

fst journal

The Journal of the Foundation for
Science and Technology
(formerly Technology, Innovation and Society)

Volume 18, Number 7, February 2005

Public health

Sir Derek Wanless: Engaging the public

Melanie Johnson MP: Working in partnership

Lucy Neville-Rolfe: Healthy choices

Professor Siân Griffiths: Lessons from SARS

Realising the value of the genome

Dr Richard Durbin

Risk perception

Sir John Krebs: Trustworthy policies

Professor Ian Diamond: The research/society interface

Professor Nick Pidgeon: Understanding and managing

Obituary

Dr Richard Haas



THE FOUNDATION
FOR SCIENCE AND
TECHNOLOGY



THE FOUNDATION
FOR SCIENCE AND
TECHNOLOGY

THE FOUNDATION FOR SCIENCE AND TECHNOLOGY

Registered Charity No: 274727. A Company Limited by Guarantee No: 1327814

VICE PRESIDENTS

The Earl of Shannon
The Lord Flowers FRS
The Earl of Selborne KBE FRS
Sir Brian Jenkins GBE
Viscount Runciman of Doxford CBE PBA

COUNCIL

CHAIRMAN

The Rt Hon the Lord Jenkin of Roding

The President of the Royal Society The Lord May of Oxford OM AC Kt PRS FMedSci
The President, The Royal Academy of Engineering The Lord Broers FRS FEng
The President, The Academy of Medical Sciences Sir Keith Peters FRS PMedSci
The President, The Science Council Sir Gareth Roberts FRS FEng
Chairman, The Arts and Humanities Research Board Professor Sir Brian Follett FRS
Chairman, The Engineering and Technology Board Sir Peter Williams CBE FEng FRS
Chairman, The Biotechnology and Biological Sciences Research Council Dr Peter Ringrose
Chairman, The Council for the Central Laboratory of the Research Councils Professor Sir Graeme Davies FRSE FEng
Chairman, The Economic and Social Research Council Ms Frances Cairncross CBE FRSE
Chairman, The Engineering and Physical Sciences Research Council Professor Julia Higgins DBE FRS FEng
Chairman, The Medical Research Council Sir Anthony Cleaver
Chairman, The Natural Environment Research Council Mr Rob Margetts CBE FEng
Chairman, The Particle Physics and Astronomy Research Council Mr Peter Warry

Dr Robert Hawley CBE DSc FRSE FEng (Deputy Chairman)
Mr Patrick McHugh (Honorary Secretary)
Mr Tony Quigley (Honorary Treasurer)

Professor Polina Bayvel FEng
The Lord Browne of Madingley FEng
Sir Geoffrey Chipperfield KCB
The Lord Haskel
Dr Geraldine Kenney-Wallace FRSC
Sir John Krebs FRS
Sir Hugh Laddie
The Lord Oxburgh KBE FRS
Sir Martin Rees FRS
Dr Michael Sanderson
The Lord Soulsby of Swaffham Prior FMedSci
Professor Sir William Stewart FRS FRSE
The Lord Sutherland of Houndwood KT FBA PRSE
Professor Mark Walport FMedSci
The Baroness Wilcox

DIRECTOR

Dr Dougal Goodman

The Foundation for Science and
Technology
10 Carlton House Terrace
London
SW1Y 5AH

Telephone
020 7321 2220

Fax
020 7321 2221

e-mail
fstjournal@foundation.org.uk

Editor
Sir John Maddox FRS

Sub-editors
Trish Dent, Judy McBride,
Charles Wenz

Production & Layout
James McQuat

www.foundation.org.uk

fst journal

Volume 18, Number 7, February 2005

contents



THE COUNCIL OF THE FOUNDATION.....inside front cover

UPDATE

BSE risks, new GM potential, climate, animal activists 2

PUBLIC HEALTH

Engaging the public
Sir Derek Wanless 3

Working in partnership
Melanie Johnson MP 5

Promoting healthy choices
Lucy Neville-Rolfe 6

Lessons from the SARS epidemic
Professor Siân Griffiths 8

LORD LLOYD OF KILGERRAN LECTURE

Realising the value of the genome
Dr Richard Durbin 9

RISK PERCEPTION

Building policies people trust
Sir John Krebs 11

The interface between researchers and society
Professor Ian Diamond 13

The understanding of risk
Professor Nick Pidgeon 14

OBITUARY

Dr Richard Haas 16

BSE risks: steady as she goes...

The precautions taken to ensure that meat from animals infected with bovine spongiform encephalopathy (BSE) is kept out of the human food chain have been effective at reducing the risk of human infection, according to recent research by a team at the Commissariat à l'Energie Atomique laboratory in Fontenay-aux-Roses, France (ref.1).

They estimate that an individual would have to eat to eat at least 1.5 kg (about 3.3 lb) of neural tissue from an infected animal that was just below the BSE detection limit when tested negative at the abattoir to be at risk of developing variant Creutzfeldt-Jakob disease (vCJD). This, the researchers conclude, has been impossible since introduction (in continental Europe) of BSE testing and the move in 1989 to exclude cattle's brain and spinal cord from human consumption.

Risk analysis work on vCJD, however, does have to be interpreted with caution. The French study estimated the infectivity of contaminated tissue in primates and the extent to which that can be extended to cover human exposure is disputed. And for the future, the possibility of vCJD cases emerging after extended incubation periods remains.

On the positive side, the latest figures on vCJD cases in the United Kingdom (ref. 2) show a declining number of deaths per year. A total of 148 people have died of vCJD in the past 13 years, nine of them in 2004; there are five patients alive and thought to be suffering from vCJD. □

1. Risk of oral infection with bovine spongiform encephalopathy agent in primates, Corinne Ida Lasmézas, C. I. et al. *Lancet* online 29 January 2005.
2. The National Creutzfeldt-Jakob Disease Surveillance Unit, www.cjd.ed.ac.uk

Opening the door to GM crops

BIOS, the 'open source' movement in biological research, is beginning to bear fruit. The Biological Innovation for Open Society initiative was established last year with the help of a US\$1 million grant from the Rockefeller Foundation. Inspired by the open source model developed to disseminate computer software, the plan is to promote the sharing of genetic resources, medical treatments and tools for use in animal and plant breeding particularly in poor countries (ref.1).

Patents for the gene transfer technology used to produce genetically modified crops in agriculture are mainly owned by large multinational corporations, making it expensive to start work in this area. The first potentially important BIOS achievement is an alternative to the central enabling technology of plant biotechnology, *Agrobacterium*-mediated plant transformation (ref. 2).

The research team, based at CAMBIA (ref. 3) in Australia and which includes Richard Jefferson of BIOS, discovered that other species of benign bacteria can be readily modified do the same gene-transfer job as *Agrobacterium*. The work-around for current patented plant transformation methodologies is freely available through a BIOS licence that aims to encourage ethical, shared and transparent development and use of the technology. □

1. www.bios.net
2. Broothaerts, W. et al. Gene transfer to plants by diverse species of bacteria *Nature* 432, 629-633 (2005).
3. The Centre for the Application of Molecular Biology to International Agriculture, www.cambia.org

Climate in the news

In the report *Meeting the Climate Challenge*, the International Climate Change Taskforce (ref. 1) has backed the figure of 2°C above pre-industrial levels as a short-term target for efforts to address global warming. The report warns that atmospheric carbon dioxide levels that would trigger this rise could possibly be reached in about a decade.

For temperature increases above the 2°C level, the risks could grow significantly: substantial loss in agricultural productivity, widespread adverse health effects and water shortage are

predicted. Above the 2°C level, the risks of abrupt, accelerated or runaway climate change also increase.

The taskforce is co-chaired by former trade minister Stephen Byers and US senator Olympia Snowe, and its scientific adviser is Dr Rajendra Pachauri, chairman of the Intergovernmental Panel on Climate Change.

Measures that should be prioritised to meet the threat, says the report, include a target for G8 governments to generate at least 25 per cent of electricity from renewable energy sources by 2025 and a phase-out of fossil fuel subsidies.

A report by the World Wide Fund for Nature (WWF) takes the prospect of a 2°C temperature increase and looks at what effect it might have on the Arctic ecosystem. Polar bears, the report says, could become extinct in the wild within 20 years if the polar caps continue to melt at the current rates. □

1. *Meeting the Climate Challenge*, The International Climate Change Taskforce ISBN 1860302645, available from the Institute for Public Policy Research (www.ippr.org.uk/publications/); pdf from the co-publishers on www.americanprogress.org or the Australia Institute www.tai.org.au
2. Rosentrater, L. (ed) *Evidence and Implications of Dangerous Climate Change in the Arctic* (World Wide Fund For Nature, 2005); pdf from www.panda.org

Animal research

The Government has announced amendments to the Serious and Organised Crime Bill that provides for animal rights extremists found guilty of 'economic damage' to research laboratories to be imprisoned for up to five years.

The move follows the news that increasing numbers of suppliers are being forced by animal rights extremists to stop providing their services to companies and universities engaged in animal research, according to figures published by the Association of the British Pharmaceutical Industry (ABPI). In the last quarter of 2004, there were 42 such incidents reported, 37 per cent of the year's total.

Despite the increase in police activity during the second half of last year, ABPI figures also show increases in the number of abusive or threatening phone calls made to companies engaging in animal research and a continuing rise in instances of recorded damage to company, personal and public property. During 2004 there were 108 reported threatening and abusive phone calls and other communications, compared with 38 in 2003 and 23 the previous year. There were 177 instances of damage to company, personal and private property during the year, compared with 146 and 60 in the previous two years.

