



Science & Public Affairs

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Openness and optimism

Promoting openness about science and technology is a recurring theme in this issue. SPATalk (p.4) shines a light on relations between the scientific and business communities by highlighting the commercial sponsorship of research. It asks whether tainted funders, like tobacco companies, should pay for research. Natalie Fenton argues that they should not. She maintains that accepting money from such sources adds credibility, status and a gloss of civility to those who do not deserve it. Gordon Graham disagrees. In his view, we need to distinguish between the funders and the way their money is spent. If the research is conducted in a spirit of intellectual independence, without any influence from its sponsors, he is not concerned about their identity.

This is a subject we can debate openly. There is, however, no debate to be had about whether nuclear installations in this country are safe from terrorist attack. Chandrika Nath (p. 6) reports that there is simply not enough information in the public domain for members of the public to make an informed judgement. A study from the Parliamentary Office of Science and Technology considers a range of scenarios - from aircraft crashing into nuclear power plants to armed terrorists attacking flasks of used reactor fuel - which could lead to a release of

radioactive material, with potentially serious consequences for public health. However, the lack of information makes informed public dialogue about nuclear security difficult, and means that we must entrust the safety of the industry to the nuclear regulators.

In view of the history of the industry, many will find this hard to stomach.

Every time Londoners use an Oyster card on the tube, details of their journey are logged on a computer and kept for two months. This is made possible by radio-frequency identification technology which, according to Susanne Lace (p.16), may challenge consumer privacy and security. Small chips are embedded in things we buy, so that they can be identified and tracked. Lace calls for industry and government to consult with consumers about the future of the technology.

This issue also looks forward to some hopeful initiatives, here and abroad. A new African Institute for Mathematical Sciences has graduated its first African students, who will contribute to the continent's development (p.14). The lives of African farmers will improve after the eradication of rinderpest (p.16), a high fatality disease which attacks their cattle. A new centre for energy research in the

UK aims to work for sustainable energy by bringing greater coherence to UK energy research as a whole (p.18). A new water directive from the European Union will result in our rivers and lakes becoming cleaner (p.22).

In the shorter term, Jane Sutton urges us to get to grips with the UK's appalling waste of money on IT projects (p.12). One of the most recent fiascos was Siemens's new system for the Passport Office, which caused such enormous backlogs in issuing passports that over 500 people actually missed their holidays in 1999. Taxpayers had to stump up to the tune of £12.5 million, to sort out the mess. The answer is better risk management and more professional qualifications for software designers.

Although this is a large task, it seems simple in comparison with David Begg's pleas for London to follow Sydney's example in planning transport for the 2012 Olympics (p.24). Banning cars from all venues and the roads leading to them; including public transport fares in ticket prices; laying on special trains, bus lanes and clearways, building the East London line! Now that would really give us all something to shout about.

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Does it matter where research money comes from?

Natalie Fenton and Gordon Graham disagree

Dear **Natalie**,

Should scientists and other academic researchers accept money from sources that are regarded as 'tainted' - money from tobacco companies, say, or arms dealers, or fortunes originally made from slavery?

There is a widespread presumption that money from certain sources is unacceptable, and that universities and other institutions should set up Ethics Committees to make sure that they do not, even inadvertently, accept any.

This seems to me mistaken, because of a fundamental confusion.

The source from which funding comes should not be confused with strings attaching to its use. The two are quite different. The second is certainly unacceptable if untrammelled free inquiry is to be pursued, protected and promoted. What I shall call 'conditional funding' precisely seeks to restrict the inquiry, or the publication of its results, in ways that are inevitably in sharp conflict with the canons of intellectual inquiry and the practice of objective intellectual scrutiny.

The contrast is with research that is free of such conditions, conducted with objectivity and in a spirit of intellectual independence, whose results meet the most rigorous standards of blind reviewing, and whose publication is likely to advance human understanding considerably. Such research, however, could be paid for by tainted, but unconditional, money.

Regards, **Gordon**

Dear **Gordon**,

Whether the source of your funding has strings attached or not, if you accept money from unethical organisations, and do good research that is published acknowledging the funders, you add credibility, status and a gloss of civility to those who do not deserve it.

Allowing such organisations to be associated with independent research provides a comfort zone for their board and shareholders and a public face to hide behind.

The case of the University of Nottingham accepting £3.8m from British American Tobacco to fund a centre on corporate responsibility could not be a better example.

The practice of academic freedom does not and some would argue should not take place in a political vacuum. To believe that it can and should is naïve. The more people who are willing to accept 'tainted' money and promote indirectly such organisations, the longer it will take to change their practice or get them to accept responsibility for it.

I wonder how much independence a company could take. How long would funding continue when the outcome of the research is directly critical of the funder's commercial practice or product? There are plenty of examples of moneys being withdrawn or people being sacked when they bite the hand that feeds them. Do you have the same number of examples to hand of continuous support for independent enquiry even when the results are damaging?

Regards, **Natalie**

Dear **Natalie**,

I am strongly inclined to reject the claim that those who try to put bad money to good purposes should be denied any credit for doing so. This view implies that compensating for past misdeeds is morally impossible. If money from BAT (or anyone else) does really make a contribution to securing better corporate government, to this extent their credibility, status and general civility do deserve to be acknowledged.

Of course, no such credit would be due if no genuine contribution was made, but, whether the money from 'tainted' sources has truly been used to a valuable end, one that brings intellectual or practical benefits, is a matter in the hands of the recipient (provided, to repeat, that no donor conditions attach).

This last point applies to the question of research that is critical of the donor. Money can never properly be accepted on the understanding that the donor must like the

results (though of course the subject of the research may have nothing to do with the donor's activities). If a series of unwelcome findings leads to the withdrawal of support, so be it. But of course, this can be true of 'non-tainted' including government money and even internal university support.

Regards, **Gordon**

Dear **Gordon**,

If the likes of BAT or arms dealers really did want to compensate for past misdeeds, make amends and change their practice for the future, of course they must be encouraged to do so. If this could be contractually ensured along with the necessary academic freedom before any money was accepted then it would indeed be a welcome funding stream.

I doubt however that many companies would sign up to such a deal. International oil, pharmaceutical and tobacco corporations are queuing up to invest in universities. Their motives are not wholly philanthropic. When funding is scarce, the pressure and temptation to take 'tainted money' increases. The consequences for the university sector and university research are dire.

The public and other researchers are already deeply suspicious of research with dubious commercial backing - and for good reason. Peer review can only partly offset this mistrust. Revelations of commercial support for some researchers undermines the credibility of others. Universities should occupy a moral high ground or risk losing the respect of academic colleagues elsewhere and the value placed upon the sector by wider society.

Regards, **Natalie**

Dear **Natalie**,

I would question your assertion that 'the consequences for the university sector and university research are dire'. What evidence is this based on? It is widely assumed that taking money from 'unsavoury' sources would bring bad publicity, and this would just be



Puffing with the devil? British American Tobacco supports research at the University of Nottingham *NewsCast*

bad for universities and those who work in them.

But in so far as this is a real danger, it arises from the way such actions are represented. If it were evident (a) that universities are places that turn tainted money to good intellectual and social purposes, (b) that they do so in an autonomous spirit that expressly refuses to accept any conditions on the research outcomes, and (c) that in this way they show themselves to be capable of initiatives that do not rely on the taxpayer and the public purse, where would the bad publicity lie?

Fear of bad publicity brings with it the culture of spin. It also betrays a special weakness in the university sector, one that takes its cue from conventional opinion rather than the exercise of critical independence of mind that universities are supposed to inculcate. This is precisely why, in my view, universities are failing to occupy a genuinely higher moral ground. Regards, **Gordon**

Dear Gordon,

This is about far more than bad publicity for certain universities. In institutions whose ideals should transcend money, a message that researchers should take what they can from wherever they can get it, as long as they are guaranteed independence, would change the ethos of university practice.

A university is about social advancement and cultural development as much as it is about scientific progress. 'Unsavory sources' will use the sponsorship of university research in their own promotional literature. University research then becomes associated with the propaganda of the business. It is not about university spin; it is about commercial practice.

I think we agree that the right of academic staff to publish any and all research findings should be the primary consideration of any contract between industry and academia. Commercial considerations should never be allowed to inhibit the publication of findings that are in the public interest, or which add to

the body of knowledge in a field. Ensuring that this is the case is critical to protect the essential purposes of a university. But if critical independence means unethical commercial partnership, you can keep it. It is not the answer to the under-funding of university research.

Regards, **Natalie**

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Are nuclear installations safe from terrorist attack?

There's no way we can tell, reveals Chandrika Nath

There is not enough information in the public domain for members of the public to make an informed judgement about the level of threat they face from potential terrorist attacks on nuclear facilities. The lack of information makes informed public dialogue about nuclear security difficult, and means that a very high level of confidence must be placed in the nuclear regulators.



Studies by UK authorities are classified

This is one of the main conclusions of the Parliamentary Office of Science and Technology (POST) in its new report, 'Assessing the risk of terrorist attacks on nuclear facilities.'

The study considers a range of scenarios – from aircraft crashing into nuclear power plants to armed terrorists attacking flasks of used reactor fuel – which could lead to a release of radioactive material, with potentially serious consequences for public health.

POST's report is the first official document attempting to provide MPs and peers with an objective overview of this politically sensitive topic. Most published information comes from groups with a pro- or anti- nuclear stance.

Like all POST's publications, this report makes no recommendations and draws only on publicly available information.

Terrorist intentions

Most information on terrorist threats to nuclear facilities is classified. Public attention has focussed on aircraft attack since 11 September 2001. However, the Office for Civil Nuclear Security (OCNS - the UK's civilian nuclear security regulator) emphasises that other scenarios are also considered, such as the possibility that 'terrorists might use vehicles loaded with explosives to crash through perimeter fences' or that 'terrorists

prepared to kill themselves might attempt to penetrate sites to detonate explosives.' However, OCNS admits that 'however valuable intelligence may be, experience shows that we cannot expect it to identify every threat, or that every threat it does identify is real.'

Security arrangements

Nuclear sites use a combination of physical measures (e.g. fences and barriers), personnel (e.g. guards) and procedures (e.g. security vetting) to protect them against terrorists. Security breaches do occur – for example, Greenpeace protesters penetrated the reactor building of Sizewell B nuclear power plant in Suffolk in 2002 and 2003. But it is unlikely that breaches of this kind would give terrorists an opportunity to inflict serious damage.

Numerous measures have been taken to increase security at nuclear plants since 11 September 2001.

Preventing non ground-based attacks, such as aircraft attack, is seen as the government's responsibility, rather than the nuclear operator's. Numerous questions have been raised about air defence: whether there would be time to detect and intercept a hijacked plane if it were heading for a nuclear plant; under what circumstances a decision would be made to attempt to shoot it down; and who would take such a decision. As so little detail is made public about security arrangements both on-site and off-site (i.e. beyond the plant boundaries), it is difficult to judge whether or not these arrangements are adequate.

Physical robustness

Many of the UK's older nuclear facilities were not specifically designed to withstand terrorist attacks, although safety measures provide some defence. For example, the thick concrete shielding around nuclear reactor cores, designed to limit accidental release of radioactive material, would perform the same function in a deliberate attack.

Nuclear plants are designed to withstand a range of accidents. The likelihood of some

scenarios with potentially serious consequences (such as accidental aircraft crash) was considered so small when the plants were designed, that they were not taken into account. But accidental likelihood is not relevant when assessing the risk of a deliberate act.

Consequences

The main risk for the general public from a release of radioactive material would be exposure to harmful levels of radiation, leading to an increased cancer risk. The numbers of people affected would depend on the amount of material released, weather conditions and protective measures taken. Modelling studies of the consequences of accidents at nuclear plants could provide an indication of the consequences of terrorist attacks, but these studies are not usually made public. POST's report examines three types of activity in detail: the operation of nuclear power plants, reprocessing plants and transport of radioactive material.

Nuclear power reactors

After 11 September 2001, the authorities in many countries investigated the vulnerability of their nuclear power plants to terrorist attack. Few assessments have been made public, so it is difficult to judge their reliability.

Published assessments focus mainly on aircraft impact. They examine whether an aircraft could breach the protective containment around a reactor core, or whether it might destroy the cooling ponds where used fuel is stored. They also consider whether aircraft impact might cause enough indirect damage to critical safety systems to bring about a release.

