'. For him the issue was 'not so much the public understanding scientific facts, but scientists coming to a better understanding of the perspectives of different publics'. He was the breath of fresh air that the Office of Science and Technology needed after eighteen years of conservatism.

With his child-like adoration of all that came out of the laboratory, Sainsbury clearly wanted the science job. After only a year he had supplanted Battle and suddenly the hopes of those of us who wished for a new social contract for scientists were extinguished.

Early Battle
In 1997, Battle had set up a Public Consultation on Developments in the Biosciences that had begun to bring academics, scientists and non-governmental organisations together to discuss a whole range of ways in which non-scientists could be given spaces in which to become informed and express their views. Sainsbury attempted to convert this rich process into a thinly veiled attempt to sell biotechnology to the public.

Despite his efforts the consultation showed the sophistication of people's opposition to the GM technology. Battle had wanted the advisory group for the process, on which I served, to undertake a critical review of the consultation process. Having engaged market researchers MORI to help him spin the promotion of GM in new ways, Sainsbury disbanded this group before it had a chance to undertake such a study.

Lack of accountability
Scientists don't have a problem with those, like Sainsbury, who love facts and inventions. We come across them all the time. But the supermarket mogul's hostility to democratic accountability, and his refusal to credit non-scientists with useful knowledge, has been a deeply damaging attitude to society and to science.

Whether the workshops they attend have been funded by the Royal Society or Greenpeace, most scientists who work at the coal-face have told me they want to be accountable. Sainsbury sought to deny them this opportunity. In the last days before the election was called, he over-ruled the expert committee that had awarded grants under the Sciencewise programme. He tried to convert those projects that had been chosen to develop mutually educative relationships between scientists and non-scientists into ones that were merely promoting the acceptance of new technologies.

Fingers crossed that his successor is very different.

Art to fight climate change

Opening minds to danger

'Taxpayers' money wasted' screamed the *Times* headline. 'No-one will see it', said a commentator in the article that followed. Arts Council money was sending twelve artists to the Arctic last March, to highlight the dangers of climate change.

By splashing the resulting dramatic ice sculpture that they had created on the trip across its news pages, the newspaper, along with others, ensured both these statements were falsified.

Along with Charlie Kronick of Greenpeace, I was one of the two non-artists who were asked to help our fellow ice-travellers make sense of what the media insists on calling 'global warming' in the surroundings of one of the most inhospitably cold environments on Earth.

When I first got the invitation, I was not sure whether this was just another lottery-funded 'science-art' initiative. Though these are clearly fascinating to those involved, to outsiders they can seem like an expensive exercise in mutual backslapping. Talking to the expedition organiser, David Buckland, soon made me realise that this was different. Its aim was to build broad support for addressing perhaps the greatest threat of our times.

The horrors of war inspired some of Picasso's greatest paintings and Siegfried Sassoon's timeless poetry. Climate change will create catastrophe among some of the world's most vulnerable communities. This demands portrayal in twenty-first century art forms.

In the battle to mobilise people in support of initiatives to combat climate change, and move away from their own carbon-emitting lifestyles, I now have more faith that art could open minds that resist more rational arguments.

Details of the expedition are at www.capefarewell.com

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Human reproductive technologies

Ian Gibson demands evidence of harm

When the Science and Technology Committee report into *Human Reproductive Technologies and the Law*[1] was published in March, the media inevitably focused on disagreements within the Committee.

If anyone was surprised, they shouldn't have been. Whenever big ethical and scientific issues have been debated in Parliament, feelings have run high. I expected this when we started the inquiry in November 2003 – but I like a challenge.

Disapproving is not the same as disallowing

Two principles

So what did we conclude that so excited the *Daily Mail?* It's a long report but there are two inter-related guiding principles, one philosophical and the other scientific. We concluded that there should be a balance between the reproductive freedom of individuals and the interests of the state, but that these interests should be based on evidence. In a nutshell, this means that if you want to tell people what they can't do, you have to be able to come up with some evidence to show that it will cause harm.

This may sound reasonable, but of course it means the green light for sex selection and genetic diagnosis of embryos, and it means that clinics and the Human Fertilisation and Embryology Authority must stop vetting prospective parents. There are lots of arguments why we shouldn't go down this path, but that is what they are – just arguments – and too often they are based on myth and prejudice. Once you've reached this conclusion, the HFEA can concentrate on ensuring that the provision of assisted reproduction is of the highest standards. It can stop tying itself in ethical knots (usually the reversed half hitch).

We need good reasons

We have been portrayed as having concluded that sex selection and 'designer babies' are a good thing. This is not the case. What we have said is that we have to have good reasons to prevent people procuring them. As we were told during the inquiry, disapproving is not the same as disallowing.

Another tasty morsel for the media hounds was our conclusion on chimeras and hybrids. Forgive me if I missed something, but I thought legislation was about providing some protection to an embryo with the potential to become a human person. So what are we doing, prohibiting something that creates something that is less than human with at best a remote chance of developing? In recognition of some people's concerns, we suggested that such creations should be destroyed at 14 days, in line with the current limit for the culture of *in vitro* (human) embryos.

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Role of the public

Of particular interest to the BA should be our consideration of the role of the public in guiding policy in this area. We held a public online consultation, and it is fair to say that the contributors were predominantly conservative. You can argue that such consultations are self-selecting and not representative, but this misses the point. As the Council for Science and Technology concluded in its recent report, *Policy Through Dialogue*,[2] 'The purpose of dialogue is not to determine but to inform policy development. It does this by challenging the thinking of policymakers and scientists who contribute to policy making, as well as that of the public, stakeholders and special interest groups.'

I like to think that people like their politicians to hold principled views

We listened to what the contributors (and witnesses to the inquiry) told us. We then went away and decided the position that we should adopt. It would have been lazy and irresponsible of us to tot up the numbers in favour or opposed to sex selection, for example, and go along with what we found. I like to think that people like their politicians to hold principled views and not sway in tune to the latest opinion poll or buckle under the weight of their postbag.

My sincere hope is that our report is the catalyst for a passionate debate

As I write, the Department of Health is working on its consultation for a review of the HFE Act. My sincere hope is that our report is the catalyst for a passionate debate that makes the government work hard to get its way. I will be there in Parliament (pending the judgement of the good people of Norwich North), and I can't wait to get stuck in to the arguments once again when new legislation is introduced.

References

1. www.publications.parliament.uk/pa/cm/cmsctech.htm
2. www.cst.gov.uk/cst/reports

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