The ABPI has welcomed the new proposals, although victims of harassment by activists have pointed out that, without additional resources, police forces are unlikely to be able to protect them any more effectively than they do now. □

Safe havens for endangered plants

A new database called the plant search database, launched by Botanic Gardens Conservation International (BGCI), a charity that aims to unite botanic gardens across the world, has enabled gardens to compare what they hold in their collections against an international list of plants, recorded alongside the World Conservation Union (IUCN) red data book status.

A two-year study by BGCI estimates that about 9,000, or a quarter, of the world's known species of threatened plants are being grown in botanic gardens. But, while the 1997 IUCN list of endangered plant species worldwide lists 34,000 species as endangered, it is estimated that up to 100,000 plants may be under threat of extinction due to mass habitat destruction and global climate change.

Peter Wyse Jackson, secretary general of BGCI said: "This is an important step in helping to reverse the current extinction crisis that we face". □

Should the Government impose healthy eating habits or let the market control what we eat? The Foundation and the Academy of Medical Sciences jointly held a discussion meeting on 20 October 2004 to debate this and other related issues, summarised here.

Engaging the public

Sir Derek Wanless



Sir Derek Wanless produced the report *Securing our Future Health: Taking a long-term view* for the chancellor of the exchequer in 2002. The following year he was invited to provide an update focusing on population health, prevention and reducing health inequalities. His report *Securing Good Health for the Whole Population* was published in February 2004. He also advised the 2003 Welsh Assembly Government's Review of Health and Social Care in Wales. He joined NatWest in 1970 and was its group chief executive from 1992 to 1999.

In my report, *Securing our Future Health: Taking a long-term view* (ref.1), I set out three scenarios to illustrate the rewards that could be reaped by increasing productivity in the supply of health services (a topical subject, but not one for this evening) and by public engagement in healthier lifestyles. I concluded that action was vital on both fronts.

In a follow-up report, *Securing Good Health for the Whole Population* (ref. 2), published in 2004, I outlined the essential changes in approach that will be needed to achieve the best of the three scenarios, that of full engagement. They include high productivity in public health as well as in healthcare, adequate workforce capacity, a broad skill mix, expanded and imaginative use of self-care and the knowledge and time of patients and individuals with particular health risks. These, in turn, will rely on innovations in the use of technology and information handling, redirection of resources to areas of proven effectiveness, enhanced research programmes and more accurate measurement tools.

The existing definition of public health, 'the science and art of preventing disease and prolonging life and promoting health through the organised efforts of society', seemed to us to be inappropriately narrow. It does not describe what preventive public health should become in the early 21st century. The definition should be widened to include the organised efforts and informed choices of society as a whole, public and private organisations, communities and individuals, in recognition of the fact that public health is primarily affected by issues and organisations outside the health sector.

A key question is why, in recent decades, have we done so badly in influencing the factors that are crucial to disease prevention? One-quarter of adults still smoke cigarettes, decades after the adverse effects became clear, obesity continues to increase rapidly in both adults and children and sexually transmitted diseases are on the rise.

To answer this question, we examined how targets had been set in the past. We found inconsistencies in goals, expectations and timescales. What is needed is a combination of short- and medium-term

national objectives for all the major targets. Subgroups of the population, such as children, ethnic minorities and the economically deprived, may need separate objectives.

All these objectives should be used to guide resource planning and priority setting and to drive action. Progress should be measured and new information fed back to inform future planning. Research, analysis and consensus building are needed. What we must avoid is a list of frenetic and uncoordinated short-term activities that can be stopped as quickly and suddenly as they are started.

The Department of Health has produced a planning framework that includes the provisional targets of reducing adult smoking to 21 per cent by the year 2010 and halting the rise in obesity in the under-11 age group. Although the targets fall short of meeting the criteria for full engagement, they do represent substantial progress.

National objectives such as these should be used to guide local decision making but should not lead to the imposition of centrally calculated targets on local organisations; passing out smoking cessation targets to primary care trusts has probably been the worst example of that. Local networks are best placed to assess their own problems and set their own priorities.

Much planning and delivery will be local: examples include increasing activity levels and encouraging the consumption of more healthy foods. National activities such as allocating resources, designing financial and information flows, setting objectives, managing performance and conducting audits must not distort decision making or lead to unjustifiable spending. Crude bureaucratic administrative systems corrode professionalism.

Another impediment to progress has been the lack of a strong evidence base regarding the effectiveness of various public health interventions. This has been caused by inadequate research funding in this area, combined with a reluctance to accept economic perspectives within public health and a lack of clear and coherent research priorities. Future research will be very demanding technically and will require more resources and greater

expertise and depth in core disciplines. The Government must tell us how such a research programme will be delivered.

Meanwhile, the need for action is too pressing to allow the lack of comprehensive evidence to excuse inertia. Activity already under way, albeit haphazard, should help to build the information base quickly. This activity must be drawn into a comprehensive research programme with an agreed framework for evaluation. I recommended that the sound methodology being developed by the National Institute for Clinical Excellence (NICE) should be used as a basis.

Primary care trusts are vital in making mechanisms such as new contracts work to everyone's advantage. I therefore recommended a close review of local structures with the aim of evolution rather than wholesale re-organisation. A well-developed network of primary care providers could produce a unique resource for evaluation and health promotion. If, as the chancellor says, the NHS is to become the best insurance policy in the world, it must start to think like an insurance company and manage its risks. Pooling of resources between primary care trusts and local authorities should be closely reviewed to see whether it is producing the expected benefits. Workforce capacity planning, including attention to significant skill shifts, must be developed to encompass the wider workforce in both health and social care.

The last point is important: failure to integrate thinking about health and social care is a crucial weakness that must be addressed. In 2002 I pointed out that the Government's demographic forecasts had been consistently wrong for many years and drew attention to the pension and social care issues that would result. Pensions have subsequently become an issue. Although social care is not yet on the agenda in the same way, I strongly recommended that health and social care should be integrated more carefully and over a longer term. This would raise some very difficult issues regarding choice and funding, but all the work in this area is incomplete without that. It would also throw into sharper focus the role of local authorities in the provision of public health.

Those responsible for capacity planning will need to take a long-term view and consider the ways in which delivery is likely to develop. For example, how will knowledge of genetic make-up and individual risk assessment influence personalised health promotion and disease prevention?

The Government must also address the risk to public health research arising from the difficulty of obtaining access to data. Debate is needed about the balance

Research. A number of speakers noted the absence of firm evidence regarding healthy eating, for example, the unexplained correlation between eating certain foods and reducing certain illnesses, or the components of diet that cause obesity. Additionally, there is little evidence regarding ways in which people can be encouraged to modify their lifestyles. If it is to be an aim of primary care to show individuals what their personal risks are in such a way that they will change their lifestyles to reduce these risks, then much detailed research will be needed, including expensive longitudinal studies. The ability to forecast risks through gene technology will increase this pressure.

Employers have yet to be convinced of the benefits of making the workplace healthier or alleviating stress among their employees, for example, by providing assistance with childcare. The economic advantages to employers need to be based on stronger evidence. Environmental factors such as traffic fumes should feature prominently as major sources of health risk, but to effect changes in these areas will meet strong opposition and will only succeed on a firm evidential basis.

discussion

between individual confidentiality and the public benefit of enhanced information. Pilot exercises should be undertaken in primary care to assess the benefits that might be gained through gathering additional information, for example, better risk monitoring and more accurate targeting of resources to reduce inequality.

While primary care will have a fundamental role in the improvement of public health, it is not the only player. Many organisations need to be shown the benefits they would accrue by helping to improve the health of their employees, members, insurees and others. This potential has not been realised and the NHS, as an employer, should be showing the way in that respect, rather than being one of the worst examples. Private sector organisations should be encouraged to help as well, by developing markets and using their power to deliver products and services that take full account of individual preferences. People's concerns about their future health can influence their buying patterns. These organisations should be viewed as part of the solution, not vilified as a cause of the problem, as is so often the case.

The Government's role extends across all departments. The secretary of state for health should ensure that the impact of the Government's policies on public health is assessed and coordinated. Limited policy assessments, for example concerning agriculture or the built environment, have been carried out in the past but have had little effect. The Government needs to eliminate gaps and ineffectiveness in areas such as the provision of health education messages.

These messages need to be effective and that means recruiting more marketing and communications professionals to help. The aim should be to enable individuals to make informed choices, rather than

having choice imposed upon them, and to encourage changes which make healthier choices easier. Inadequate or confusing information on food labels is one area that needs to be addressed. It is also vital to determine whether the messages have been received, believed and understood — and all three of those are important — by the public, to ensure that people are aware of the wider implications of their choices. Application of all these principles should help the Government decide when its various levers, such as information, taxation, subsidisation, regulation and deregulation, are appropriate.

In my view, leadership will make the difference between success and failure in all of this. Policy makers must recognise that, although individuals are ultimately responsible for their own and their children's health, they need information and support. An individual's right to choose needs to be balanced against any adverse effects that his or her choices may have on the quality of life of others. Strong, persuasive leadership is most likely to be effective both nationally and locally by establishing aggressive goals, building widespread consensus, encouraging action by the self-interested as well as the community-minded and driving voluntary engagement.

My report was designed essentially as a checklist against which the Government's responses can be judged; but so too can the responses of all those others that have a part to play. Public health is by no means purely a matter for government. To all of you who are involved in any part of it, I wish you well in your endeavours. □

1. Wanless, D. *Securing Our Future Health: Taking a long-term view* (April 2002); www.hm-treasury.gov.uk/Consultations_and_Legislation/wanless/consult_wanless_final.cfm
2. Wanless, D. *Securing Good Health for the Whole Population* (February 2004); www.hm-treasury.gov.uk/consultations_and_legislation/wanless/consult_wanless04_final.cfm

Working in partnership

Melanie Johnson



Melanie Johnson is MP for Welwyn and parliamentary under-secretary at the Department of Health. She was appointed public health minister in June 2003.