Conclusions vary depending on the reactor design, and assumptions made about the aircraft. An analysis carried out by the US Nuclear Energy Institute concluded that if a Boeing 747 crashed into a US nuclear power plant, there would be no release of radioactive material. A similar analysis commissioned by the Swiss nuclear regulator 'could not rule out' the possibility of a release from its older power plants, although accurately targeting the right building would be difficult. Critics argue that the US analysis is too constrained, because the aircraft speeds and approach angles are based on those seen during attacks on the Pentagon on 11 September 2001.

Studies carried out by the UK authorities are classified. International assessments cannot be used to draw conclusions about UK nuclear power plants because of the huge variation in design in different countries. Of the UK's 13 operational power plants, POST's report points out that the three oldest Magnox

plants would probably be the most severely damaged in a terrorist attack, because of their design. However, these are all scheduled to shut down by 2006.

Studies of accidents at the Sizewell B nuclear power plant have shown that if there were serious damage to the reactor core, the number of people developing long-term cancer could vary from only 2 or 3 cases, to several thousand. At worst, they predicted that 3,000 people might need to be evacuated from an area of 20-30 kilometres, with restrictions on food over a similar area.

Preventing non ground - based attacks, such as aircraft attack, is seen as the government's responsibility, rather than the nuclear operator's.

The Chernobyl accident in 1986 had far more widespread consequences. However, it is misleading to draw conclusions about the scale of the consequences of a terrorist attack from this accident, since it involved a flawed reactor design that is not used anywhere in Western Europe.

Reprocessing

Reprocessing plants extract re-usable plutonium and uranium from used reactor fuel, and generate large amounts of radioactive waste. In Europe, commercial reprocessing takes place at Sellafield in the UK and at Cap de la Hague in Northern France.

Because of the lack of detailed published information about these facilities, many reports make 'worst-case' assumptions about the consequences of a release of radioactive material. For example, one report on the consequences of a release from the largest liquid radioactive waste store at Sellafield predicts several million fatal cancers, in a worst case scenario. But these figures are not based on detailed design calculations, and do not take into account the effect of emergency measures to protect the public.

Transport

Transport involves smaller quantities of radioactive material than a power plant, but shipments often pass close to major cities. Several hundred shipments pass through London annually. Used fuel is highly radioactive, so it is transported immersed in water, in heavily shielded metal flasks. These flasks were not specifically designed to



Nuclear transport: not designed to withstand terrorist attack *Courtesy of Martin Forwood*

withstand terrorist attack.

There are no published assessments of the consequences of a terrorist attack on a used fuel flask in the UK. Some overseas studies have considered what would happen if terrorists used artillery to puncture a flask. But these studies cannot be used to draw firm conclusions for the UK, where the types of fuel being transported, and flask designs, are different.

Emergency planning

Emergency measures would be crucial in limiting people's exposure to radiation. They might include restricting food and water supplies, sheltering or even evacuating people. Because of the large number of agencies involved (e.g. local authorities, police, emergency services), there is potential for confusion over responsibilities. Emergency exercises highlight problems in communication between different agencies and with the public.

Steps are being taken to improve emergency response, although some issues remain. For example, the Civil Contingencies Bill, currently passing through Parliament, aims to clarify roles by allocating statutory responsibilities at local level, although there are concerns over whether local authorities are adequately funded to fulfil their responsibilities.

References

1. The report is available from www.parliament.uk/parliamentary_offices/post/new.cfm

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Shorts

Shot in the arm for UK science



Investment for innovation and wealth: the partnership between building consultants Lightly & Lightly (Colin Linley, left) and York Bioanalytical Solutions (Jeremy Cook, right) to provide YBS with expanded premises housing state-of-the-art analytical instrumentation *York Evening Press*

The Government's 10-year investment strategy for science and innovation, announced alongside the summer spending review, has met with strong support from the scientific community – with some caveats. Promising an additional £1.1 billion a year for the science base by 2007-8 (compared with 2004-5), the strategy outlines the Government's ambition for public and private spending on UK research and development to rise to 2.5 per cent of gross domestic product over the next decade, and provides annual real growth in public science funding of 5.8 per cent.

The framework has been developed alongside other interested parties including The Wellcome Trust, which itself expects to commit £1.5 billion to UK science over the coming five years. It includes a set of measures to enhance the teaching and learning of science, technology and engineering

throughout the education system; an annual fund of £35 million (from 2006) for the Director General of Research Councils to respond quickly to emerging priorities; and a plan for the Government's Chief Scientific Adviser to progress work on a centre for 'science and technology horizon scanning'.

Among the plaudits was that from Professor Ian Diamond, speaking on behalf of Research Councils UK, who said: 'The new framework balances the need for money for new front-line research projects with the need to ensure that our research base is sustainable.'

Professor Sir Gareth Roberts, President of the Science Council, was also enthusiastic, but brought up the science in schools issue: 'The Review should [...] have given more emphasis to the fact that the crisis in schools lies more within the physical sciences and mathematics than other areas of science.' His concerns were

backed up by a stipulation from Julia King, Chief Executive of the Institute of Physics: 'The first step is to invest in the infrastructure of school science teaching and university physics departments.'

Meanwhile Peter Cotgreave, of Save British Science, was reassured that the hopes he expressed before the review (*Science & Public Affairs*, June 2004, p.8) had been fulfilled: 'I'm just about happy with the money side of things.' But he expressed concerns about funds for salaries: 'There does not appear to be any substantial new money to recruit and retain the best people, which means we are in danger of having fantastically well-equipped labs but not being able to attract the world-class people to stay to work in them. It will end up a very serious problem.'

See: www.hm-treasury.gov.uk/spending_review/spend_sro4/

Nanotechnology and its critics

ICI has expressed its reservations about 'Nanoscience and nanotechnologies: opportunities and uncertainties', a report from the Royal Society and the Royal Academy of Engineering. The report recommends that nanoparticles and nanotubes be treated as new chemicals under UK and European legislation.

'While welcoming the report, we do not think that nanoparticles and nanotubes need new regulation,' said ICI's Dr Amit Khanderlwal. 'We should do more research to see what impacts those technologies will have in terms of safety, then incorporate that science into existing regulations.'

The think-tank Demos called for an immediate public debate on the pros and cons of the technology. 'The report calls for public debate to move upstream, but stops short of explaining how that debate should take place,' said head of strategy James Wilsdon. 'How can public concerns be incorporated into decisions about research funding? How can we force companies to open up their research to wider social scrutiny? These are questions that the report leaves unanswered.'

See: www.nanotec.org.uk/finalReport

Call for UK to pioneer global open access

The House of Commons Science and Technology Select Committee has given renewed impetus to the open access movement in its report, 'Scientific publications: free for all?' The Committee observed that high and increasing commercial journal prices, compounded by shrinking library budgets, were making it hard for academic institutions to buy the subscriptions their users require – and that a Government strategy is urgently needed.

To begin, it suggests, all UK higher education institutions should establish repositories where their published output can be stored and read, free of charge, online, and that funders should compel researchers to deposit their publications there. Longer term, it recommends a more radical solution, such as the author-pays model, subject to further experimentation. The UK Government, it says, should act as a proponent for change on the international stage and lead by example.

Jan Velterop, of open access publisher BioMed Central, said: 'The importance of this report cannot be overstated. It gives the clearest political signal yet that open access to the research literature is to be regarded of great benefit to science and society.'

See: www.publications.parliament.uk/pa/cm/cmsstech.htm

Consultation on flooding

Following Government proposals for a 20-year strategy to tackle the risk of flooding and coastal erosion, The Department for Environment, Food and Rural Affairs is holding a consultation on the subject. 'Climate change means we may well see more and worse flooding in the future. We must factor in and plan for this across the board, working closely with the insurance industry and other interested parties, so that the adverse consequences for people and for business are minimised,' said Environment Minister Elliot Morley.

The consultation paper brings together, for the first time, ideas on what might be done to tackle all types of flooding – coastal, river, groundwater, sewers and urban and road drainage problems – and across all areas of Government policy.

The consultation, which applies to England only, closes on 1 November. Copies of the consultation documents are available via <http://www.defra.gov.uk/corporate/consult/default.asp>

Lords look at science in treaties

The House of Lords Science and Technology Committee has called on the Government to 'take action at the highest levels to persuade other States [...] to ratify the Kyoto Protocol and to reduce their emissions of greenhouse gases.' The call comes as part of the Committee's report on an investigation into the scientific basis of international agreements on environmental matters.

The report makes a number of general recommendations for improving such agreements, calling on Government to improve the scientific expertise available within its departments; to increase the level of involvement of academic scientists and industry in negotiations; to engage in more scientific exchanges with the developing world and to promote a scientific approach when dealing with risk.

See: www.parliament.uk/hlscience/

Stem cells available

The new UK Stem Cell Bank – the first of its type in the world – is up and running, having taken delivery of human embryonic stem cell lines grown at King's College London.

The Bank is responsible for managing and supplying ethically-approved, quality-controlled stem cell lines for research into diseases such as Parkinson's and Alzheimer's.

The European Parliament is finalising a Human Tissue Bill, which will determine the legal limits of stem cell research.

The Nuffield Council on Bioethics welcomed the opening of the Bank but urged proper consideration of the ethically-contentious issues surrounding the research. 'We trust that the regulation of embryo research by the Human Fertilisation and Embryology Authority and of stem cell research by the Stem Cell Bank Steering Committee, provides the UK with an ethically informed system which can meet the needs of the future, including challenges from the European Parliament,' said a spokesperson.

See: www.nibsc.ac.uk/divisions/cbi/stemcell.html

Stem cells: research for therapy



Centre for less animal research



New centre: aiming for fewer animals in research
Research Defence Society

News that the Government is to establish a national centre to research means of minimising the suffering of animals in laboratories has met with mixed responses. The centre, to be known as the National Centre for the Replacement, Refinement and Reduction of Animals in Research, will be located within the Medical Research Council and will focus on methods to refine procedures to minimise suffering; reduce the number of animals used and replace animal-based experiments (termed collectively the 'Three Rs').

Professor Robert Combes, Director of the Fund for the Replacement of Animals in Medical Experiments, said the Centre 'offers an opportunity which must be taken,' but doubted that it would be truly independent, adding that it 'will need to be kept under close scrutiny so that all concerned can see whether it is truly delivering on all Three Rs.'

Measures afoot to avert chemistry crisis

The Royal Society of Chemistry has begun an initiative to boost the position of the chemical sciences, to counter what's been described as a looming crisis in the field.

Its 'Campaign for Chemical Sciences', which kicked off in summer with the formal investiture of its new president, Dr Simon Campbell, is designed to raise the profile of chemistry within schools, universities and funding bodies.

'It is essential that we stabilise the chemistry base in the UK,' said Dr Campbell, adding that he had spoken with Education Secretary Charles Clarke about the matter. 'We want to see short-term money to ensure that [existing] departments survive, to improve the quality of school science labs and to increase the number of science teachers qualified in their subject. Longer term, we want to attract more young people to study science and to take up scientific careers,' he said.

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Knowledge transfer: not what it says on the tin

The arts and humanities are dynamic, argues Geoffrey Crossick

I'm not sure when the concept of 'knowledge transfer' made its first appearance on the public policy scene, but it is now a prominent part of all Government pronouncements on research strategy.



This 'smart second skin' dress releases scent in reaction to signals from the body. It was designed by Dr Jenny Tillotson of Central St Martins College of Art and Design, who received an AHRB small grant in creative and performing arts

The way it is currently conceived, however, impoverishes our understanding of what the arts and humanities have to offer.

The term 'transfer' is itself unsatisfactory, describing a linear process by which the outcomes of research are passed to grateful recipients in the business world outside. The most important areas of business engagement for the arts and humanities are the creative industries, one of the most important and fastest growing parts of the UK economy. It is a sector that thrives on the intensive interaction between researchers and businesses, and on the movement of people whose portfolio careers mean that they often work in higher education whilst also running creative enterprises.

This dynamic engagement is far from some simplistic vision of a scientist inventing a new

device and then transferring it to business. Researchers and users are bound together in an exciting process that creatively uncovers new opportunities and new challenges.

Too narrow a concept

The Arts and Humanities Research Board is about to become a full research council. We must show how research in the arts and humanities makes a real difference, for if we are to argue that an underfunded part of the research world should get more resources then we need to show the value of how those resources will be spent. And here lies the problem, because conventional ideas of knowledge transfer as articulated in Government policy have become increasingly narrowed to mean knowledge transfer to business. And then narrowed still further to mean technology transfer to business.