She has also served as minister for Competition, Consumers and Markets and economic secretary to the Treasury. Before taking up her ministerial post, she was parliamentary private secretary to Barbara Roche as financial secretary, and a member of the Select Committee on Public Administration and the Home Affairs Select Committee.

Derek Wanless spoke of the many challenges that await us. Of the three scenarios described in his report, the fully engaged model would deliver the best health outcomes and be least expensive. The gap between the best and the worst scenarios was some £30 billion by 2022/23, or one-half of NHS expenditure.

His follow-up report, *Securing Good Health for the Whole Population*, focused on prevention and contained a powerful analysis of the wider determinants of health, including smoking, inactivity, diet, nutrition and the significant impact of economic inequalities on people's health. The report makes it clear that achieving full engagement will depend on the combined efforts of individuals, who are ultimately responsible for taking care of their own health.

The role of the Government is to provide strong leadership and to support people who make healthy choices. The report set out recommendations suggesting ways in which the Government could do more to provide clear, accessible health information to the public and to improve health literacy among certain subgroups of the population, while acknowledging that the Government on its own cannot achieve full engagement of the public: the efforts of employers, the NHS, local government, the voluntary and community sectors and industry will also be vital.

We already have an excellent example of the Government working successfully in partnership with national and local organisations in the Five a Day programme to encourage consumption of more fruit and vegetables. The Department of Health (DoH) took the lead in establishing a clear and consistent criterion setting out how food counts towards Five a Day, based on scientific evidence, but it could not bring about changes in accessibility, availability, awareness and attitudes to fruit and vegetables without the partnerships that had to be established with industry.

By working together we were able to get messages across to consumers and to respond to their needs by making fruit and vegetables available in convenient formats and locations. The strength of these partnerships has contributed to the effectiveness of this programme, as evidenced by the year-on-year increase in awareness of the Five a Day message, which rose from 52 per cent in October 2002 to 59 per cent in October 2003. The Five a Day logo is the first government-licensed logo

and is used by almost 500 organisations with high-volume sales.

The NHS needs to be transformed from a sickness service to a health service, with prevention given the high priority it deserves — a key message that is now embodied in the NHS Improvement Plan. For the first time, specific targets on obesity and smoking have been included in the Public Service Agreement, signifying the Government's commitment to tackling these problems. We have made substantial progress towards reducing smoking through the programme that was launched with the 1998 white paper *Smoking Kills*.

The latest figures show a reduction in the prevalence of adult smoking in England to 26 per cent from 28 per cent in 1996. NHS Stop Smoking Services are helping large numbers of smokers to give up; over 200,000 people stopped for at least four weeks in 2003/4. We are also trying to discourage young people from taking up smoking through the use of hard-hitting media campaigns, stark warnings on cigarette packets and a ban on tobacco advertising. However, smoking kills 120,000 people every year and we must continue our efforts. The target is a reduction in smoking prevalence to 21 per cent or less by the year 2010. This figure is greater than that of the Cancer Plan, which had previously set a target of 24 per cent by 2010. We have taken into account inequalities in health by setting a slightly lower target of reducing smoking prevalence to 26 per cent in manual workers — still a challenging goal.

In addition, a new target has been introduced to halt the year-on-year increase in obesity in children under the age of 11 by the year 2010. This target is part of a broader strategy to reduce obesity in the population as a whole and underlines the Government's commitment to tackling this very major health problem. The target is shared between the DoH, the Department for Education and Skills and the Department for Culture, Media and Sport, in recognition of the fact that delivery will depend on a concerted effort across government and at local level.

A joint delivery plan setting out our proposals for achieving that target is now being developed. Although it is a challenge, it is one that we are fully committed to working towards; we clearly recognise the problem of overweight and obese children and I cannot over-emphasise the importance that we attach to improving their diets. The best long-term approach

to tackling obesity is prevention, particularly in childhood, and we know that getting things right in childhood is likely to create the best chance of young adults making healthy choices. To this end, we have already taken action to increase breastfeeding and reform the Welfare Food Scheme.

The Five a Day programme I mentioned earlier includes the National Schools Fruit and Vegetable Scheme. By

the end of this year, all children between the ages of four and six in local education authority-maintained infant, primary and special schools in England will be eligible for a free piece of fruit or vegetable every school day. The Food in Schools programme is bringing together information to assist schools in implementing a whole-school approach to healthy eating and drinking.

In addition, we are continuing our

broader work with industry to address the sugar, fat and salt content of foods.

These targets challenge us all and, while the Government will take the lead, it will look to others — and there are many significant others — to play their parts, while building on the partnerships that have already been established. A genuine collaborative approach offers our best chance of securing real improvements in public health. □

Promoting healthy choices

Lucy Neville-Rolfe



Lucy Neville-Rolfe has been corporate affairs director at Tesco since 1997. In 2003 she was also appointed company secretary. Before that, she was a member of the Policy Unit at 10 Downing Street and was director of the Deregulation Unit at the Cabinet Office and the DTI. Outside appointments include non-executive director of the Foreign Office, deputy chairman of the British Retail Consortium and membership of the CBI Economics Committee.

Public health concerns us all and takes many forms, from the prevention of disease to the issue of smoking in public places through to healthy eating. I am going to speak mainly about diet and healthy eating.

Public health is not a matter solely for the Government; experience shows that results are achieved when all stakeholders work together. The reduction in smoking prevalence we have seen over the past 30 years is an example of this principle working in practice, and is also a good illustration of the public responding to a simple, believable message.

A slightly less well-known example of the same principle is the switch from full-fat to skimmed or semi-skimmed milk. According to data from the National Food Survey, the intake of full-fat milk dropped by one-third, from 2,053 g per person per week to 664 g between 1984 and 2000 and, during the same period, the intake of skimmed milk rose from 185 g to 1,138 g per person per week.

A third example is the move away from saturated fats to unsaturated fats; intake of saturated fats fell from 41.9 g per person per day in 1984 to 29.2 g per day in 2000. What lies behind these changes in public behaviour? Education, increased awareness, changes in cultural attitudes and the provision of clear, simple messag-

es all play a part. Supermarkets contribute by responding to changing lifestyles and the concerns of their customers.

The increase we have seen in sales of fruit and vegetables has come about partly as a result of publicity surrounding the health benefits of eating more of these foods. Perversely, there was a recent well-intentioned but misguided attempt by a local authority to prosecute Tesco for including on its packaging the statement that eating five portions of fruit and vegetables a day helps to prevent cancer. Happily, the case has been settled without the need to go to court. Tesco is now going to try to have the rules and regulations changed to allow us to include information on healthy eating on our food packaging.

The real issue, for me, is how we can harness consumer power to improve public health. I will describe briefly how we at Tesco go about our business, in case there is anything that could be learned from that and applied to public health problems.

Our business is driven by the need to empathise with our customers and to earn their lifetime loyalty. We have 12 million customers a week going through our stores and our approach is to try to understand what they say, what they do, what they want, including their attitudes

Prevention. It was agreed that education is a priority and all professional training programmes should feature a module on prevention. However, prevention needs to begin much earlier, in our schools. No doubt much is already going on in the better schools to encourage healthy eating but it is doubtful whether these efforts affect those in low-income areas, where the need is greatest. Perhaps little can be done without increasing income levels and diminishing income inequality; nevertheless, it is important to roll out programmes on obesity, smoking and sexually transmitted diseases in these schools now and to set demanding targets. It is, for example, quite inadequate to set a target of stabilising the increase in child obesity in 2010, when half the cohort in question has not yet been born.

discussion

to important issues such as health and their aspirations, and what they feel they can and cannot do.

What do our customers tell us? They say that value for money and availability, that is, the amount of food on the shelves, are of primary importance. This is especially true of low-income groups, who also have the greatest health problems.

Convenience is another strong driver of food choice for people such as busy mothers rushing to feed their children, often with ready-made meals. Some may not approve of this lifestyle, but it is a reality and public policy solutions must take account of that. I do not think that you are going to be able to change the wish for convenience and the sheer speed of life. There is no point in having lots of healthy food on the shelves that no one has time or, indeed, knows how to cook.

Cooking at home has become much less frequent than in the past, partly, perhaps, because it is no longer taught in schools. Time spent cooking at home has fallen from 2 hours to 20 minutes per day and continues to decrease. Television programmes featuring chefs such as Jamie Oliver have led to cooking being regarded as a weekend leisure activity involving 'fancy' ingredients. The demographics are not on our side.

However, there is an encouraging trend towards an increase in the demand for healthy food. Daily consumption of fat has fallen from 97 g per person per day in 1984 to 74 g in 2000, while the consumption of fresh fruit has increased from 539 g per person per day to 745 g. Purchases of frozen, tinned and dried fruit (although their health merits may be debatable) have risen by 50 per cent.

Despite these changes, people remain uncertain as to whom they should trust. Confidence in politicians seems to be at a low ebb. Health scares occur regularly and receive an enormous amount of media coverage. Consumers are increasingly reluctant to be directed, especially by the Government. For these reasons I strongly believe that public policy in this area must go with the grain of social attitudes and build consumers' trust by providing them with balanced and accurate information on which they can base their decisions. I think that is a far more powerful tool for change than trying to lay down the law.

At Tesco we have made a number of practical changes to encourage healthy eating, particularly within low-income groups. We have reduced our food prices by 11 per cent in real terms in recent years. In addition, we are making healthy food more appealing, with 80 promotions every week featuring fruit and vegetables. 'Value' lines were introduced in the early 1990s in response to an economic downturn. They make it possible to pur-

Food retailing. There was a certain amount of scepticism about the commitment of supermarkets to healthy eating. One speaker noted that sweets were still placed strategically close to checkout points. People shop on impulse, and that leads to purchases that tempt rather than those that will improve diet. It should be possible for a customer to check the healthiness of his or her shopping basket at the till.