In areas as diverse as design and music, computer games and animation, intelligent textiles and new media, the vitality of the creative industries rests on bringing together the creative and performing arts, cutting-edge technologies and innovative forms of business organisation. Traditional conceptions of technology transfer cannot handle that.

The need for broader thinking

Even at the level of business, arts and humanities researchers find prevailing conceptions of knowledge transfer constraining. We must think broadly when we think about knowledge transfer, as my three examples will show.

Take the UK's museums and galleries, world-leading institutions that make an extraordinary contribution to the cultural, educational, social and economic life of the nation. What keeps the UK's museums so exciting is the research that lies behind their special exhibitions and the presentation of their permanent collections. It is that which draws visitors – five out of the top seven visitor attractions in the UK are museums – and it is that which makes them a

powerful force in people's lives.

The same can be said of many other aspects of our cultural landscape – the heritage sector, music, drama, dance. So much that is rich and transforming about people's cultural lives depends on an interplay with research that is often hidden from view.

Public policy also benefits

Then there is the contribution made by research to public policy and wider public understanding.

For example, the AHRB's new programme on 'Diasporas, migration and identities' will provide new insights into the way migration affects cultures and identities, a critical question in a multicultural society. Many such areas of public policy and debate benefit from the insights of arts and humanities research.

And what about the most pervasive example of knowledge transfer, the flow to the public of the latest research in history and archaeology, in art history and literature, in philosophy and classics and so many other subjects? Through television and radio, as through books and newspaper articles, research reaches an increasingly responsive and enthusiastic public.

Knowledge transfer is indeed about business, but it is also about much more than that. The arts and humanities will insist on this broader conception, because without it we shall be losing so much. We're therefore particularly gratified that the breadth of the difference that the arts and humanities make has been so emphatically signalled in the Government's 'Science and Innovation Investment Framework' for the next ten years. Call it knowledge transfer if you will, but remember just how broad it is.

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Averting the hostile use of biomedical research

Current proposals aren't good enough, assert Edward Hammond and Jan van Aken

The Royal Society¹ and the US National Academy of Sciences² have recently proposed a vetting process for research projects before they are undertaken.

The proposals have been drawn up against the background of rapid developments in biotechnology, genetics and genomics, which open up tremendous possibilities for biological warfare. The US approach, however, falls far short of the minimum requirements for a comprehensive arms control system. It is disturbing to see that the Royal Society also appears to favour some of the unsatisfactory features proposed by the US.

Experiments such as the development of more lethal mousepox strains, the chemical synthesis of polioviruses or the partial recreation of the Spanish Flu virus emphasize the increasing need to control some specific experiments.

Five elements are key to ensuring that experiments, where the potential harm outweighs the potential benefit, are identified and stopped before they begin.

Legally binding

Scientists tend to favour non-binding systems based on their own – individual or collective – responsibility. But it is very doubtful that a responsibility-based system will be comprehensive and effective.

We are currently conducting a survey of nearly 400 Institutional Biosafety Committees (IBCs) which are responsible for reviewing the risks of genetic engineering. These are the same committees that, under the US proposals, would perform biosecurity peer review. Initial results indicate that the IBC system is not functioning properly. Even at major research institutions, committee meetings are rare events, risky experiments have been approved without full committee review, and committees often don't meet basic composition and disclosure requirements of the non-binding guidelines under which they are set up.

All inclusive

Every single entity that performs biomedical research must be covered by the vetting system, including industry, private non-profit institutions as well as military installations.

The current exclusion of classified research from the US system appears to be particularly ill-conceived, as this is likely to be the area where most dual-use experiments are to be expected.

Large parts of private industry and private non-profits labs in the US, including major biodefence contractors, do not even have IBCs that are registered under the guidelines. If certain types of government funding is the only leverage to enforce compliance, private institutions will not be covered.

Transparency

Transparency is a key element of international arms control. Only full transparency in all aspects of biodefence and relevant biological research will enable nations to make a better assessment of others' intentions, and act to discourage suspicion and build good will. Transparency will also encourage necessary self-restraint among biodefence scientists.

Broad representation

A much favoured term these days is the 'bottom-up approach', meaning that scientists should be tasked to operate such an oversight system. While it is certainly desirable to have some scientists with the relevant technical knowledge, we think it is paramount to have a majority of non-scientists on the review board.

A broad representation of individuals from science, civil society, governmental regulatory agencies and security agencies will ensure a more balanced view of experiments of concern. Many individuals from civil society and government regulators do have a solid scientific plus a security/arms control background – a fact that is often ignored in the scientific community.

International harmonisation

The microbiological research community is a global one, and a lack of international harmonization of biosecurity/biosafety



Avoiding hostilities: vetting proposals should be more effective OPCW

measures will create security gaps. In order to avoid research tourism, an international standard-setting body should be responsible for defining experiments of concern, and for establishing safety and security requirements for research requiring biological containment.

Whatever a final national or international system may look like, the proposed US guidelines for 'biosafety' and 'biosecurity' appear to be the worst templates. The Royal Society appears to favour a vetting process 'on a case by case basis by the relevant sponsors', which appears to indicate a non-binding and non-comprehensive system similar to the US.

In autumn 2004, the Royal Society will hold a meeting on biosecurity and bioterrorism. The British scientific community could use this opportunity to endorse mechanisms that go beyond the notion of 'scientific freedom first', that can truly contribute to international arms control.

1. Royal Society (2004) *The individual and collective roles scientists can play in strengthening international treaties*. www.royalsoc.ac.uk/policy/
2. *Biotechnology research in an age of terrorism: confronting the dual use dilemma*. www.nap.edu

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When the chips are down...

Susanne Lace sees dangers in radio-frequency identification technology (RFID)

It is a warm August morning in 2010. You arrive early at your local gym. Passing through the reception, you run your wrist over a scanner and enter the changing rooms.

An hour later and you're on a train to work. You're late. You finally arrive and race towards the station's exit barriers. They automatically open. But you've forgotten to bring a birthday present for a colleague. You dash into the local supermarket, grab a box of chocolates and run out again, hearing only a faint beeping noise as you pass through the door.

Such is the potential of RFID, a wireless identification and tracking technology that recognises things and people (including their credit cards). Promoted as the bar-code's most likely successor, the technology came to prominence over half a century ago, when used in military aircraft 'friend or foe' identification systems. Since then, it has been used in staggeringly diverse applications, from tracking cattle in Italy and lobsters in the Gulf of Maine to collecting tolls and allowing consumers to pay for petrol without stopping.

The technology is, however, hugely controversial. While supporters believe RFID will revolutionise consumption, critics have argued that it will 'enslave humanity'. So why has RFID caused such concern? To unravel this debate, we need first to look at how the technology actually works.

No check-out queues...no privacy?



How RFID works

RFID uses tags containing microchips with antennae, which can be embedded in things, built into packaging or attached as labels. These chips broadcast a unique number when woken up by a scanner's radio signals. This allows each product to be identified and tracked individually, unlike bar-codes which use generic product codes.

Passive tags can be as small as a grain of sand and have no batteries (so they are powered by a scanner's signal, from up to 5m away). Larger tags have their own power and a greater transmission range. All tags, again unlike barcodes, do not require a line of sight to be read, so the entire contents of a lorry (or a supermarket trolley) could be scanned at the same time.

Interestingly, these chips can be inserted in people. The Baja Beach nightclub in Barcelona already offers to 'chip' customers so they can pay for drinks without carrying cash. A chip is injected into a customer's upper arm, bar staff scan the arm and the scanner links the chip's number to the balance on the customer's account. The bill is then paid automatically.

Linking chips to people is the key to understanding the current debate about RFID in retail.

The debate

Linking chips to people is the key to understanding the current debate about RFID in retail. Prices for chips are falling and this has unleashed the technology's potential. While the cost of tags in the past limited their use largely to tracking pallets of goods in the supply chain, now technologists hope RFID will galvanise the growth of ubiquitous computing (the widespread use of technology) through item-level tagging.

Such ambitions are intensely contentious. The advent of item-level tagging has conjured visions of an invasive surveillance society, where people are tracked through the tagged products they buy or carry or even the tags they implant.

The US pressure group CASPIAN (Consumers Against Supermarket Privacy Invasion and Numbering) has led a growing backlash against RFID. Launching a series of boycotts against trials of RFID (and following Benetton's trials of washable tags in clothing), they announced they 'would rather walk naked than wear clothes that have been tagged.'

Nevertheless, such opposition has yet to derail the RFID train. The technology is promoted widely and retailers are experimenting with RFID more intensely than ever. Walmart, the world's largest retailer, has told its top 100 suppliers to use RFID by 2005. In the UK, several retailers (including Marks & Spencer) have trialled the technology, many funded by the Home Office's Chipping of Goods initiative.

At the National Consumer Council, we have followed this debate with increasing interest, ever since our own research on consumer futures early in 2003 identified RFID as an issue of consumer concern. In February this year, we organised the first summit to discuss the future of RFID in retail. We wanted to know

whether RFID would, in fact, 'enslave humanity'. Would we see chips with everything?

What we found

While RFID should not be under-estimated, on the evolutionary scale it is probably still a spotty adolescent. Technological glitches do exist - as one summit participant put it: 'At the moment, the technology is at minus five years.'

However, some technologists do believe that RFID will be used much more extensively over the next five to ten years. Certainly, RFID can be used in positive ways. In healthcare environments, for instance, applications include tagging vital equipment so that medical staff can locate it easily. In retail, RFID offers enhanced stock availability and product traceability. Future applications might even be developed to provide consumers with better information on products and to positively enhance privacy, by providing opportunities to make choices or offer real-time access to their data.

That said, we are still some way from a halcyon future. We need to address RFID's potential risks now.

Potential risks

RFID will challenge consumer privacy and security, unless concerted action is taken. If chips are embedded in everyday items (from clothes to credit cards, mobile phones to medical bracelets), we need to think seriously about what that means and how we can best protect ourselves. To take the example of scanner-enhanced mobile phones, which are already on the market: could tag codes be broken so people could read the tagged items we have, wear or carry by pointing their mobiles at us? Would that make theft, fraud or even burglary easier?

The advent of common tag standards and readers has brought claims of inter-store tag recognition and widespread tracking, but stand-alone applications already exist that have caused concern. Readers who are familiar with London's public transport system will recognise Oystercards, the RFID-enabled plastic season and pre-paid tickets that are being rolled out across the network. When these cards are used, customers' personalised journey details are logged on a computer and kept for two months. No such database existed in the past, and few Londoners know of it. Few people also know about the possibility of chipping people - is that a legitimate use of the technology?

Worryingly, our summit found that it was unclear whether existing law would protect consumer privacy adequately. In the UK, some retail uses of RFID (such as in-store monitoring) may concern consumers but not involve their

@ a glance...

RFID is a wireless identification technology that allows people and things to be tracked individually

Supporters believe it will revolutionise consumption through the widespread tagging and tracking of retail items, but critics argue that it will 'enslave humanity'

Supporters welcome enhanced stock availability and product traceability in retail

Critics foresee an invasive surveillance society, where people are tracked through the tagged products they buy or even the tags they implant in themselves

So far, the technology has been developed and implemented largely without the knowledge or participation of consumers

Government, regulators and business should take account of consumers' concerns

personal data so the Data Protection Act would not protect them. Outside Europe, many countries do not have effective data protection/privacy legislation so their consumers may be even more vulnerable. Health is also an issue here - consumers need reassurance that scanners' radiation levels are safe.

And what should we make of claims that RFID will make shoppers' lives easier - that check-out queues will be a thing of the past as a more efficient consumer experience beckons? Will increased automation alienate some consumers? Will retail jobs be lost, as staff are replaced with chips? The technology so far has been developed and implemented largely without the knowledge or participation of consumers. We need look no further than the history of genetically modified food to see the dangers of that.

Beyond stores, the information RFID collects could be used to profile consumers more efficiently and that might impact adversely on disadvantaged consumers. Consumers perceived to be less commercially attractive than others could be offered a less favourable service, reinforcing existing exclusion. This does raise complex policy issues, issues the NCC is currently exploring in a book on the personal information economy (which will be entitled *The Glass Consumer*).

Worryingly, our summit found that it was unclear whether existing law would protect consumer privacy adequately.

Our proposals

It is vital that we begin to develop effective responses to these issues. We are calling on government, regulators and business to take action now. In summary, we believe that:

- Data protection authorities, here and overseas, should investigate RFID and issue guidance on its use
- Industry needs to provide convincing evidence of genuine consumer benefits from RFID, build privacy protection into it and develop applications that work for consumers
- Both industry and government must pay real attention to consumer concerns, by investing in consultative processes to inform policy and build consumer literacy and trust.

RFID is a technology that is unlikely to go away. It raises profound questions about the kind of a private life we want and ultimately the society we want to live in. Right now, my advice to those promoting the technology would be to mark well the words of Confucius (Analects XV): 'Do not impose on others what you yourself do not desire'.

References

1. A report of the summit, 'Calling in the chips?', can be downloaded at ncc.org.uk/technology/rfid.pdf

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Maths for Africa

Tracey Chalmers is excited about a new initiative

'Why are hummingbirds so small?' 'How big is a raindrop?' 'Roughly how long does it take to boil an egg?' These are a few of the ice-breaker questions that confronted the first intake of students at the African Institute for Mathematical Sciences (AIMS) at their campus in Cape Town, South Africa, in September 2003.¹



Life-changing: students at AIMS

On Friday 18 June 2004, these same students graduated with their diplomas in postgraduate mathematics. They had spent the previous nine months immersed in a range of courses – from fundamental physics and pure mathematics to applications of maths, such as demographics, disease modelling, and fluid mechanics – and, of course, they could now answer those approximation questions!

Focus on maths

The AIMS course (based on the diploma programme established by the International Centre for Theoretical Physics, in Italy) is unique in its focus on mathematics as the thread that runs through all sciences. The main drive of the course is to enable students to 'learn' mathematical intuition and flexible thinking, so that they can analyze the world and make a contribution in teaching, research, industry or government.

Students applied from throughout Africa, hearing about AIMS from lecturers or reading about it on the Internet. Thirty top students, including seven women, were selected to join the AIMS programme. They came from 11 African countries, where they worked as

teachers, lecturers, research assistants, accountants, and banks clerks.

AIMS was founded by Cambridge theoretical physicist Neil Turok, as a way to nurture young African scientists and to keep mathematical skills, which are critical for development, on the continent. The institute is a collaboration between the South African universities of Cape Town, Stellenbosch, and the Western Cape (which formally accredit the diplomas), and the universities of Cambridge, Oxford, and Paris-Sud XI.

The course has financial backing from, amongst others, the Gatsby Foundation, Ford Foundation, Vodafone Group Foundation, the International Council for Science (ICSU) and South Africa's Department of Science and Technology. This ensures that the students can travel to the institute from anywhere on the continent and receive free accommodation and tuition.

Independence and interaction

The course is made up of three sections: skills, to develop the students' analytical and computational abilities; review, to expose them to exciting areas in science and help them shape

their area of focus; and writing, which allows students to pursue independent research.

All the students were enthusiastic about the lecturing style used at AIMS, which is completely different from the traditional 'talk and chalk' methods they had encountered at their schools and universities. The approach is highly interactive, with lecturers acting as facilitators to problem-solving. The students are urged to engage with the material, to communicate with their peers, and to confront the 'experts'.

They were also unanimous in their praise of the AIMS tutorial approach, where morning lectures are reinforced in the afternoon under supervision.

The lecturers live on campus and the in-house library and open-source computer centre are accessible at all hours. This is designed to encourage the students to work independently while knowing that they can call on world-class resources at any time.

Impact

The AIMS experience – an association that is intended to be life-long – has markedly changed the lives of its students (see boxes).

All the students hope that the interaction between African mathematicians established at AIMS can be maintained. It will be encouraged via the AIMS policy of making the institute's internet facilities available to all past students, and maintaining computer resources for remote access that will aid research collaboration with institutes worldwide.

The gain hasn't all been one-way, either. More than a hundred academics from around the world have volunteered to participate as guest lecturers, and those that have lectured at AIMS are clamouring to come back because of the outstanding reception they get from the students.

At graduation, the three participating South African universities indicated how they have already benefited from their association with AIMS: they have recruited many high-quality postgraduate students from the first group of AIMS students.

Graduation for all the students signalled a threshold in their lives, and all signs point to AIMS becoming the model for a wider collaborative network for scientific development on the continent.

Shehu Abdussalam, Eucharia Nwachukwu and Emmanuel Osalusi

Shehu Abdussalam was in his final year of a BSc at Ahmadu Bello University (Nigeria) when a lecturer told him about AIMS. He would like to specialise in theoretical high energy physics, and, because ‘maths is the language for physics’, Shehu applied to AIMS. He is thrilled about how his time at AIMS brought him into contact with wonderful ideas about maths. Shehu graduated *cum laude* and is going on to the Department of Applied Mathematics and Theoretical Physics Part III programme at Cambridge University.

Eucharia Nwachukwu was a few months into a Master’s degree in operations research at the University of Port Harcourt (Nigeria) when her lecturers went on a protracted strike. Feeling concerned about this six-month hiatus, she was surfing the web for a solution and hit on the AIMS website. Her

head of department and academic mentors were very encouraging about her application to AIMS; and because the work undertaken at AIMS is recognised by her university, Eucharia only has to complete her thesis once back in Nigeria to be awarded her degree.

As for the future, Eucharia would like to work on a PhD in financial maths and perhaps return to AIMS as a lecturer.

Emmanuel Osalusi, also from Nigeria, worked for most of the major oil companies for five years until he realised that his BSc had not equipped him with the practical skills needed for promotion in this industry. He returned to university and spent two years as a postgraduate student, trying to re-skill himself. Emmanuel was in the same predicament as Eucharia, making little progress on his research owing to the lack of resources and political instability.

Emmanuel says that his time at AIMS ‘changed my destiny’ by exposing him to a style of teaching and to computer programs that have revolutionised his approach to his speciality – fluid mechanics.

Emmanuel will continue research at South Africa’s University of the North. He is investigating crude oil extraction using thermal methods: heating the oil underground by injecting steam. This changes its viscosity and allows more to be recovered than through standard drilling techniques.

Emmanuel is armed with new skills in mathematical modelling, as well as free, open-source tools – such as the Linux operating system and the Octave program used for numerical computations – which he plans to disseminate wherever he goes.

Tendai Mugwagwa and Peter Mhone

Tendai Mugwagwa had been a secondary school biology teacher in Zimbabwe for a year when a lecturer from her *alma mater*, Bindura University of Science Education, told her about AIMS. He had heard about the institute and knew that, although Tendai loved teaching, she had a long-standing interest in epidemiology.

As a component of the AIMS programme – from which she graduated *cum laude* – Tendai submitted an essay on the role of immune responses in HIV infection, which is going to be expanded into a Master’s thesis at the University of Cape Town. She is using mathematical models to predict how HIV/AIDS spreads at the cellular level and

sees herself returning home to work for one of Zimbabwe’s biomedical research centres.

Peter Mhone, from Malawi, was an undergraduate student at the University of Malawi when he met a mathematician whose passion for the subject convinced him beyond doubt that he needed to be an applied mathematician. Once he had completed his Master’s degree in mathematical modelling, Peter became a lecturer at his university. After a year and a half there, he felt that he needed more exposure to different aspects of applied maths and to other African mathematicians.

Peter was impressed by the AIMS website and the range of subject matter published in

the course outline. He was also keen on the prospect of connecting with other mathematicians and possibly collaborating with them on future projects.

He found the tutorial approach was totally refreshing, even for material that he had encountered before. He valued meeting ‘famous’ mathematicians and discovering that they are human and approachable.

The University of the North has offered Peter funding for a PhD, but because he has a wife and young child he is not certain whether he will be able to take up this offer, or whether he should return to his lecturing post. In any event, Peter plans to revitalise his own teaching style with the skills learnt at AIMS.

@ a glance...

The African Institute for Mathematical Sciences (AIMS) at Cape Town, South Africa, has produced its first set of young African graduates

It concentrates on mathematical intuition and flexible thinking, so that students can analyze the world and make a contribution in teaching, research, industry or government

The approach is highly interactive, with lecturers acting as facilitators to problem-solving

The course was founded by Cambridge theoretical physicist Neil Turok, and is a collaboration between three South African universities and Oxford, Cambridge and Paris-Sud XI

It has changed the lives of the students and benefited the participating South African universities

Reference

- 1 See www.aims.ac.za

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Eradicating rinderpest

The Institute for Animal Health is tightening the net, reports Tracey Duncombe

For people in developing countries, farm animals are living assets that provide more than just food. Livestock provides households with a regular source of income from the sale of surplus eggs, milk and young stock. This income is becoming increasingly important in countries where a combination of socio-economic factors, including the rising numbers of people living with HIV and AIDS, mean that there are fewer people to work the land to grow staple food crops.



Treating a cow for internal parasites whilst checking for foot-and-mouth disease Eric Denison, Courtesy of IAH

Animal disease is one of the major factors contributing to poor livestock productivity. Since 1985, international efforts have focussed on empowering people in developing countries to control and prevent animal disease. The Institute for Animal Health (IAH) Laboratory in Pirbright, Surrey, has had a long-standing role as a provider of appropriate, affordable diagnostic services and scientific expertise on infectious animal disease to developing countries.

One of the major driving forces has been the eagerly anticipated eradication of rinderpest, a disease commonly known as 'cattle plague', which has decimated herds around the world for centuries. Staff at the Pirbright Laboratory have worked with the joint Food and Agriculture Organisation (FAO)/International Atomic Energy Agency Programme to introduce diagnostic tests for rinderpest into African countries. Pirbright is the FAO World Reference Laboratory (WRL) for rinderpest.

In Sub-Saharan Africa, animal losses due to disease are estimated to be £2.2 billion annually, approximately a quarter of the total value of livestock production. According to the FAO, rinderpest in Africa accounted for losses of £1 billion during the 1980s alone.

Eradicating rinderpest

Dr John Anderson, Head of the Rinderpest WRL, maintains that introducing diagnostic tests to African countries has had a big pay-off. 'The success of this technology transfer programme was realised in the late 1990s when IAH expertise was no longer needed for troubleshooting in diagnostic techniques. Many African experts had been trained and were available to assist not only in Africa but also in Europe and Asia,' he says.

The objective of eradicating rinderpest is an ambitious one, and success would make it only the second infectious disease to be eliminated

after smallpox. The target date for worldwide eradication is 2005, with final certification in 2010. 'The current international effort means that we have a real opportunity to rid the world of rinderpest once and for all, but we must learn from the past,' says John Anderson.

Rinderpest has escaped elimination once before. During the 1960s, a successful vaccination programme was believed to have eliminated the disease in Africa. However, between 1979 and 1983 there was a resurgence of the virus throughout western, central and eastern Africa, resulting in the loss of more than one million cattle and wild animals. With hindsight, vaccination was stopped too soon, and the disease re-emerged from small pockets of infection. Today the last pockets of the virus are believed to be in the Somali eco-system spanning the borders between Ethiopia, Kenya and Somalia. The eradication programme is helping to ensure that these countries remain vigilant.

Tailoring research to need

In recent years the nature of IAH Pirbright's input has changed significantly, in line with the changing stages in the eradication process. The stages of rinderpest eradication are clearly laid out by the World Organisation for Animal Health (OIE). Mass vaccination is the first step in controlling any outbreak. Countries that have detected no clinical sign of disease for two years, and who have stopped vaccination, may proclaim 'provisional freedom from the disease'. Disease surveillance is then required for a further five years before a country can be declared free from infection.

Initially, research at Pirbright was aimed at developing simple serological assays capable of being used in African laboratories to monitor the effectiveness of the national vaccination campaigns. These tests were produced as kits and introduced into 28 countries in Africa. Once vaccination had stopped, serological tests were developed to detect antibodies due to infection (not vaccination).

Research also moved towards rapid diagnosis for identifying the remaining foci of infection. This involved the development of a rapid pen-side test which can be used in the field and gives a result in 5-10 minutes. It works in the same way as a home pregnancy test, using a

sample taken from a simple eye swab. A prototype of this test proved highly valuable during a rinderpest outbreak in Tanzania in 1997, when the mild virus strain present could not be detected by any other method. More recently, in 2003, it was used during the final rinderpest screening programme that led to an announcement from the FAO that Pakistan was provisionally free from the disease.