However, supermarkets, as with any other retail business, do not live in an ideal world; they must give customers what they want and can only use marketing to change buying habits. Customers are cost-conscious and suppliers have to cut prices to such an extent that they are forced to lower the nutritional levels of their products. One supplier noted that health qualities form a very small part of food retailers' concerns.

chase a healthy diet more cheaply than an unhealthy one.

Derek Wanless mentioned better marketing, but I would say beware: some marketing professionals are good, some are less good and some are dreadful; some marketing works and some does not. At Tesco we have a Clubcard that provides vouchers as well as special promotions on fruit and vegetables. In addition, over the past 10 years we have introduced 'healthy living' lines, which must contain less than 3 per cent fat or half the fat of standard products, at least 10 per cent less sodium and no more sugar than standard products. These lines now contain 440 products, including ready meals. For example, we sell a 'healthy living' lasagne that is the same price as our normal lasagne, thus enabling people to choose a healthier option. We also run a Healthy Living Club with 175,000 members and use our online service to provide extra information on healthy food choices.

A study conducted by Sainsbury's looked at the impact of new store development in socially deprived areas, focusing on the Tesco superstore that opened in Seacroft, a deprived area of Leeds consisting mainly of large housing estates. Using food diaries and interviews, the researchers compared the diets of the local people before and after the store opened. They found that those with the worst diets showed the biggest improvements, consuming one-third more fruit and vegetables than before. This was an interesting and unexpected result of a study that was intended to investigate economic regeneration and job creation.

What can we do to move forward? First, we should address the needs of low-income groups and ensure that we provide them with clear and consistent messages to help them attain and maintain good health. Labelling has improved substantially over the past 15 or 20 years, making it easier for consumers to determine what is in a product. However, Tesco realises

that only a small number of consumers have the time and the enthusiasm to read the nutritional information given on the backs of food packs. We have plans to add simple nutritional information, presented in an easily read format and placed on the front, rather than the back, of the pack.

Second, the Government could help by reducing legislative barriers. I have spoken of the restrictions on the use of the Five a Day logo. We need to get the rules right to allow us to include the appropriate information on food packaging. Another example is the requirement to list 'sodium' rather than 'salt'; I do not really know what sodium is and I believe that the measures used for sodium are different from those used for salt. We list the salt content as well. This type of change could be very helpful.

Third, most of us do not do enough physical exercise and we need to devise ways of encouraging people to exercise. Tesco sponsors the Race for Life, in partnership with Cancer Research UK. This is the sort of partnership that Melanie Johnson referred to earlier.

Fourth, we should consider what to do in schools, where I think we can help with food and exercise. There are also wider issues concerning parental control, role modelling, the seduction of the sofa, the television and the playstation, and even the hidden cigarettes.

At Tesco we strive to make objectives clear. We set a small number of priorities and focus on those. We avoid unnecessary complexity: for example, we have abolished the use of acronyms because people do not understand them. We tell people what we are trying to do, as I think the DoH is already doing through its advertising campaign. I am not in favour of over-regulation; I am not in favour of forcing people to do anything. I believe that, if we can create a demand for healthier eating options and healthier living, we will make a small but important contribution to public health. □

Lessons from the SARS epidemic

Siân Griffiths



Professor Siân Griffiths is senior clinical lecturer in the Department of Public Health and Primary Care at Oxford University and a visiting professor at Oxford Brookes University. Her career has involved her in local, national and international work on a wide range of public health issues. In 2003 she chaired the Hong Kong government's inquiry into the SARS epidemic. She was president of the Faculty of Public Health from 2001-4. She is currently adviser to the Department of Health, a board member of the Health Protection Agency and also the Post-Graduate Medical Education and Training Board. She leads the NHS Alliance Public Health Network to promote greater engagement of primary care.

When it comes to public health policy, it is important to focus also on issues other than that of individual choice. Public health encompasses factors other than those on the public health improvement agenda; we also need to address health protection and the way in which we run our health services. Although our main focus here is the United Kingdom, public health is a global issue.

Individuals make choices in relation to their lifestyles and within their community and social networks. Therefore it is fundamental to public health that we understand communities as well as individuals. Factors that influence choice include education, employment, environment, and even water and sanitation, which are enormously important globally. Healthcare services and housing are also crucial.

I was very interested in Lucy Neville-Rolfe's examples of ways in which people have changed their food choices. The real questions are: 'Does everyone have access to healthy affordable food?' and 'Will food labelling help people make healthy choices?' Social inequalities between unskilled and professional workers are widening and the public health challenge is to allow everyone to be able to make healthy choices.

Some of the principles of health improvement also apply to health protection. Health protection covers a number of areas, including control of communicable diseases, response to bioterrorism, emergency response and response to radiological and chemical incidents. The Health Protection Agency is a national organisation, partially mirrored in many parts of the world by Communicable Diseases Centres. These agencies are at the very heart of events such as the SARS epidemic, which was a classic public health emergen-

cy. Many of the lessons we learned from it, particularly concerning the withholding of information and the rights of individuals versus those of society, can be applied to other public health problems.

SARS displayed a classic epidemic curve consisting of a first stage, when there were a few early cases in the hospital, followed by the second stage, with rising numbers of cases in the community, and finally the tail-off as control measures were brought into play. The obesity epidemic in the United Kingdom and elsewhere in the Western world is in the second stage. The number of people with obesity is increasing and obesity in the young has tripled over the last 20 years. We have yet to reach the third stage, when control measures bring about a reduction in cases.

Very early on in the SARS epidemic there was no transfer of information. Details about the cases of SARS that occurred in November and December 2002 were held within Guangdong and were not sent to Beijing. The story began with an infected individual who travelled to Hong Kong and stayed on the 8th floor of the Hotel Metropole, infecting other guests at the hotel and spreading SARS into Hong Kong, whence it eventually spread to a number of countries.

The teaching hospital that treated the first patient with SARS initially thought he had an unknown atypical pneumonia, as he withheld from them the crucial information that he had visited the 8th floor of the Hotel Metropole. As a result, he was admitted to a general hospital, where he infected numerous others in the ward, including doctors and nurses; this was the beginning of the epidemic. Had those treating him been aware that he had been in the Hotel Metropole, he might have

continued on page 16

Individual rights. The controversy over the MMR vaccination has raised important questions concerning information, the role of the media and whether the right of parents to refuse vaccination should be overridden in the interest of the population as a whole. Where does the boundary lie between personal choice and the rights of the community? If there were the prospect of a measles epidemic, would compulsory vaccination be justified?

The underlying problem is a lack of public trust in the evidence. Although there is no evidence that the MMR vaccine causes autism, there are cases of children who have had the MMR vaccine and subsequently been diagnosed with autism. People tend to believe in anecdotal evidence rather than scientific and governmental assurances and to many these cases prove the link.

discussion

Realising the value of the genome

Dr Richard Durbin, deputy director of the Wellcome Trust Sanger Institute at Cambridge, was given the Foundation's 2004 Lord Lloyd of Kilgerran Award in recognition of his work in using mathematical computer-based techniques for analysing the properties of the genomes of various organisms, notably the human genome. The award, which commemorates the life of Lord Lloyd of Kilgerran, the first president of the Foundation, is awarded annually to a person distinguished for having applied science and technology for the benefit of society. At the award ceremony on 26 October 2004 held at the Royal Society, Dr Durbin delivered a lecture entitled Realising the value of the genome, which is reported here by Sir John Maddox.

The structure of DNA is famously one of the outstanding discoveries of the 20th century, but the secret of life is by no means an open book. Although the chemical makeup of human DNA has been determined as a result of the Human Genome Project (HGP), interpreting the huge volume of data embodied in the result is still not complete. Dr Durbin suggested that the task would take far longer than the five years between the beginning of serious work on the HGP in 1995 and the publication of a draft 'sequence' of the genome in 2000.

The task lends itself to the use of computers. DNA molecules (from different people as well as from different species) differ in the arrangement of chemicals called nucleotide bases placed at precise intervals along the length of each of two strands of a double helix. The result is that particular DNA molecules can be represented by a sequence of symbols denoting particular bases, of which only four occur in DNA, represented by the characters a, c, g and t. The human genome has roughly three billion symbols — as many as the printed characters in 10,000 books of modest size.

Even so, Dr Durbin remarked, the human genome contains less information than that in the software that keeps personal computers running. Moreover, because genomes of all species consist of ordered strings of the same four symbols, they carry information "in exactly the same way as information is stored in a computer". Genome sequences, like the numerical integers, are therefore well defined: their meaning is unambiguous. With modern laboratory techniques, they can also be determined accurately. The error rate in the human genome is estimated at one base in 100,000. Figure 1 shows a small part of the human genome sequence — roughly one ten-millionth of the complete genome.

The obvious problem is to tell where,

in this apparently meaningless array of the four characters, are the genes whose sequence determines the chemical structure of the proteins that carry out vital functions in all forms of life. Since the early 1960s, it has been known that the parts of the DNA (the genes) that correspond to these proteins are first copied in living cells into a chemically similar material called RNA. These, in turn, are used to determine the way in which protein molecules are assembled from the 20 or so amino acids of which they are constructed.