In rural areas, trained Community-based Animal Health Workers (CAHWs) have greatly helped disease surveillance. They represent a new approach to animal health delivery, initiated and funded through the Department for International Development. These professionals are especially important in places like Sudan, where war makes it impossible to operate state veterinary services. CAHWs tend to be trusted local herdsman, who have been selected by their local community to fulfil the role. Schemes such as this have to be sustainable, and the field diagnostic test is a powerful tool for CAHWs and rural veterinarians. Reports of an outbreak cannot be ignored when the veterinarians get a positive result, and this ensures a rapid response.

In addition to low-technology tests, Pirbright has developed sophisticated DNA-based tests. These tests will play an important role in the end stages of eradication, when it will be vital not only to detect any virus but to identify its lineage and origins.

Genome sequencing technology has revolutionised virus identification, and is now a standard method for diagnosing a number of viral diseases.

IAH reference laboratories

In addition to being the WRL for rinderpest, IAH Pirbright is home to reference laboratories for eight other diseases on the A List of the OIE.² Each OIE reference laboratory is led by an expert in that particular disease. This expertise is called on by organisations such as the FAO, OIE, and the EU, and also by the UK and foreign governments, to advise on disease control policy. The reference laboratories also supply standardised reference strains and reagents that are used to calibrate diagnostic test systems and as research tools by research institutions around the world.

The reference laboratories hold unique collections of animal viruses that have been gathered from around the world over many years. Scientists at IAH Pirbright are able to use data obtained from these virus collections to trace the possible origins of new strains as they evolve, and track their movement around the globe.

Genome sequencing technology has revolutionised virus identification, and is now a standard method for diagnosing a number of viral diseases. This has many advantages over traditional methods in terms of speed, reliability and cost. As a recent example, in 2003, the genome sequence data and techniques generated at Pirbright for the sheep disease bluetongue were used to identify an outbreak in North Africa and Mediterranean Europe in a matter of days.

Of course, as we saw in the UK during 2001, exotic diseases like foot-and-mouth disease (FMD) are global problems, and are not exclusive to developing countries. Pirbright is one of the best equipped places in the world to study FMD. The IAH has always welcomed visiting scientists, who come to learn the latest techniques that have been developed in the field of exotic disease research, or to attend one

The reference laboratories hold unique collections of animal viruses that have been gathered from around the world over many years.

of our disease control training courses. With plans now in place to build new laboratory facilities at Pirbright, we expect to be able to open our doors more widely to the international scientific community with the new concept of a 'research hotel'.

Building an international centre of excellence

IAH Pirbright needs state-of-the-art facilities, given our front-line role in the national response to emergency outbreaks of exotic diseases of livestock. A current project aims to modernise and improve the facilities of the laboratory, including relocating the Virology Department from the Veterinary Laboratories Agency at Weybridge onto the Pirbright site. Over £50 million has already been committed to this project by both the Office of Science and Technology and BBSRC, and Defra has included funding of the project in both short and long term funding plans. Work is due to begin on site in 2005.

Head of IAH Pirbright, Dr David Mackay, says 'This development will bring all the UK-based reference laboratories for exotic viral diseases of livestock together onto one site and, together with an increased research capacity, will create an international centre of excellence in veterinary virology.'

References

1. Rinderpest is a highly contagious disease that affects cattle and buffalo. It is caused by a paramyxovirus, which is related to measles virus. The disease is characterized by fever, lesions in the mouth and throughout the alimentary tract, severe diarrhoea and a high fatality rate.
2. The OIE List A diseases for which IAH Pirbright provides diagnostic services are: African horse sickness, African swine fever, bluetongue, foot-and-mouth disease, lumpy skin disease, *peste des petits ruminants*, rinderpest, sheep and goat pox, and swine vesicular disease.

@ a glance...

Animal disease leads to poor livestock productivity and reduces food and income for people in developing countries

The Institute for Animal Health's Pirbright laboratory is the acknowledged world expert on eight serious viral diseases which affect livestock in developing countries

IAH Pirbright advises on controlling outbreaks of these diseases

It has contributed practicable diagnostics to the current campaign to eradicate rinderpest, which is a high-fatality disease in cattle

IAH Pirbright's current rebuilding programme will ensure its future as an international centre of excellence in veterinary virology

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The UK is wasting billions

Jane Sutton reports on ideas for improvement

The headlines say it all. 'How £20m IT system cost £450m...' 'IT failures show lessons have not been learned...' Literally billions of pounds are wasted every year on new information technology (IT) systems, according to a recent report by the Royal Academy of Engineering and the British Computer Society (BCS).¹

Despite many examples of good practice, there is still a lack of professionalism in software engineering that could even be dangerous in safety-critical systems. Britain is failing to produce software engineers and managers with the IT and project management skills to commission and execute complex IT projects.

Public sector most at risk

Britain's most expensive IT disaster was the collapse in 1999 of a £1 billion joint project between the Post Office, computer firm ICL and the Benefits Agency to create a swipecard system for benefits. When it failed, the Post Office wrote off £571 million and ICL and the Benefits Agency each lost £127 million. That year was a vintage one for public sector IT failure. Siemens's new system for the Passport Office, which cost £230 million, caused enormous backlogs. Over 500 people actually missed their holidays and it took £12.5 million of taxpayers' money to sort out the mess.

The week before the Academy/BCS report was published, the Government had to admit that the Child Support Agency's new computer system, which cost £400 million, was still not working after 13 months. Fully 95,000 lone parents have had their maintenance payments delayed.

'The UK public sector alone has spent an estimated £12.4 billion on software in the last year and the overall UK spend on IT is projected to be a monumental £22.6 billion,' says Basil Butler, Chairman of the working group that produced the report. 'We looked at a range of studies showing that only around 16 per cent of IT projects can be considered truly successful. Things are improving but the complexity of the systems being attempted is also increasing all the time.'

It is difficult to quantify the cost of these low success rates, but a recent review estimated that over US\$150 billion is wasted every year on IT failure in the US in addition to about US\$140 billion in the EU.

'I wonder if the Government has assessed the

risks of its latest proposal to merge the IT systems of the Inland Revenue and Customs & Excise,' muses Professor John McDermid, Professor of Software Engineering at the University of York and a member of the working group. 'I'm not saying it can't be done, but I'd like some reassurance that the analysis has been carried out. Have the risks been analysed? Can the projects be implemented? Will they do what Ministers want cost-effectively?'

The Government has two other enormous projects that depend critically on successful IT management. The £6 billion national NHS IT programme to network patient records, prescriptions and appointments is the world's largest non-military IT venture. The Home Office's proposed introduction of ID cards based on biometrics is both highly complex and mired in controversy.

Managing risk

The evidence gathered for the report suggests that risk management is one of the most neglected aspects of IT project management. It requires the definition of hazards that could threaten progress, followed by brainstorming

to develop a recovery plan to eliminate or control each hazard. Effective risk management is indispensable for a successful project: the earlier the problems are identified, the better the chances of correcting them with minimal disruption.

Regrettably, says the report, risk management is often limited to compiling a risk register at the start which plays little role in the day-to-day management of the project.

'The really critical safety issues are well controlled,' says John McDermid. 'The problem for the safety community is achieving the level of safety they do at a more reasonable cost. Very few accidents can be attributed to software despite many incidents, although this might change as software gains higher authority. Infrastructure, for example in commerce, is potentially open to attack and we are continually learning how to make systems more secure.'

Learning from other disciplines

The Academy and the BCS are concerned that UK universities are not producing people skilled enough to deal with the rise in capability of

@ a glance...

Billions of pounds are wasted every year on new information technology (IT) systems, according to a recent report by the Royal Academy of Engineering and the British Computer Society

Both public and private sector systems are at risk. The Benefits Agency, the Passport Office and the Child Support Agency have all suffered expensive IT failures in recent years

Risk management is one of the most neglected aspects of IT project management

UK universities are not producing people skilled enough to deal with the demands of modern IT

The report recommends that all senior IT practitioners should be either Chartered IT Professionals or Chartered Engineers

The UK desperately needs systems architects and a UK Software Engineering Institute modelled on the American one

on IT projects

computing and communications technologies. Their report recommends that all senior IT practitioners designing and delivering high-consequence systems should be either Chartered IT Professionals – a new qualification launched recently by the BCS – or Chartered Engineers.

'It is time for the IT industry to recognise the engineering content of their work and to embrace the discipline and professionalism associated with traditional branches of engineering,' says Professor McDermid. 'In fact, there is a powerful argument that registration should be mandatory for people working on high-consequence systems like safety-critical or banking software. We think the Office of Government Commerce should consider this.'

One of the problems with cutting-edge software is that it is often hard to visualise what the system will do. 'I wouldn't ask an engineer to build a 1,000 metre long concrete beam suspended at one end because I know it can't be done – I have a physical perspective on it,' one respondent told the working group. 'With software it's never like that. We don't have any underlying feel for whether something is even feasible.'

It is a cardinal mistake to select suppliers for a complex IT project on the basis of price alone, since it is very difficult for suppliers to predict costs accurately at the outset. If a customer is asking for something unrealistic or ultra-high risk, the supplier should tell the customer and encourage them to review the project.

'It needs to be recognised that IT and software projects have many of the characteristics of traditional engineering programmes,' says working group Chairman Basil Butler. 'Many software and IT projects could benefit from employing the disciplines applied on other major projects.'

'The BCS firmly believes that increasing professionalism is key to improving success rates on projects,' says Professor Wendy Hall, President of the British Computer Society. 'It is fitting that this report should have been issued at the same time as the BCS launched its Chartered IT Practitioner scheme.'

Many witnesses consulted by the working group emphasised the fundamental importance of senior management backing for securing the success of a project. 'IT is now such



Medicine for the NHS: the world's largest non-military IT venture *Getty Images*

a big part of many businesses and organisations that an understanding of it now needs to be part of the tool kit of top management,' said one respondent. The report recommends that management schools ensure that IT is a core module of future MBA courses.

Systems architects are the key

'Projects are often poorly defined, codes of practice are frequently ignored and there is a woeful inability to learn from past experience,' says Professor McDermid. 'The role of systems architects is critical – their job is to translate a business vision into a technical blueprint. They often hold the keys to success in complex IT projects, but they are in very short supply. The UK could benefit enormously from exploring ways to identify and support people with these unique skills.'

Early identification of individuals with the capability to take on this role could be very beneficial to the UK. Skilled architects can command very high salaries. The report urges professional bodies to work with the Engineering and Physical Sciences Research Council to develop the skills of people with the potential to become systems architects.

The US Software Engineering Institute at Carnegie Mellon has made a profound impact on standards of professionalism in the United States. By focusing on technology transfer and embedding best practice within the industry, it has raised competitiveness and improved success rates. The report calls on Government and the Department of Trade and Industry to work with industry to set up a UK Software Engineering Institute, which could provide a valuable hub for academics and industrialists. By carrying out large-scale forensic studies of unsuccessful IT projects, such an institute could expedite the process of learning from failure at an industry-wide level.

Reference

1. *The Challenges of Complex IT Projects* is available online at www.raeng.org.uk or www.bcs.org.uk or in print from the Engineering Affairs Department at the Royal Academy of Engineering, tel. 020 7227 0500.

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The UK Energy Research Centre

Co-ordinating research will help to usher in a sustainable energy future, says Jim Skea

The UK Energy Research Centre was established by the Research Councils in April 2004 to co-ordinate UK research on sustainable energy. It will also facilitate collaboration with industry, encourage UK participation in international projects and establish its own multi-disciplinary research programme.



The UK Energy Research Centre aims to keep the lights on – sustainably

The Centre was set up on the advice of the 2002 Energy Research Review Group convened by the Government's Chief Scientific Adviser. It will be a 'networking' centre which will bring greater coherence to energy research activity in the UK as a whole. It will play a leading role in international networks and develop route-maps to identify the sequence of research problems that need to be solved in order to bring sustainable-energy technologies forward. It will also synthesise existing research to cast light on key policy and technology development issues.

The Centre has been established against the background of soaring oil prices, clear evidence of climate change and increasing dependence on energy imports - the harsh realities against which the Government drew up its energy strategy last year². Strikingly, its Energy White Paper was more than a reaction to these challenges. It distinguished the UK internationally by setting the long-term goal of cutting carbon dioxide emissions by some 60 per cent by 2050. Other aims are to maintain reliable energy supplies and ensure that every home is adequately heated. All this is to be done within the framework of competitive markets.

As we begin our work, what is the outlook for sustainable energy in the UK?

Immediate prospects

In the short term, the UK's dependence on fossil fuels will increase as existing nuclear power stations close. Production in the North Sea will decline and our self-sufficiency in oil and gas may well disappear by the end of the decade. Environmental pressures on coal, through a new EU carbon emissions trading scheme and tightening limits on sulphur and nitrogen emissions, may increase our dependence on imported gas supplies. Renewable energy will make inroads but will account for only a limited proportion of energy supply. Finally, advances in energy efficiency are being counter-balanced by underlying increases in demand for energy services in areas such as consumer electronics, commercial buildings and transport.

Against this background, the short-term policy challenge is to meet targets and obligations using existing and near-market technologies. The UK's Kyoto obligation of a 12.5 per cent reduction in greenhouse gas emissions looks assured but the domestic goal of reducing

carbon emissions by 20 per cent by 2010 is unlikely to be achieved. Targets for renewables and combined heat and power hang in the balance.

Reliability and security of energy supply are rising up the agenda. However, import dependence does not by itself imply insecurity. Security can be managed by maintaining stocks, constructing storage capacity, building redundancy into networks and ensuring a diverse range of supply sources. There is no absolute guarantee of security, but such measures will buffer the system against shocks. For individual consumers, failures in national networks are more likely to interrupt supply than disruptions to global supply chains. The performance of competitive markets in providing secure electricity and gas supplies needs continuing evaluation.

Long-term transformation

A radical transformation of the energy system is possible in the long-term. By 2050, energy demand could be much lower than today, with a diminishing reliance on fossil fuels. This will require technological advances, corresponding investments in R&D and changes in energy-consuming behaviour.

In electricity supply, there are many options. The UK has a large potential for renewable generation and is particularly well-endowed with wind and marine (wave and tidal) resources. Biomass energy, based on crops such as oil seed rape or willow coppices, could in principle meet a significant proportion of electricity demand. However, land use implications and the organisation of the supply chain need to be addressed. Solar photovoltaics (PV) may be more expensive than other renewable options but could be integrated into building design. Other than onshore wind, which is a mature technology, R&D could improve the cost and performance of each of these options.

Nuclear power remains controversial, but costs and reliability have undoubtedly improved. Some countries, such as Finland, have initiated new nuclear projects. There are still obstacles in the UK, including capital costs and

the time required to secure planning permission. This makes it difficult to secure finance given competitive electricity markets where risks fall on investors rather than consumers or taxpayers. In the longer term, the pay-off from nuclear fusion, should it prove successful, would be vast. Given the high cost of R&D in this field, the UK is participating in a shared international programme of research.

Carbon dioxide from fossil fuels can be captured from combustion gases and used for enhanced oil recovery or stored in geological formations. At current carbon prices this is not economic but, with more research on storage issues, including the environmental dimensions, this could ultimately be a feasible option.

Reducing energy demand

Energy demand can be reduced through well-designed policy instruments that encourage investment in energy efficiency and promote changed patterns of behaviour. But technology also has a major role to play. Novel methods of insulating the traditional housing stock would yield enormous benefits. Reducing electricity consumption in consumer electronics, perhaps by installing low voltage networks in houses, would curb rising electricity demand. The distinction between supply and demand would be blurred by installing solar PV or micro-CHP (combined heat and power) in individual homes.

In the transport sector, aviation is a rapidly growing source of greenhouse gas emissions. In the absence of radical technological alternatives, curbing emissions from aviation appears to depend largely on modifying travel behaviour. Technological developments could have a more radical impact on road transport. Cars are becoming more fuel efficient and novel hybrid engine technology (combining the petrol engine with an electric motor) is having a small

but perceptible market impact. In the longer term, the link between road transport and oil use could be broken. One option is to use biofuels. An existing EU Directive requires member states to set indicative targets for biofuels for 2010, aiming at 5.75 per cent of the market.

The more radical option would be a move towards the much-hyped hydrogen economy. Cars powered by hydrogen fuel cells would emit only water vapour. Such a move would take decades and there are many obstacles, both technological and logistical. Better hydrogen storage is needed for transport uses. New infrastructure would be needed to deliver hydrogen to users. Hydrogen can be produced today by reforming natural gas but, over the whole fuel cycle, this results in higher carbon emissions than a conventional engine. 'Carbon-free' hydrogen could come from electrolysis using non-fossil electricity, from direct production (biomass, nuclear) or from fossil fuels in combination with carbon capture and storage. In practice, fuel cells will be used initially in portable applications and other niche markets.

The role of R&D

Radical transformations are possible, but sustained R&D activity is needed. Public support for energy-related R&D has declined dramatically in the UK over the last twenty years. The decline has been more rapid than in many other developed countries. The privatisation of the nationalised energy industries, which had active research programmes, may have contributed to this apparent decline.

The Chief Scientific Adviser identified six priority areas for research: carbon capture and storage; energy efficiency; hydrogen production

and storage; nuclear power, focusing on waste; solar PV; and wave and tidal power.

These choices reflect strategic impacts on energy security and carbon emissions, the current status of the technologies and the UK's competitive position.

Co-ordinating energy research

Interdisciplinarity will be at the heart of the Centre's philosophy. This reflects both the scientific challenge and the wider energy policy context. The need for public engagement, the role of competitive markets and the environmental consequences of energy sector activity make a 'whole-system' approach essential. To give just one example, adapting current electricity transmission and distribution networks to accommodate small-scale distributed renewable generation in a competitive market demands collaboration between electrical engineers and regulatory economists.

The Centre's activities will be organised round three themes: energy demand reduction; sources of energy; and infrastructure and supply. Cutting across these are three further themes which address: the energy system as a whole and how it can be modelled; the sustainability of energy systems, including the capacity of the natural environment to support various forms of energy supply; and the rational design of new materials in areas such as photovoltaics, hydrogen production, nuclear waste storage and thermal insulation.

Climate change and energy security are critical policy challenges. Technology is essential, but it will not provide all the answers. The UK Energy Research Centre represents a unique effort to galvanise the joint efforts of natural scientists, engineers and social scientists in an interdisciplinary fashion.

References

1. Chief Scientific Adviser's Energy Research Review Group (2002). *Recommendations to inform the Performance and Innovation Unit's Energy Review*. London: Office of Science and Technology
2. Department of Trade and Industry (2003). *Our energy future – creating a low carbon economy*, Energy White Paper, Cm 5761. London: TSO

@ a glance...

The UK Energy Research Centre has been established by the Research Councils to co-ordinate UK research on sustainable energy

In the short term, the UK's dependence on fossil fuels will increase

A radical transformation of the energy system is possible in the long term

Important technologies would include novel methods of insulating the traditional housing stock, reducing electricity consumption in consumer electronics and breaking the link between road transport and oil use

Sustained research and development, interdisciplinary research and co-ordination will be crucial for this future

The new Centre will galvanise the joint efforts of natural scientists, engineers and social scientists towards sustainable energy for the UK

Professor Jim Skea
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Caring for Europe's water

Rob Flavin welcomes a new regime

The new European Water Framework Directive is changing the way we care for our rivers, lakes and coastal waters.



First find your river... The Water Framework Directive will help to avoid situations like this

The old regime specified maximum acceptable levels of pollutants. Under the new one, managers will have to move to an holistic approach designed to enhance waterbodies, ensure the sustainable usage of water, reduce pollution, and lessen the effects of floods and droughts.

Environmentalists welcome the Directive as a major step forward, and ecologists and hydrologists are excited by the scientific challenges it brings.

An old problem

Concern for the health of our waterbodies is nothing new. An Act of Parliament in 1383 ordered that anyone with latrines over Wallbrook Stream – a tributary of the Thames – should pay two shillings a year towards the cost of the clean-up. Sadly, this early environmental awareness was lost and sewage effluent, industrial discharges and thermal pollution from power stations eventually left the lower reaches of some of our larger rivers totally devoid of life. It was not until the late 1960s that the work to reverse this began.

The task fell predominantly to municipal authorities whose areas of jurisdiction were marked by political boundaries. This was a problem as a single river could be the responsibility of several councils, and there was little or no coordination of effort. The Water Act of 1973 helped overcome this by creating regional water authorities. Their boundaries were defined by the catchments – or drainage basins – of our major rivers. This approach has endured and these boundaries define the domains of our current water companies and the regions of the Environment Agency.

Whilst the move to a catchment-based system solved one problem, it highlighted another: that decisions taken by Local Authorities – particularly on planning – could impact on the health and function of waterbodies. A very visual and politically sensitive example of this is the flooding of new housing developments which planners allow to be built on floodplains.

The Water Framework Directive will remedy this by requiring each catchment to have its own River Basin Management Plan that will

bring together the managers, planners and other stakeholders, who will have to act in concert to meet their new responsibilities. The management plans will also include a novel approach to managing water quality.

From pollution limits to healthy ecosystems

Existing legislation lays down acceptable limits for chemicals. These limits change depending on the intended use of the water. For example, a site from which water is to be abstracted for human consumption will have stricter limits than a salmon fishery.

This is not an ideal approach as it is focused too much on people's needs, and it could fail to protect waterbodies that do not have a recognised purpose. The reassuring aspect of the Directive (which was enacted into national law in December 2003) is that it will apply to every river, lake and coastal water. The belief is that a waterbody with a healthy ecosystem is fit for *all* uses.

If healthy ecosystems are an objective, there has to be a well-defined reference condition that can be applied to the whole of the European Union. This is a major challenge considering the variety of topography, geology and land-cover across the region. However, this challenge is neatly overcome in one short sentence. The Directive states that all waterbodies should, as a minimum requirement, achieve 'good ecological and good chemical status' by 2015. This is clear... until you start to think. What is 'good status'?

Measuring health

In this case, it describes how a waterbody would be if it were only slightly modified by human impacts. Having to return a degraded waterbody to something close to pristine, however, could be unacceptably expensive and may have massive societal and cultural implications. So, which point in history should we set as our reference? Pre-agricultural? Pre-industrial?

Putting aside costs and benefits, there are a number of considerations that could affect the decision. For example, when a river or lake recovers from a pollution incident, it does not

always return to the same state as before. In other words, the same physical conditions can support a different ecosystem. Also, human activities aren't necessarily detrimental. The output from sewage treatment works can change important factors such as nutrient and oxygen levels. This may lead to a richer environment that is neither better nor worse – just different. It is not surprising, therefore, that the working group with the responsibility of defining reference conditions is still hard at work.

Whichever definition of 'good status' is chosen, the task of delivering it in each country falls to a nominated competent authority. In England and Wales it is the Environment Agency. In Scotland it is the Scottish Environment Protection Agency, and in Northern Ireland it is the Environment and Heritage Service. They each have a daunting task as there are many powerful stakeholders in water. Lengthy consultations have been conducted and, with the initial cost of implementation in the UK estimated to be £4 billion, there is a big incentive to ensure that all decisions are based on best available knowledge.

'When we are establishing healthy ecosystems and balancing the needs of competing pressures such as food production and energy generation, it is essential that all decisions are underpinned by sound scientific knowledge,' says Professor Alan Jenkins of the Centre for Ecology and Hydrology. 'While there is good understanding of individual components of the water cycle such as river flows, point pollution, diffuse pollution and the ecosystem, the Directive relies on an integrated understanding.'

This is one area where the Directive is demanding a quick response from the scientific community, and it is also prompting researchers

to explore new ways of advancing proven techniques.

Establishing river quality

The River Invertebrate Prediction and Classification System (RIVPACS) is an established method of assessing the biological quality of rivers. It is a record of the presence of invertebrates at a site, along with the environmental and hydrological characteristics of the location. This has been done at a vast number of unstressed river sites and a substantial database of river characteristics and associated invertebrates now exists.

Researchers have used these data to develop models that can predict the expected invertebrate community at any river site if it were pristine. The actual invertebrate community is then measured, and the differences between the observed and expected community provides a quantitative measure of the extent to which a river ecosystem is stressed.

This approach is ideal for use within the Directive, but samples need to be sorted and identified by microscope. This is a specialised, time-consuming and labour-intensive process, and the related costs could be prohibitive if it were applied to a high number of sites on a regular basis. However, new gene-based technology may overcome this obstacle.