Exactly three DNA bases are required to determine a single amino acid. Because there are 64 ways in which triples of nucleotide bases can be constructed, but only 20 amino acids to be specified, there is evidently some redundancy in the so-called genetic code. More than one triplet can specify the same amino acid in a protein molecule, while other nucleotide triplets have housekeeping functions, such as truncating the copying of DNA into RNA. The upshot is that a stretch of DNA will be a gene only if successive nucleotide triplets correspond to amino acids. It is possible for these 'open reading-frames' to be identified by human eye, but computers can evidently do the job faster and more reliably. That is one of the criteria used to tell which parts of the human genome correspond to genes.

Dr Durbin also urged the importance of comparisons between the genomes of different species in the search for sequences representing genes. The inheritable variations that are the basis of darwinian evolution are seen, in the light of modern biology, as small changes ('mutations') of the genetic DNA, perhaps the replacement of the nucleotide at one position by another, for example. What research in the past few years has shown is that "genes that are similar to each other will behave similarly", so that when "we learn about one gene....we infer information about



Dr Richard Durbin FRS is head of the Informatics Division and deputy director of The Wellcome Trust Sanger Institute. Prior to joining the Sanger Institute in 1992, Richard was at Harvard and Stanford Universities in the USA, before returning to join the scientific staff at the MRC Laboratory of Molecular Biology, Cambridge. He was directly involved in the data handling and analysis aspects of the *C. elegans* and human genome sequencing projects, as well as the development of data resources for accessing genomic information. These include the ACEDB genome database initially for *C. elegans*, the Pfam database of protein families and the Ensembl database of vertebrate genomes and genes.

other genes. This is a key approach of modern biology."

Nevertheless, Dr Durbin emphasised, the identification of genes merely from the genome sequence is not yet an exact science. An open reading-frame may be a necessary condition for a sequence to be a gene, but it is not a sufficient condition. If it is to function in the cells in which it is found, it must be copied into RNA, for example. Although there are

techniques for isolating and analysing the structure of RNA from cells, there are many genes that are only partially transcribed in the copying process, while there are suspicions that RNA molecules may be missed even in the most exacting searches for them. What this implies, Dr Durbin said, is that the identification of genes cannot be left to computers alone: experiment of some kind is required. And, as the interpretation of experimental data is always subjective, different people may come to different conclusions about the reality of particular putative genes.

That is part of the explanation of the continuing uncertainty about the number of genes in the human genome. Although it was commonly believed ten years ago that up to 100,000 genes would be found in human DNA compared with the 17,000 found in the nematode worm — the first multicellular organism whose genome was sequenced — analysis of the now-complete human sequence has revealed many fewer. Dr Durbin gave his own estimate of the number as “about 22,000”. It had been “a bit of a surprise that we couldn’t find as many genes as we thought”.

This is the outcome of a search for genes in the human genome carried out with the database called Ensembl in whose design and construction Dr Durbin has played a leading part. (The database is a joint venture by the Sanger Institute and European Molecular Biology Laboratory, one of three comparable centres in the world.) The idea is to compile and keep up to date the complete genome sequences of several organisms (15 in total, at present all animals, including two fish, the chimpanzee and *Homo sapiens*). The database includes ‘annotations’ that identify features of each genome of interest to people working in the field. In his talk, Dr Durbin likened the annotations to the drawings by which mediaeval maps, the *Mappa mundi*, for example,

```
31861 ggaaaaattaagttttagaagtgtttaagggtacttttctataaattattattataaaaag
31921 ataatagctctcccttgctcatgacatgtggtaattctatgaaagtttgatagaattatga
31981 tattcacataaaaacaagggtgtgatgtctgggtggttcagatccggtgacttttgatgca
32041 attcttggtagacatcctccgactatgttttagatgtcattttcaagtttgcagtttct
32101 cgaaatattagaagccatgtctgcaccgaactgcgcacgaaaaatgatattgctcgtct
32161 ttccagcttgaattttcaaatttcccaatagtgttatcttagcttgataagcttaacttt
32221 tatattttcttattttgctgtgaaaattgttcatcaaaaatcgattttccaactttccac
32281 taaaatcttattatttccacaatttggtttctgcgaaacttcatcaacttttatacttatt
32341 ttccgcactccgaaggctcaacctggcatatttctatattgacgaaccatgtgttctct
32401 aatatcggaagctgactgtctaccttcaaggttttagtaactggaataagtggaaat
```

Figure 1. What part of the genome sequence looks like

were adorned by their makers with drawings of objects associated with particular places.

The usefulness of the human genome sequence was also illustrated by its relevance to the understanding of cancer.

Several times in his talk, Dr Durbin declared that informatics “has changed biology”. Almost trivially, it has enormously simplified telling what may be the role of a newly discovered gene in human beings: see if the Ensembl gene browser contains an organism with a similar gene, in which case it will prob-

ably have a similar function. If so, what might have been a five-year research project is “now a five-second exercise”.

Further reaching benefits are suggested by the use of sequence data likely to identify the cause of genetic handicaps in young children caused by malformations of one or other of the 46 chromosomes into which DNA is packaged. Instead of labour-intensive and uncertain examination of cells under a microscope, the knowledge of the human genome and the techniques of molecular biology can quickly tell where exactly in the genome the defect lies — and the result can be printed out automatically without the need for microscopy. The Sanger Institute has established a database, along the lines of Ensembl, to collect data in this field from 15 clinical centres around the world.

The usefulness of the human genome sequence was also illustrated by its relevance to the understanding of cancer. Cancer is caused by the unrestrained proliferation of somatic cells somehow freed from normal restraints, often by genetic mutation. Sequence data have made it possible to show that a gene called ABL, involved in many forms of cancer including 66 per cent of malignant melanomas, is turned on inappropriately by a physical rearrangement of a chromosome. This has led to the development of a medicine (‘Glivec’) that will turn off the gene again, curing the cancer. The Sanger Institute is collecting further examples that might be dealt with similarly.

At the beginning of his talk, Dr Durbin had acknowledged that the nexus between genomics and computation is an essentially collaborative field. He closed with a forthright declaration that genetic data of the kind now accumulating in the databases should be freely and generally available to all. That was the principle adopted at a meeting held in Bermuda soon after the Human Genome Project was formed, which was followed in the course of the sequencing and which guides the policy of the Wellcome Trust Sanger Institute still. □

The future. Dr Durbin emphasised the substantial work that still needed to be done on unravelling the mysteries of the double helix. We were at the start, not the end of the use of genome research. We did not yet have sufficient knowledge to trace evolution of living matter, although there was knowledge of human evolution. More work could be done on environmental and developing world problems, but the Sanger Institute was a health institute and that governed its priorities.

Developing world work had been done, such as the malaria project. Many diseases had genetic components, but often many genes were involved and it would take considerable further work to use genetic information in individual cases. Although the information growth was outrunning computer capability, computing power was not a limiting factor.

discussion

Should policy choices be made in response to the public perception of risk or to science-based risk evaluation? An FST discussion meeting on this topic, held jointly with the Hazards Forum on 12 October 2004 at the Royal Society, is summarised here.

Building policies people trust

Sir John Krebs



Sir John Krebs FRS is chairman of the Food Standards Agency. He has held a Royal Society research professorship in the Department of Zoology, Oxford University, where he is also a fellow of Pembroke College, since 1988 and in 2005 will become principal of Jesus College. He has also held posts at the University of British Columbia and the University of Wales, Bangor. Between 1994 and 1999, Sir John was chief executive of the Natural Environment Research Council.

When the Food Standards Agency (FSA) was set up in April 2000, it was in many ways a child of the bovine spongiform encephalitis (BSE) crisis. There was a mood of suspicion about the way that government handled food safety issues in the wake of the BSE crisis and other incidents, including salmonella in eggs. I very soon discovered that everybody you encounter is an expert on food, simply because we eat it all the time, and everybody you encounter is an expert on risk, or so they believe.

We set out to reposition the way in which government handles food safety and communicates food safety to the public. The old approach was based on the notion of claiming that food could be declared absolutely safe, that scientists had looked into this and could give you a clear-cut answer. The role of the policy maker and the implementer of the policy was to decide what the policy should be, announce it and then defend it in the face of criticism.

The new approach starts from the assumption that, just as life is not risk free, food is not risk free. Although we turn to science to determine the risks associated with food, we recognise that very often the science is incomplete and, more often than not, scientists do not have a clear-cut answer. Rather than 'decide, announce and defend', we now involve all stakeholders — industry, consumer groups, green groups and so on — early on, so that they see the thinking as it emerges and we carry out the process of policy development in public.

The advantages of this approach are threefold. First, it helps to build trust in the process of decision making and policy making. Second, it leads to better judgments about risk management because, if you are left with incomplete science, there is no formula for deciding what the appropriate policy of risk management is. A judgment is better if informed by a wide range of views. And third, that having made a policy decision, it is more robust in the sense that it is less likely to unravel because people object to it. That is how we have tried to behave differently from the past.

But where does science fit in? Science is the bedrock of risk assessment and a raft of ten or so independent committees carries out our risk assessment. But it is important to remember that it is not possible to think of a set threshold of risk that is acceptable. Often we do not know what the magnitude of the risk is but, equally important, there is public acceptability. In some areas, the public expects, for one reason or another, that government should take a much more pro-active attitude in managing risks while other areas they consider a matter of individual choice and lifestyle. And sometimes the public perception of risk is directly at odds with the scientific evidence.

What about the policy options for managing risk? Well, the FSA has a role of a public protection body, but it is also a regulator. The tools at our disposal include: regulation by introducing new rules or legislation, encouraging voluntary action by food producers and informing the public and letting them decide what to do. Each

Adverse findings of research should be announced or made public, once peer-reviewed. People should be told of emerging findings and what further research is being done to sort out the problem. If the press are actively and honestly engaged they normally do not create scare stories, although they are influential.