Researchers are aiming to obtain gene fragments of each of the four hundred invertebrate species within RIVPACS and record the gene sequences on a chip. A prepared water sample – a sort of 'gene soup' – is compared to the information held on the chip. An automated system will then record the occurrence and abundance of invertebrates in the sample. This is an exciting prospect and a good example of new technology meeting the demands of policy.

The River Invertebrate Prediction and Classification System (RIVPACS) is an established method of assessing the biological quality of rivers.

Building up the data

Advances in the lab can be made only when there is a thorough understanding of real-world processes and when there are high quality supporting data available. This means there is an on-going need for good field-based experimental facilities. Fortunately, although most catchment experiments and infrastructure around the world have been run down over the past twenty years, the Natural Environment Research Council (NERC) has invested heavily in instrumenting three catchments as part of the Lowland Catchment Research Programme.

This facility allows intensive measurement of all the components of the water balance, including the chemistry. In addition, NERC-funded research projects link the ecology within these catchments. It is a five-year programme that will deliver an invaluable database and an abundance of applied research outputs that are relevant to the Directive.

This gives Alan Jenkins confidence that the UK is in a position to lead in the implementation of the Directive. As Chair of EurAqua – the European network of freshwater research organisations – he is aware, however, that there is a desire to think even bigger. 'Whilst it is encouraging that water is seen as so important, it cannot be tackled in isolation. Reforms to agreements such as the Common Agricultural Policy could have massive implications for water that could go beyond what the Directive can cope with. At some stage in the future, the principles and lessons learnt from the Water Framework Directive need to be taken and applied more widely so that "good status" is something that we can expect for the environment as a whole,' he says.

@ a glance...

The new European Water Framework Directive sets the standards for water quality in Europe

It changes the approach from defining maximum levels of pollutants to holistic management of our rivers, lakes and coastal waters

The Directive requires all waterbodies within the European Union to have 'good ecological and good chemical status' by 2015

Defining 'good status' is an interesting exercise, and it is yet to be finalised

The need for basing all decisions on best available knowledge is prompting researchers to explore new techniques to measure the health of waterbodies

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Transport for the Olympics

David Begg urges London to emulate Sydney

There is one word that keeps recurring every time mention is made of the UK's 2012 Olympics bid - transport. And it's not hard to see why, when the chosen location for the bid venues is Hackney, which lacks a tube station and has arguably the most to gain from the regeneration benefits the Games will bring.

To see why transport is so important one only has to look back at recent Games to see what happened. The Atlanta games were blighted by the failures of the early bus services, while Sydney's triumph was underpinned by excellent public transport.

Although London had 1.7 billion bus journeys alone last year and the innovative congestion charging scheme cut Central London traffic congestion by 30 per cent, there are still lessons the London bid team can learn in funnelling so many people into a new location in such a short period of time

Lessons from Sydney

At Sydney, the car was banned from all venues and the roads leading to them. Public transport fares were included in ticket prices. Sports lovers homed in on the venues at the rate of up to 400,000 a day. In all there were 22.5 million public transport journeys to the Games – an immense achievement for Sydney.

The entire city was braced for 50 per cent more bus passengers and 80 per cent more rail during the Games. Fully 3.5 million people got to the Games sites by train while 3350 buses were drafted into service.

Special Olympic bus lanes were introduced

on the 140 kilometre-long network of primary routes, while 500 kilometres of road were designated as clearways.

These measures are not for the faint-hearted, but in traffic-choked Sydney anything less would have spelt disaster for the Sydney Games rather than the triumph they became.

Opportunities for London

So where does that leave us with Hackney? It's a part of London with an antiquated roads network which has barely changed in 100 years, no underground lines and a lack of heavy rail facilities.

Let's look on the bright side. Part of the Games benefit for the UK is the regeneration opportunities the Olympics will bring – the chance to create work, environmental, amenity and social benefits, all triggered by the major boost that public transport improvements and Games amenities would offer.

London already handles 11 million public transport passengers each day and the Mayor is not afraid to take radical longer-term measures such as congestion charging, let alone introduce short-term restrictions.

Few of those who were there will forget the pleasure of roaming in an entirely traffic free

Central London during the Queen's Golden Jubilee. Far from being an imposition, people could not believe their luck.

Transport for the Games will be a cross London issue – managed by the same team who control services daily and have managed down the role for the car and encouraged millions of extra public transport journeys each year.

The capital has 13,000 kilometres of road, 580 kilometres of red routes, 700 bus routes and over 7000 buses. London has five international airports at our doorstep, a brand new Channel Tunnel Rail Link with a key stop at nearby Stratford and is pushing hard for new initiatives.

East London line is crucial

The Government has at last officially backed Crossrail, which will link the Isle of Dogs in the east and Heathrow airport in the west, and confirmed that the East London line will go ahead. This line will connect Hackney in the east with Chelsea in the west. Whether either of these can be built before 2012, however, remains to be seen.

While it would have been a bonus if Crossrail could have been completed on time for the Games, it is the extension to the East London line that is really crucial to the future of both the Olympics and Hackney.

We have a great tradition of thinking the worst in this country as well as planning ourselves to death.

Congestion charging was howled down by its critics until day one – when it proved an instant success. Crossrail meanwhile has been analysed to death. It has been subjected to review after review by Government after Government. We need funding now and to get on and construct it, irrespective of the Olympics.

Many of London's recent transport improvements have largely by-passed Hackney – although it does have the UK's most improved bus services and a 70 per cent increase in cycling in the past decade. But it is not hard to imagine the benefits that could be delivered when the UK's bid is successful next year and our transport planners can put their whole focus on benefits to just one small and very deserving part of London.

Look, London! – all aboard for the Sydney Olympics Sydney Olympic Park Authority



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UK policy on science and innovation

Sustainable development should dictate, maintains Stuart Parkinson

Chancellor Gordon Brown's ten-year investment framework for science and innovation¹ is clear that economic priorities are to be given even greater emphasis in shaping UK science.



The Ministry of Defence spends more on R&D than all the civil Departments put together
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What's also clear (but you have to look carefully at the detail to find it), is that the military will continue to exercise considerable power over public R&D finances. Currently, the Ministry of Defence is the single largest spender in this area, responsible for 30 per cent of the total budget.²

To give the Government its due, it has identified other key dimensions of science and innovation policy. It mentions the importance of science and technology in contributing to quality of life and environmental sustainability. It also aims to get public services to make better use of scientific research. It even highlights how critical it is to maintain public confidence in the area. But it proposes far too few measures to ensure these issues are tackled.

The Government does not seem to appreciate the scale of the conflict between innovation for these socially responsible needs, on the one hand, and its focus on economic priorities and the pervading influence of the military, on the other.

Business tail wags the research dog

Possibly the most important example of this conflict concerns the prominence given in the framework to a large-scale expansion of business-university collaboration.

One of the single biggest factors in public concern over experimental technologies such as GM crops is the way that industry is driving the R&D, especially through the funding of university researchers. The public is justifiably worried that this is leading to the erosion of academic independence and hence the ability

to warn of possible damaging side-effects of these technologies.

Furthermore, economic growth, assisted by current patterns of technological development, is driving unsustainable levels of consumption and leading to global environmental problems such as climate change and loss of biodiversity. We will fail to tackle these problems if we do not place much greater emphasis on environmental concerns when deciding what technologies to commercialise.

Sustainable development

Given that some commercialisation of science and technology can help tackle important current problems, how can we ensure wide benefits? One critical way is to make sustainable development the driving force behind UK science and innovation policy, instead of just economic growth. This would lead to a much stronger emphasis on social and environmental criteria within grant schemes, regulatory measures and other incentives that steer innovation such that these pressing problems are tackled.

Some such steps have already been taken in, for example, the field of sustainable energy, but we need many more. Furthermore, to help us judge when and if innovation is positive from a social/ environmental point of view, there need to be more protected sources of independent, scientific expertise. This could be achieved by the creation of more research centres (especially those with an interdisciplinary focus) which are clearly independent of business.

In parallel with this, there needs to be increased access to scientific expertise by community, environmental and other similar groups so that research can be carried out in areas which they consider a priority. One way of doing this would be to set up a 'Community Research Council': one whose funding would only be available for use by public interest groups.

Taking on the military

The other main problem with the ten-year framework is the heavy presence of the military. With £2.6 billion of tax-payers' money currently being spent annually by the Ministry of Defence on R&D – larger than all the civil Government departments put together – it is about time a

little democratic light was shed on this area.

This argument is made all the more compelling in the light of the Chief Scientific Adviser's assertion that climate change is a more serious threat than terrorism. If this is so, why can the annual public funding of R&D on sustainable energy only be measured in tens of millions?

If we make sustainable development the driving force behind all publicly-funded science and innovation, then we should carry out a large-scale transfer of military funding to civil work.

The Blair Government has been good to UK science. Public spending this year on the 'science and engineering base' is 54 per cent higher than it was five years ago.³ In a speech to The Royal Society last May, Tony Blair publicly defended scientists against a 'culture of unreason' on issues such as GM crops and animal experiments. Gordon Brown's investment framework includes a further major expansion in funding, together with policies designed to ensure the UK remains a world leader in scientific and technological excellence.

But if the Government is serious about ensuring that UK science and innovation plays a key role in improving the quality of life, it needs to stop the current favouritism given to business and the military. Only through a fresh outlook will we realise the potential of science to contribute meaningfully to achieving sustainable development.

For a more detailed discussion of these issues, see SGR's response to the consultation on the ten-year science and innovation investment framework and other related articles at: <http://www.sgr.org.uk/SciencePol.html>

References

1. HM Treasury, DTI, DfES (2004) *Science and innovation framework 2004-2014*
2. OST (2003) *The Forward Look 2003: Government-funded science, engineering and technology*, OST, London
3. The science and engineering base is made up of the Office of Science and Technology (OST), the seven Research Councils and the Higher Education Funding Councils. Its 2004/05 spending is £4.3 billion. Figures from OST (2003): as note 2

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Future food and sustainability

Dear Editor,

Professor Crute (*S&PA*, March 2004, p 22) is justifiably proud of the fact that we can now grow enough food to give over 80 per cent of us a good diet. What he does not mention is that this result is entirely dependent on a plentiful supply of fossil fuel, both for fixing nitrogen and for operating machinery.

By the time my great grandsons are my present age – if they have the good fortune to live that long – cheap fossil fuels will certainly no longer be available. It follows that 90-95 per cent of the protein consumed by them will have to be of vegetable origin: legumes or leaves.

The late Bill Pine, working at Rothamsted during World War II, recognised this fact and developed the leaf fractionation (LF) process. This has been applied in many countries to supplement the diet of undernourished children, with spectacular success. The process is being used on lucerne (alfalfa) in France on a big scale to produce a protein curd which is used to supplement the feed of dairy cattle, and for feeding non-ruminant animals such as chicken and pigs. The company also produces a product for humans.

About 10 years ago I recognised the value of this process for Africans, and we are now working with the Ugandan Government on a

proposal to apply the LF process to harvested water hyacinth. This would both reduce eutrophication in Lake Victoria, and provide a new industry giving employment. This industry will be based on the use of the roots as fuel, the use of the stems for manufacture of many useful products, and the use of the leaves in the LF process to produce protein curd, fibrous matter suitable for ruminant feed and a sugar containing liquor. This industry will not pay the whole economic cost of the process, so it will have to be subsidised because its main benefit is that it enables the vital fishing in the lake to continue.

We are also working with a Nigerian professor, who has responsibility to the President for cassava, on a scheme to install small LF plants to work on farms all over the country. These would use leaves, both from specially closely planted cassava and from other plants, to enrich cassava for export and, more importantly, for food. We are planning two sizes of plant, the smallest one pedal-powered and the larger one using some 4 kW from photovoltaics.

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Dear Editor,

Professor Thring makes a very good point in his response to my article about plant science.

Primary agricultural production of sufficient calories and protein for the world population is substantially dependent on inputs of inorganic nitrogen derived from the energy-demanding synthesis of ammonia by the Haber-Bosch process. At present, natural gas is the primary source of energy for the process, but a proportion of synthetic nitrogen fertiliser is being produced using electricity derived from renewable energy (such as hydro), and we can expect this proportion to grow rapidly in the coming decades. I would argue that, from the perspective of long-range environmental sustainability, it is the management of gaseous and soluble nitrogen efflux from agricultural systems that represent a greater concern than the source of energy for synthesis.