People need good information with sources of evidence and indications of whether pieces of work are rogue or fit into a more general pattern. Facts need to be put into context and scientists should be open about uncertainty. However, one can give a clear and balanced exposition of the science and be both widely praised for it and condemned by NGOs. Social scientists can contribute at both the risk assessment and risk management stages. Engagement and communication have to happen all the way through. Even when there remain uncertainties, one can still give advice.

discussion

of those methods, or various combinations, will be appropriate in different circumstances.

Three examples will serve to illustrate these points. The first is a case where it is clear in the minds of the public that they would expect the Government to manage the risks through regulation, the issue of BSE. One current policy decision still under discussion within government is the 'over 30 months rule', which requires that no cattle over the age of 30 months can go into the food chain. This regulation has been in place in this country since 1996, when Stephen Dorrell announced the putative link between BSE and variant Creutzfeldt-Jakob disease (vCJD) in Parliament.

Most other countries test animals for BSE before allowing them into the food chain. A robust risk assessment, conducted for us by an expert group under the aegis of SEAC (the Spongiform Encephalopathy Advisory Committee), concluded that, if we switch from the over-30-months rule to testing, there would be a slight increase in risk because the test is not 100 per cent effective at picking up animals in the early stages of developing the disease. That might lead to between 0 and 2.5 additional deaths from vCJD over 60 years in the human population.

The implication in terms of public policy is that the current arrangements, compared with the alternative arrangements, are valuing an individual life saved at around £2 billion. In most areas of public policy, although it is a brutal thing to say, the value of a life is put at something in the order of less than £1 million up to, in extreme cases, £20 million, so this is way off the scale. In terms of the proportionality of managing risk and what we can conclude from the scientific evidence, acknowledging the uncertainties, it is a clear-cut case in favour of testing.

My second example provides a contrast. The matter of salt in the diet is one, like other questions of dietary imbalance, where the public expectation is that what we eat is a matter of personal choice and lifestyle. This is despite the fact that eating too much salt may be a much greater risk for many people than the risk we face from BSE, food poisoning or nut allergy, where government is expected to act.

The scientific evidence — from the Scientific Advisory Committee on Nutrition report and elsewhere — is pretty clear. Most of us are eating too much salt and the prevalence of high blood pressure and heart disease will be reduced if we eat less. Much of the salt in our diet is from prepared foods. Our action in this case, where the public does not expect vigorous legislative action, has been to encourage manufacturers and caterers to reduce the salt content of their products. We can also inform the public, using, for instance, the

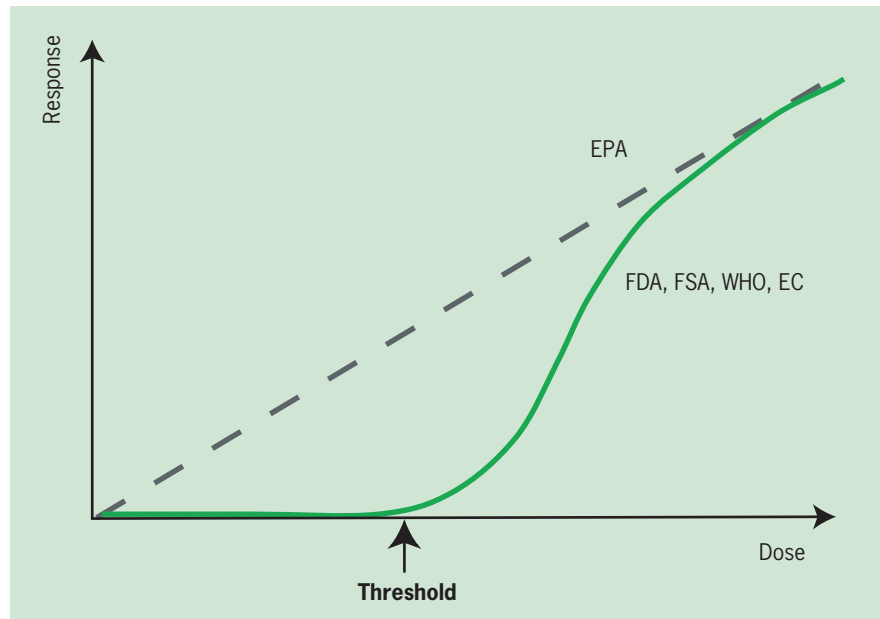


Figure 1 Comparison of different risk assessments for dioxin levels in salmon

Sid the Slug cartoon character in a public awareness campaign. There is a lot to be done in improving the information on food packaging, but if we do everything we can in that direction, it then becomes a matter of informed choice for consumers.

My third example concerns the safety of eating salmon. Every so often, a report appears which says that salmon and other oily fish contain dioxins, which are widespread environmental contaminants, making salmon unsafe to eat. The most recent report was published in *Science* in January 2004. A group of US scientists had analysed 2,000 kg of salmon from around the world and found that farmed Atlantic salmon contained more dioxins than wild Pacific salmon. This was presented as a matter of 'farmed versus wild fish', but in fact the salmon are different genera: Atlantic salmon is *Salmo* whereas Pacific salmon is *Oncorhynchus*. We know that farmed and wild oily fish in the North Atlantic contain similar amounts of dioxin-like chemicals because they are already there in the environment; it does not matter whether your fish ingests them in the form of fish pellets in a salmon farm or from wild prey in the ocean.

The group behind the *Science* paper said that, on the basis of their research, people should eat no more than three portions of Scottish farmed salmon a year. FSA nutritional advice, based on the importance of long-chain polyunsaturated fatty acids, found in oily fish but not many other places in our diet, was that people should be eating at least one portion of oily fish per week. So where does the balance of risk and benefit lie?

The difficulty is that different authorities disagree about the nature of the risk assessment. The US Environmental

Protection Agency makes an assumption that there is a simple linear relationship between dose and response. Others, including the US Food and Drug Administration, the WHO, the European Commission and the FSA, assume that there is an observable threshold dose, below which the cells behave normally and above which there is a steeply rising curve of effect (see Fig. 1). The basis of this thinking is that dioxins work as carcinogens by blocking receptor sites and, in a mechanism that involves blocking receptor sites, there will be a level of the contaminant below which sufficient receptors are active for the cell to function normally.

Imagine trying to explain that reasoning on *BBC News* in a 10-second sound bite — it is not that easy! It means that we, as scientists, have to think carefully about how we present cases where the scientific evidence is contradictory and different people take different views.

I want to close by asking, 'does our new approach work?' A recent Norwegian study looked at public perception of food safety in six European nations and — this surprised me — consumers in the United Kingdom have the highest confidence in food safety of all the countries studied. In some polling that we commission each year from Taylor Nelson Sofres we asked a sample of 3,000 members of the general public: 'who would you turn to for reliable information about food and food safety?' The FSA is the most often cited body. So those two findings are evidence that we are beginning to make headway with this new approach, through being more open about uncertainties and recognising that public concerns have to be melded with scientific evidence in building trust. □

The interface between researchers and society

Ian Diamond



Professor Ian Diamond, chief executive of the Economic and Social Research Council, joined the ESRC in January 2003. He came from the University of Southampton where he was deputy vice chancellor. His research has involved collaboration with many government departments including the Office for National Statistics, the Department for International Development, the Department of Transport and the Department for Work and Pensions.

I want to focus on both the roles of researchers and research councils in informing public policy on the critical interface with civil society. During the past few years there has been much talk of 'evidence-based policy' and the need to base political decisions on risk-assessed, scientific evidence, yet this is not a new phenomenon. What is new is the perception of an increasing divide between the political and the academic sectors. Nor is it as common as one might wish for academics and civil servants to move freely between their respective sectors.

Why is there increasing concern about the disjuncture between science and policy making? Perhaps we can understand this by noting that some of the recent examples, BSE and GM foods, are seen as technological and natural scientific issues. This leads me to the nub of much of my argument: political decision making is a social scientific process and therefore does not necessarily fit well within a natural scientific model of knowledge transfer. There is, therefore, a need to engage more with social scientists at all levels of the scientific process if we are to make the most of the enormous potential of the science and technology base of this country. In my view, strong engagement with social science is central to achieving the great aims of the Government's ten-year-science and innovation framework.

I would like to look at how the relationship between academia, policy and civil society can work. First, a model with academia as a part of both civil society and public policy but acting in a set of traditional roles — with the public sector as an expert and civil society as a citizen. This can lead to two outcomes: insufficient relevant research is carried out and inaccurate and uncritical use of scientific evidence. Two things result from the natural scientific model: (1) a slow permeation of research outcomes into society through the traditional academic publishing route providing only general guidance to society and politicians alike; and (2) an engineering-like process where researchers produce problem-centred outcomes to consumers, on a process rightly parodied in the phrase 'technical fix'.

If we are to make the science and technology base work to optimise its benefit for the UK economy, then we need a different approach.

An alternative model might have research in a neutral transaction space

shared by all three sectors: academic, public sector and civil society. In this framework, efforts are made by both the research community and the public sector to engage civil society in the research agenda. Critically, there is a need for a proper engagement between researchers and the public sector for this to happen.

Given the need for such an engagement, what are the barriers that might impact on the successful prosecution of research? I am going to draw on an international workshop organised by the Opportunities and Choices Workshop at the University of Southampton, funded by the Department for International Development. In a paper resulting from this, Rob Stephenson and Monique Hannick (*Journal of Health Communication* 2004) identify the following key determinants for getting research into practice:

- Identifying and involving decision makers from the beginning of the process;
- Engendering an evidence-based culture among decision makers;
- Ensuring that the evidence received is of high quality;
- Understanding from the start of the process the full implications of the research and engaging in multiple research methods to achieve this;
- Communicating the results of the research properly and effectively throughout the process and involving all the actors in this process.

First, it is essential that all the decision makers have real ownership; that is, they understand the process and are comfortable with their ability to influence.

Second, not all research is designed to have a policy impact. Much research is simply curiosity-driven; essential if the United Kingdom is to achieve the Government's ten-year framework challenge. However, there is still a need for policy makers to be aware of potential developments. This requires careful communication and an understanding of the wider aims. In Economic and Social Research Council (ESRC) research we are now discussing some of the implications of new developments in genomics.

To ensure that decision makers can be engaged requires not only that they have an interest in the science but that they can understand it. Not all civil servants need to understand the intricacies of a large hadron collider but they do need to know about the research method and what con-

stitutes evidence. At present the portfolio of competencies required of applicants for the senior civil service does not include an understanding of what research is.

Understanding is one thing, and necessary, but recognising quality is another essential and here the need is for the research councils to work with the public sector to ensure quality. Key to this is the recognition that, before undertaking research, landscape reviews are necessary. Here again I would argue that the research councils have a role to play.

Critical to the development of science which can properly impact on policy is the need for interdisciplinarity. At the very least this must involve social science. No development in technology can impact on policy without at the same time impacting on society. This has been accepted recently by the increasing talk about 'upstream processing'. As many will know this means crucial questions must be answered at the outset: who controls the technology, who benefits and who needs it?

We need to ask about the long-term social consequences of developing a tech-

nology rather than simply worrying about the 'risk'. In so doing we must understand that we cannot simply ask what will be the technology in ten years' time and how will that impact on society; society changes all the time and will reflect other technologies and political and social developments in the meantime. Undertaking this challenge really requires social science.

Finally, if we are to ensure that research is properly used it must be properly communicated. This is a fundamental job, I would argue, for the research councils in partnership with the other major groups of science communicators. As in the Research Councils UK's Science in Society strategy that has recently been developed, research councils have a multifaceted role. We identify and find the research that helps to drive wealth creation and we are important conduits between science, the public and the Government.

Communication of research to all stakeholders is a fundamental imperative for all researchers who accept public money to do research. Yet, should all researchers do communication themselves? No, for two

reasons: they are often not much good at it, and not all research gives positive answers. Much depends on the accumulation of research findings and individual projects often have little to add. Instead research councils should act as the conduits to ensure proper dissemination of key research outcomes. It is also critical that there is an ongoing and interactive relationship with the media.

The thrust of this talk has been the interface between academia and the public sector. But it will be essential to engage the public who should be engaged at all levels of the process. How can the research councils be a conduit for this? In the ESRC Science in Society programme there are increasing moves towards the encouragement of 'connoisseurs'. Such people, trusted on all sides of the spectrum, are able to communicate serious science in plain English and to 'tell it like it is'. Scientists need to be more honest about what they do not know and the research councils, as conduits between science, the public and government, must have the confidence to declare uncertainty to gain trust. □

The understanding of risk

Nick Pidgeon



Professor Nick Pidgeon, a psychologist, holds a chair in the School of Environmental Sciences at the University of East Anglia. He is currently director of the programme Understanding Risk funded for five years by the Leverhulme Trust, which conducted the independent evaluation of the 2003 GM Nation? public debate.

It is not difficult to see why risk has arrived at the top of the public policy agenda. BSE, foot and mouth disease, railway accidents and GM agriculture have made this point only too plain. What these events all demonstrate is that risk controversies are rarely about risk itself or the probability of harm alone. Critically, they also involve the context within which an issue arises. So concerns about GM food arose in the wake of BSE and now nanotechnology arises in the wake of GM food.

There are also fundamental questions about how regulatory institutions have managed risk in the past and questions over the trustworthiness of those institutions to manage risk in the future. Research on the causes of major accidents shows that institutions sometimes, even with the best will in the world, do get things wrong. So questions about institutional performance are often a legitimate part of the risk assessment process.

That leads on to my topic: the current vogue for engagement with the public around a range of science and technology issues. This issue was covered at length in the Royal Society/Royal Academy of Engineering's nanotechnology report (ref. 1), where we listed a number of potential objectives to be achieved by public engagement and dialogue:

- Incorporating public values (such as equity) in decisions
- Improving decision quality

- Resolving conflict
- Establishing trust and legitimacy
- Education and information (involving genuine two-way engagement).

But there are some basic questions over engagement that we need to consider. The first is that not all expressions of public attitude carry legitimate or actionable values. If they did, the abolition of hanging would not have happened as early as it did. Equally, we cannot ignore what the public might have to say. Scientists and engineers do not have the final say on many of the difficult ethical questions surrounding what is acceptable to a society in risk terms.

Second, 'the public' is not a single entity. In social science terms it is highly differentiated, in terms of gender, ethnicity and social exclusion, and these all have an impact on the way individuals view risk.

A third point is that policy makers often confuse stakeholders — people who have a financial or other specific interest in the issue — with the wider public. Stakeholders have their own agendas and that needs to be borne in mind when considering both their views and their involvement with dialogue processes.

The final point is the extent to which we need to balance deliberation and representation, and the example that I will cite is our work on the GM Nation? public debate on biotechnology (see *FST Journal* 18(3): 9-14, 2004). The GM Nation? exercise engaged well over 40,000 people in various

ways across the country and was widely reported in the media as demonstrating an overwhelming opposition to GM food. The *Daily Express* headline ran 'GM comes a cropper as Britain says a huge No'. The *London Evening Standard* cartoon showed a mutant corn cob reading a newspaper with the headline '93% reject GM food'.

These media discourses set the message. So where did their figures originate? The Public Debate Steering Board's report is quite complex and subtle and I do not wish to go into an elaborate discussion of its details. But, as part of their consultation, they distributed a paper and also a website questionnaire that eventually received over 36,000 responses. There were ten items on the questionnaire, five of which measured perceived benefits and five perceived risks. Overall, the responses strongly favoured the 'very high risk and very few benefits' position. And, of course, 36,000 responses is a considerable number. But GM Nation? did not have a built-in methodologically sound external check to see whether these attitudes might match those of a properly constituted random sample of the general population.

Our Leverhulme Trust-supported research programme conducted an independent evaluation of GM Nation? And, with the help of the polling specialists MORI, undertook just such an external check. After GM Nation? had concluded, but prior to publication of the steering board's final report, we surveyed public opinion on agricultural biotechnology across a whole range of issues, in particular repeating the questions asked as part of the GM Nation? debate. We found that there were indeed some 30 per cent of the population strongly opposed to the technology, these people seeing very high risks and very few benefits from GM. But the main group in our survey occupied the middle ground; about 50 per cent can be classified as ambivalent, in the sense that these people hold considerable concerns but also endorse some of the benefits potentially associated with GM food and crops in the future.

Our conclusion was that GM Nation? overestimated the strength of outright opposition but that it did have a number of other strengths. Some have suggested that our analysis invalidates the whole result of GM Nation?. I do not believe this to be the case, but certainly the questionnaire methodology did not take account of the implications of giving out a questionnaire to a self-selected sample.

Incidentally, our MORI survey also found that 77 per cent of respondents thought that public debates such as GM Nation? would be useful in the future.

A further consideration to arise from the GM Nation? experience is that policy makers often have to take account of qualitatively different evidence streams: in

Special interest groups. How can one avoid dialogue being captured by special interest groups? If one is trying to understand the various opinions of the different groups comprising the public, the answer is a combination of qualitative and quantitative market research, although even then there may be a gap between what people say and how they subsequently behave. Normally only activists turn up to public meetings, but it is important to engage such people. In a well-constructed group, the tensions between the various interests allow the host to act just as ring holder. Stakeholder groups may express outrage after an event and gain media attention, but the decision makers need to recognise that such views may not be those of the general public.

discussion

this case the economics, science and public debate. The question then arises, how should they weigh the different forms of evidence?

Of course, what constitutes decision making is different in each of these three areas. In relation to science, we look at whether the evidence is solid, whether the risk is measurable, whether we have had peer review. In terms of economics, decisions are based on cost and benefits, overall utility and sometimes 'value of life'. The economic case can take account of uncertainty, but only imperfectly. When it comes to the public debate, there are wider values involved: issues of trust in institutions, and concerns about long-term uncertainties. When scientists are unable to eliminate uncertainty, it can generate distrust and accordingly much public discourse is about the wider impacts of a technological development on society. These three areas all present rather different evidence criteria.

Proper deliberation about what is acceptable risk in the public and policy spheres requires consideration of all three evidence streams, also set against the pressures from media, politics, law and lobbying. We should not forget that science still has a privileged place in this whole process, through its direct links with the political institutions. However, public dialogue does introduce a new communication route, one which can influence the policy process: it changes the risk game significantly.

Finally, something new. In the past year a new term has entered the deliberation lexicon, so-called 'upstream engagement'. This can be defined in a number of ways. One definition would be: dialogue and deliberation among affected parties about a potentially controversial risk issue at an early stage ('upstream') of the research and development process and in advance of significant applications or controversy.

We discussed this approach in the Royal Society nanotechnologies report and Demos has also recently issued a detailed case for upstream engagement (ref. 2).

Some of the difficulties with the engagement process are likely to be removed by upstream engagement. But some will be

made worse, particularly when a technology is barely in the public eye. For example, as part of the Royal Society's work on the perception of nanotechnology, we asked people, in a nationwide poll, whether they had heard of it and whether they were able to provide a definition of nanotechnology.

Only 19 per cent of the public could provide a definition, most of which were quite sensible: 'something small', 'small computers', 'things in the blood'. We then asked these people whether it would improve life in the future and 68 per cent of those who could provide a definition said it would, compared to only 4 per cent who said it would make things worse.