Professor Thring is also right to point out the dependency of agriculture on practices such as ploughing, harvesting and spraying that involve combustion of fossil fuels. He could have added our dependency on petrochemical-derived crop protection, and the finite global limits to land for arable production, as additional constraints on sustainable food supplies.

I believe we are in close agreement that science must continue to be focussed on these issues. We need new sustainable practices and products that will, over time, substitute our over-reliance on fossil-carbon energy inputs to food production while sustaining, over the generations, a predictable (and almost certainly increased) per hectare output of biomass with the nutritional quality demanded by developing human populations.

I am optimistic that rapid advances in plant and associated sciences genuinely hold out the prospect for the emergence and application of new sustainable technologies. Any pessimism I may have derives not from what is achievable but more from the short-term complacency of affluent societies and their seeming loss of commitment to scientific endeavour in pursuit of these objectives.

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Israeli Defence Force soldiers block access to Birzeit University

Partial picture

Dear **Editor**,

I welcomed the June 2004 issue of *S&PA* as it handled the problems of conflict with balance and sophistication, not least in the tense 'academic boycott' debate. However impartiality slipped when it came to the images, and the sole picture was that of the Israeli scientist.

To preserve the journal's impartiality I would suggest publishing also a counter image, such as that used by the Birzeit University campaign for Palestinian academic freedom. This shows Israeli Defence Force soldiers standing before the chained gates of Birzeit University denying access to Palestinian academic staff and students alike.

Remember too, that despite Professor Lappin's claims, every Israeli has done or does military service. In consequence academics and soldiers are not quite such separable groups as they are when the army is professionally recruited.

Lastly, while a handful of courageous Israeli

academics strongly protest their country's abuse of the human rights of Palestinians (documented also by Amnesty International), most are silent and thus give tacit support to the Sharon regime.

Academics and soldiers are not quite such separable groups as they are when the army is professionally recruited.

Professor Hilary Rose
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Correction

Dear **Editor**,

Unfortunately, the version of my article that was included in the June 2004 issue of *S&PA* ('Ignoring climate change', p 24) was not the final one. The published sentence about Hardin is not what he himself meant by the term 'Tragedy of the Commons'. The sentence which starts, 'This relates to what Hardin called...' should read: 'This relates to what Hardin called "the Tragedy of the Commons" - the inevitable degradation of the environment as a result of people's tendency to maximise their personal benefit from this unowned, public resource.'

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Severe weather warnings

Rachel Tonkin dissects an increasing need

Climate change may double the risk of flooding in some areas of the UK by the end of the century.

As the frequency of severe weather events increases, it is becoming ever more important to ensure the public are given the right information in order to protect themselves. The latest SPA Forum, sponsored by the Met Office, was held in Edinburgh to discuss the difficulties of issuing severe weather warnings. The speakers were Ewen McCallum, Chief Meteorologist at the Met office, David Faichney, Leader of the Flood Warning Development Team at the Scottish Environmental Protection Agency (SEPA), and Irene Lorenzoni from the Centre for Environmental Risk, University of East Anglia.

Effective warnings

Although it is impossible to eliminate flood risk altogether, it is possible to manage it.

Effective weather warnings play a vital role in minimising the risks, and the way these are communicated to the public can make all the difference to how people respond to the warning.

The focus should be on providing a simple message, in spite of the fact that weather forecasting has become more technical over the

last decade.

It is also important to alert the public to the uncertainty of each forecast, especially as the further in advance a forecast is given, the less certain it is.

Weather warnings also have to provide the probability of each weather event happening. A major problem of issuing severe weather warnings is that the probability of the most extreme events occurring is very low; if an event seems very unlikely then the public do not always take it seriously.

Scotland too

The Met Office's predictions not only have to be tailored for the general public, but also for specialist organisations such as SEPA.

The Met Office and SEPA work with meteorologists and hydrologists to provide information and give individual river and loch flood warning levels, alerting local authorities if necessary.

SEPA identifies high-risk areas by looking at historical data and using global positioning

systems to create digital maps of areas at risk. They are building up long-term data to help identify those areas and also run a flood information phoneline.

Getting to grips

Flood warning is a key part of flood risk management, so more time and effort will need to be spent on this in the future. But experts also recognise the need to look at the bigger picture - cutting down greenhouse gas emissions.

Reference

1. A longer report of the event is available at <http://www.the-ba.net/the-ba/CurrentIssues/ReportsandPublications>

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Wind turbines? – no thanks!

Jack Harris prefers nuclear power

Work your hands from day to day, the winds will blow the profit- Louis MacNeice

Each year we have a holiday in Scotland.

Our last stop in England when we are travelling north on the M6 is invariably the excellent Tebay motorway service station just south of Penrith. It is privately owned and largely run by local people, many of whom are from the nearby Tebay village - from which the service station derives its name.

It was here, a year ago, that I first learned of the proposal to construct one of the country's largest windfarms along a stunning Cumbrian ridge at Whinash, close to Tebay. This is a precious piece of land, which stands between the Lake District and the Yorkshire Dales. If the scheme receives approval, 27 wind turbines each generating 2.5 megawatts of electricity [MW(e)] would be strung along five miles of this beautiful moorland ridge. Each would be more than a 100 metres high and would require 1,000 tons of concrete to hold it in position.

The proposal is bitterly opposed by the local people and they run an anti-Whinash windfarm stall at the service station. They have the support of a number of celebrities, including David Bellamy and Melvyn Bragg.

Writing in the *Times*, top columnist Simon Jenkins, came close to comparing the desecration of Whinash to the deliberate burning of a Constable painting.

The wind of course also produces good vibrations – brightly coloured kites and the billowing sails of yachts, shimmering aspen trees and the slowly rotating vanes of picturesque Dutch windmills. To go further and extract free energy from the free wind seems entirely virtuous, so why not build wind turbines?

Simon Jenkins came close to comparing the desecration of Whinash to the deliberate burning of a Constable painting

Drawbacks

The main problem is that wind turbines do not generate much electricity. The power that they do generate varies as the area swept out by the blades, so huge machines are *de rigueur*.

The power produced is also proportional to the cube of the wind velocity, so huge machines at elevated positions, where they cause maximum visual damage, are essential.

Another drawback is that the wind blows only intermittently, so the blades are motionless longer than they are turning. The ratio of the latter (the time it is generating) to the former (when it is 'stood down') is known as the load factor. The government attributes to wind a load factor of 35 per cent for its calculations, but this seems unduly generous; from Danish experience values within the range 20-25 per cent are more usual. This can be compared to a load factor of between 75 per cent and 90 per cent for fossil or fissile-fuelled stations. It follows that 3000 1MW(e) wind turbines would be needed to match the annual output of a 1000MW(e) fossil or fissile station.

If wind turbines are packed too close together they interfere with each other; in fact it is only possible to harvest about 3 MW(e) of wind power per square kilometre of land. Taking this into account, it can be calculated how large a windfarm would be needed to equal the output of a standard 1000 MW(e) fossil or fissile station. It turns out to be about 1,000 sq km, an area slightly larger than that occupied by Monmouthshire or Bedfordshire. An alternative of course would be to create another 44 Whinashes!

Lost generation

The government's target of 10 per cent of our electricity being supplied by renewables by 2010 seems unattainable. It has been calculated that to meet the target would require the installing of eight 1 MW(e) offshore wind turbines *each day* until 2010' - an impossible task. The 2020 target seems just as unrealistic. Professor Ian Fells has calculated that if all the wind turbines in the world today were concentrated in this country, they would only just be able to provide 20 per cent of UK electricity. Even if the target of 20 per cent renewable contribution were to be achieved, this would only just match the planned decline in nuclear generation, so there will be no net savings on carbon dioxide emissions.

I have just returned from this year's annual

Another drawback is that the wind blows only intermittently, so the blades are motionless longer than they are turning

jaunt to Scotland. On the up journey we of course stopped at Tebay service station, picked up some leaflets from the anti-Whinash stand and started on our last lap to the Scottish border. Turning left at Gretna, we were soon alongside the Chapel Cross nuclear power station, which is to close next year. Will the lost generation be supplied by wind turbines, I wondered - just 10 Whinashes or 600 1MW(e) wind turbines would do the trick. The station staff would like to see a brand new nuclear station rise from their station's ashes - Chapel Cross II. I wish them well, but I don't fancy their chances.

References

1. *Nuclear Issues* 25 April-May 2004

Websites

- www.nowhinashwindfarm.co.uk/
- www.raeng.org.uk/policy/reports/



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Science: no use by itself

Ian Gibson reflects on his trip to Malawi

I recently met with President Bingu Wa Matharika of Malawi, during a Select Committee visit to the country. We were there as part of our inquiry into the use of science in UK international development policy.

During this meeting, the President outlined the country's dependence on science for its recovery, and in welcoming the help and cooperation his government had received from ours, he stated that the focus on science and technology was 'music to my ears'.

The president has moved the science portfolio from Education, where it was just viewed as a subject to be studied, to Industry, under a new minister and to a new Ministry of Information which is going to be heavily involved in technology transfer, providing information to the private sector on how to benefit from new technologies.

New programmes are also being developed, with the Department for International Development, on using technologies for the benefit of farmers.

This is all good news, but over the course of the visit (which focused primarily on agriculture and health) our attention was drawn to a complexity of problems that cannot be resolved through the promotion of technology alone. In order for it to be applied fruitfully, a host of other social and political issues must be taken into account.

Science and social conditions

First of all, it is difficult to persuade farmers to change their methods and switch from very basic technologies. Then, when law and order has broken down to such a degree as in Malawi, there is no point in simply providing farmers with tractors and other equipment, as they are guaranteed to be stolen. Similarly, half the drugs delivered to the country tend to fall off the back of a lorry and be sold on the black market, into the private sector, or across the border to Mozambique.

While corruption and lawlessness is clearly a problem, another major obstacle to progress is the severe shortage in human capacity. Advanced hospital equipment often lies idle without the technical support staff to set it up, calibrate and maintain it. Lilongwe Central Hospital has one nurse to 80 patients and, of the 480 nurses trained last year in Malawi, 400 are missing in action. Many have been poached

by the private sector or are working in other countries – in fact it would not be an exaggeration to say that Malawi is in part helping to fund our own National Health Service.

As well as the problems of retention, we cannot ignore the fact that many trained personnel are lost to HIV infection and AIDS. The Global Fund has helped with the provision of antiretroviral drugs, but again the human capacity to distribute them and make sure they reach sufferers is lacking.

Furthermore, we also need to be more conscious of the effects of politically and commercially mishandled science and its potential to impede advances where they are most needed. This was brought home to me at a research station in Chitdeze, which is looking into ways of improving crops. When asked if they were working on GM crops, we were told that 'GM is not a nice word'.

UK response

My point is not that introducing new technologies is pointless in this environment, but that its application cannot be isolated from a proper consideration of many other, often basic and overlooked, factors. We need to recognise that science is integral to policy, whether on health, environment or international development. It needs to be applied within the context of social and political realities if it is to have a positive impact and bring about change. Even the most basic technologies are of no use without this.

In discussing the matter with the Secretary of State for International Development, Hilary Benn, it was clear to me that science has still to be taken out of its box and seen as

While corruption and lawlessness is clearly a problem, another major obstacle to progress is the severe shortage in human capacity.

As well as the problems of retention, we cannot ignore the fact that many trained personnel are lost to HIV infection and AIDS.

underpinning, rather than supplementing, policy. But the outlook is favourable. The Secretary of State has announced plans to employ a Chief Scientific Adviser in the Department for International Development. He acknowledged the Committee's role in stimulating this decision.

It is unusual for the Science and Technology Select Committee to be scrutinising this department, but transcending such barriers no doubt helps promote a more comprehensive understanding within both government and society of the role science has to play and how it is to be viewed across differing contexts. The recent Spending Review sees the Chancellor announcing an increased budget for overseas aid, particularly to Africa. I hope to see some of the recommendations in our report receive some of this extra funding.



Dr Ian Gibson MP
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The resource is linked to **BA CREST**, the nationally recognised, project-based scheme for students aged 11-19. **BA CREST** Awards encourage students to develop their scientific curiosity, problem-solving, communication and practical skills for use in the ‘real world’.

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With over 20,000 students taking part so far **BA CREST** is clearly meeting a demand for more exciting, relevant and practical science in schools. The new resource makes it even easier for students to investigate the subjects that really interest them.

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