That looks very positive for nanotechnology but it is a small sub-group of the overall population and might also be tapping beliefs about technology generally, which we know to be favourable, rather than nanotechnology in particular. Accordingly, the study group also sponsored two qualitative workshops involving about 50 members of the public. Here there was a greater range of responses; many positive but balanced by some negatives. On the positive side there was enthusiasm for the possible ways in which nanotechnology would benefit people, especially in relation to medical developments and consumer goods. But alongside that there was concern over long-term uncertainties and who can be trusted to control and regulate nanotechnology. A minority also expressed the view that it was not right to manipulate atoms to build new materials because this was messing about with nature.

Those of you who know the GM debate well will recognise those latter points as constituting some of the generic concerns also raised about GM. I think this tells us that upstream engagement presents us with some very significant challenges. That does not mean that we should not try it, but we need more research and more careful thought about how this should be done. □

1. *Nanoscience and Nanotechnologies: Opportunities and Uncertainties* (the Royal Society, London 2004).

2. *See Through Science: Why Public Engagement Needs to Move Upstream* (Demos, London 2004).

continued from page 8

been sent to an infectious diseases hospital where appropriate precautions could have been taken. This story is not only a fascinating piece of epidemiology; it is a perfect illustration of the fine line between an individual's right to withhold information and society's right to demand it.

The SARS epidemic spread from the hospital into the community and local doctors were inundated with cases of diarrhoea and chest infections. This led the authorities to invoke an isolation order to prevent anyone leaving Block E of a residential complex known as Amoy Gardens. SARS spread longitudinally up and down that tower block and its residents had to be put into isolation. The question then arises: at what point do you tell people that they cannot go out of their front doors; at what point does government intervene?

This question led to a heated debate among politicians, healthcare professionals and the public. The decisive factor was the fear that, because there are many similar tower blocks in Hong Kong and it appeared environmental factors were

important, if the disease were not contained by effective intervention the epidemic would continue to spread.

My point in telling this story is to raise the issue of intervention. The residents of Block E were quarantined, not allowed out and were subsequently moved to a holiday camp to isolate them because it was believed that the environment of Block E was infective. We might think that this restriction of choice of movement was a fairly draconian response; however, it contained the epidemic and was necessary to protect others. This is a dramatic example of the decision to remove individual choice in the interests of protecting the public.

A final lesson from the SARS epidemic is the need to remain vigilant. The tail end of the epidemic included many older people who became infected with SARS but whose symptoms were masked by co-morbidities and their medication. These patients were admitted to hospital with other conditions, such as broken legs and heart attacks, and silently passed on infection.

There are many points we can take

from the SARS epidemic regarding public health. It showed us that science must take societal factors into account. Following the SARS epidemic the gross domestic product of Hong Kong dropped by 6 per cent and 6 million jobs were lost. That was the impact of not taking public health seriously. It was only when information was extracted and measures taken to protect the general population, rather than the rights of individuals, that the epidemic was finally contained.

In this country we have much debate about smoking and the right to a smoke-free environment. Whose right is it? Who makes the decisions? Although less dramatic than SARS, the issue of smoking raises many of the same questions.

As I said at the beginning, public health is a global issue. The *British Medical Journal* recently published a sobering article on the healthcare system in Armenia, where nearly half of those living in rural areas had no access to healthcare. We are very fortunate in this country to have the social, economic and political environment in which we can make choices about our health. □

obituary

In 1983 Dr Richard J Haas CBE became an active and influential member of the Foundation's Council. In 1992 he was elected a vice president of the Foundation. He was a regular participant in Council debates from 1983 to December 2004. He died last month.

Richard Haas

It is with much regret that we report the death at the end of January of Dr Richard Haas, a vice president of the Foundation. The late Lord Lloyd of Kilgerran, the second chairman of the Foundation, introduced Dr Richard Haas to the Foundation for Science and Technology two years after its inception. Dr Haas made it possible for the Foundation to survive in its early years with a generous grant to help make a fresh start. But he also took a large part in turning the fortunes of the Foundation around through his positive and optimistic approach.

Soon after his election to the Foundation's Council he promoted a number of initiatives, one being to launch the Foundation's journal. This he did despite the majority of members of Council, including the vice president Lord Shackleton, being sceptical about

the value of a further journal of science and technology being launched into a full market. The journal was launched on Haas's insistence and he covered the cost of the first few issues to give it a jump-start. But once they had seen those first issues, all the members of Council changed their tune and gave Dr Haas their full support.

Dr Haas strongly believed that there should be a register of learned and professional societies and again made it possible financially for the Foundation to produce the first edition of its Register of Learned and Professional Societies in 1986. Four editions followed over later years until electronic publishing and the internet made such paper lists somewhat redundant.

Those two publications, along with the Learned Societies' Newsletter gave valuable publicity towards raising the mem-

bership of the Foundation, especially in its early years.

Dr Haas had a huge span of contacts that he frequently used for the benefit of the Foundation. He arranged a seminar in the American Embassy; he initiated a conference in Frankfurt and another in Paris, through a combination of his influential contacts and his sponsorship. These seminars and others that followed were the result of his suggestion that the Foundation should develop a European dimension.

Had Dr Haas not provided his support at a crucial time in the early development of the Foundation, it might not have survived to develop into the very successful forum for debate about science and technology policy that it is today. □

With thanks to David Hall OBE, former director of the Foundation.

Companies, departments, research institutes and charitable organisations providing general support to the Foundation.

3i plc	Ford Motor Company Limited	Science Media Centre
Aberdeen University	Foreign & Commonwealth Office	Science and Technology Policy Research
Advantage West Midlands	Fugro GEOS	Scottish Funding Council for Further and Higher Education
Aerial Group Limited	Gatsby Foundation	SEMTA
ALSTOM Power	GCI Healthcare	Severn Trent plc
Altran Technologies	GlaxoSmithKline	Sharp Laboratories of Europe
ARM	Harley Street Holdings Ltd	South Bank University
Arts and Humanities Research Board	Heads of University Biological Sciences	Textile Institute
Association for Science Education	Health & Safety Executive	Thames Water
Association of the British Pharmaceutical Industry	Higher Education Funding Council for England	The British Academy
BAE SYSTEMS	House of Lords Select Committee on Science and Technology	The City Centre for Charity Effectiveness
Baker Tilly	IBM (UK) Ltd	The Generics Group
Bank of England	Imperial College of Science, Technology and Medicine	The Hydrographic Society
BBC	Japan Society for the Promotion of Science	The Institution of Electrical Engineers
Biotechnology and Biological Sciences Research Council	Johnson Matthey plc	The Institute of Physics
Blackwell Publishing	King's College London	The Leverhulme Trust
BP	KMC Search and Selection	The Meteorological Office
BRIT Insurance Holdings plc	Kobe Steel Europe Ltd	The Open University
British Antarctic Survey	Kohn Foundation	The Royal Academy of Engineering
British Computer Society	Lloyd's Register	The Royal Commission on Environmental Pollution
British Council - Science Section	London Development Agency	The Royal Commission for the Exhibition of 1851
British Geological Survey	London School of Hygiene and Tropical Medicine	The Royal Society
British Library	Loughborough University	The Royal Society of Edinburgh
British Maritime Technology	Medical Research Council	The Smallpeice Trust
British Trade International	Michael John Trust	The Wellcome Trust
Brunel University	Microsoft Research Limited	UK Council for Graduate Education
BTG plc	Middlesex University	UK eUniversities Worldwide
CABI Bioscience	Ministry of Defence	UK Marine Information Council
Calderwood Han Limited	Monsanto plc	University College London
Cambridge MIT Institute	National Grid Transco	University of Birmingham
Cancer Research UK	Natural Environment Research Council	University of Bristol
Council for the Central Laboratory of the Research Councils	Natural History Museum	University of Buckingham
Chantrey Vellacott	NESTA	University of Cambridge
CIRIA	NIMTECH	University of Dundee
City & Guilds	North East Science & Industry Council	University of Durham
Comino Foundation	Nottingham Trent University	University of East Anglia
Conoco (UK) Limited	Office of Science and Technology, DTI	University of Edinburgh
Council for Industry & Higher Education	Office of the Deputy Prime Minister	University of Glasgow
Council of Heads of Medical Schools	Ordnance Survey	University of Hertfordshire
Cranfield University	Oxford Innovations Limited	University of Hull
David Leon Partnership	Parliamentary Office of Science and Technology	University of Kent
Department for Education and Skills	Particle Physics and Astronomy Research Council	University of Leeds
Department for Environment, Food and Rural Affairs	Peter Brett Associates	University of Leicester
Department for International Development	Pfizer	University of Manchester
Department of Health	PowerGen	University of Nottingham
Department of Transport	PricewaterhouseCoopers	University of Newcastle upon Tyne
Department of Trade and Industry	QinetiQ	University of Reading
DSTL	Queen Mary, University of London	University of Southampton
East Midlands Development Agency	Rail Safety and Standards Board	University of Surrey
Economic & Social Research Council	Roehampton University of Surrey	University of Sussex
Elsevier	Rolls-Royce plc	University of Teesside
Engineering and Physical Sciences Research Council	Royal Botanic Gardens, Kew	University of Ulster
Engineering and Technology Board	Royal Holloway, University of London	University of Warwick
Environment Agency	Rutherford Appleton Laboratory	University of Westminster
ERA Technology		University of Wolverhampton
		Winsafe Limited

The Foundation for Science and Technology
10 Carlton House Terrace
London
SW1Y 5AH

Telephone: 020 7321 2220

Fax: 020 7321 2221

e-mail: fstjournal@foundation.org.uk

www.foundation.org.uk



THE FOUNDATION
FOR SCIENCE AND
TECHNOLOGY