

fst journal

The Journal of the Foundation for
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Food safety

Sir John Krebs: Food safety is risk management

Hugh Pennington: The fight against food-borne illness

Geoff Spriegel: Safety seen from the supermarket

Science in society

Lewis Wolpert: What to tell the public

**Lord Jenkin of Roding: Restoring
public confidence**

Design counsel

**James Dyson in defence of
manufacturing industry**



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FOR SCIENCE AND
TECHNOLOGY



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This is the first issue of the *FST Journal* (formerly *Technology, Innovation and Society*). We hope our readers appreciate the new style. We were grateful for those who returned the comment forms circulated last year; many of the ideas included in the forms have been used in the redesign of the journal. Suggestions for further improvements would be welcome by e-mail to fstjournal@foundation.org.uk.

FST — free access on the web

Further details of the lectures and discussions reported in this issue of *FST Journal*, and of the previous events listed on page 16 of this issue, can be found on the Foundation’s web site at www.foundation.org.uk. For each event a two-page summary of the discussion session is available, in addition to those published in the Journal.

Reports and announcements

The Royal Society

The Royal Society has recently published views on depleted uranium and lung cancer, on climate change and research on GM animals — for more information see www.royalsoc.ac.uk or contact Bob Ward at their press office (020 7451 2516).

House of Lords

The Select Committee on Science and Technology of the House of Lords published a clutch of interesting reports before the House rose for the general election. On 20th March the sub-committee chaired by Lord Oxburgh KBE FRS

published a report on “Human Genetic Databases: Challenges and Opportunities”. This was the subject of a debate at a Foundation dinner/discussion meeting on 30th May with Lord Oxburgh, Baroness O’Neill of Bengarve, President of Newnham College, Cambridge and Dr Peter Goodfellow of GSK speaking.

Foreign and Commonwealth Office

The FCO has announced a significant increase in the funding for science support of an extra £3 million over the next three years. This will be used to appoint more overseas Science Counsellors and to increase the strength of the FCO science team in London.

Congratulations due

The Foundation congratulates four members of Council; Sir John Browne FEng and Sir Robert May AC PRS, on their invitation to join the House of Lords, Professor Brian Eyre CBE FEng on his election as a fellow of The Royal Society and the Chairman, the Rt Hon the Lord Jenkin of Roding, was elected an honorary fellow of the Royal Society of Edinburgh.

Dear Sir...

FST Journal invites correspondence from readers for possible inclusion in the journal. Preference will be given to matters arising from the Foundation’s lectures and discussions. Address material for consideration to: Letters, *FST Journal*, Buckingham Court, 78 Buckingham Gate, London SW1E 6PE.

Seen on the web



Google — even cleverer than you thought...

Google.com is generally acknowledged as the current method of choice for searching the web. But did you know that a known site can be searched by entering ‘site:[URL of site]’ in the search window? For example to find references to ‘foot and mouth’ only on the Department of Trade and Industry site, simply enter ‘foot and mouth site:www.dti.gov.uk’. There is also a translation service on google.com that will automatically translate pages in Italian, French, Spanish, German, and Portuguese.



Alpha Galileo

The Alpha Galileo site at www.alphagalileo.org provides on the web a wide range of access to news on European science, medicine and technology. Up-to-date news is freely available, or users can choose to register as ‘journalist’, ‘contributor’ or ‘expert’.

How can public trust in science be restored?

by The Rt. Hon. the Lord Jenkin of Roding

Science in its social context

Not for the first time, a report by the House of Lords Select Committee on Science and Technology has ignited debate about the proper conduct of science in Britain. Last year, its report entitled "Science and Society" examined the apparent gulf between science and the public. On 28 June 2000, the merits of the report's conclusions were debated by Lord Jenkin of Roding, the Chairman of the Committee (and also Chairman of the Council of the Foundation for Science and Technology), Professor Nick Pidgeon of the University of East Anglia and Professor Lewis Wolpert of University College, London. The Chairman of the discussion meeting was Mr David Moorhouse, Deputy-Chairman of the Foundation's Council. A note of the meeting, anonymous except for principal speakers, was taken by Sir Geoffrey Chipperfield, parts of which appear on page 4.



The Rt. Hon. Lord Jenkin of Roding

A member of the House of Lords Science and Technology Committee. Chairman of the Sub-Committee which conducted the inquiry and Chairman of the FST.

Over the past year or two, a gulf of mistrust has been opening up between science and the public. Last year, science comprehensively lost the public argument over genetically modified organisms (GMOs). Earlier, the BSE fiasco had done huge damage to public confidence in the regulation of food standards. Shell's debacle over the Brent Spar oil-rig was a defeat for the concept of 'the best practicable environmental option'. A survey by the Office of Science and Technology (OST) uncovered deep public concern about scientific developments such as reproductive cloning, xenotransplantation and other potential applications of modern genetics.

Against this background, I readily agreed to chair an inquiry into the origins of this mistrust by the House of Lords Select Committee on Science and Technology. The Committee chose as a working title "Science and Society". I did not dissent: I had been a member of an earlier Inquiry on the management of nuclear waste where we had identified the need to gain public acceptability for the preferred solution as a key, even the key, issue. Science and Society was a natural follow-on.

In our call for evidence for the inquiry, we asked: What are the sources that shape public attitudes to science? How can dialogue with the public be improved? What factors influence public attitudes and trust? Are some scientists trusted more than others and, if so, why? Can modern science be presented to the public in an accessible and trusted form?

From the outset, we were faced with a remarkable paradox. Science today fascinates the public. The sales of popular science books, and the audiences for serious science programmes, have never been larger; yet trust in many kinds of scientists, particularly Government scientists, seems to be at an all-time low.

Survey after survey has shown that this lack of trust is profound and widespread. It is not just a British but a European phenomenon. My committee had no difficulty in expressing the view that "Society's relationship with science is in a critical phase". Science is advancing so fast on so many fronts that there is a real danger of the public being left behind. The

pace of scientific discovery and application seems to be running far ahead of public awareness, let alone public assent. The result is not only that many people are fearful about what is happening but that this in turn breeds a climate of anxiety among scientists who fear what one broadcaster described to as "tabloid crucifixion".

After over a year of enquiry and after receiving over 400 pages of written and oral evidence, we made 26 specific recommendations (conveniently lettered "(a)" to "(z)"). I shall summarise them in five main messages.

Message No. 1

Yes, there is a crisis, and unless it is faced and addressed, we risk, not only driving good scientific research abroad, but also undermining our ability as a nation to earn our living in an increasingly technological world. Issues such as GMOs, cloning, stem cell research and others I have mentioned arouse serious anxieties, and this in turn may well result in the public withholding consent. Time does not allow me to give details of who is trusted and who is not, but it is no secret that government scientists, politicians and journalists all come at the bottom of pretty well every table.

Message No. 2

Science is certainly not alone in facing public scepticism. We live in an age when all authority is questioned. Many issues get out of focus as a result of a pervading cult of secrecy. Much information is suspected of being tainted by its source. Media hype fouls up much more than science.

Yet, we identified one feature of the controversies over science, namely, a confusion between attitudes to the science itself and attitudes to the ethics, values and morals that lie behind the science and its applications. Many of our witnesses told us that what may appear to be a hostile public reaction to a new scientific discovery may not be hostility to the science itself, but may stem from a belief it raises these other issues of concern — environmental, ethical or even moral issues — which the scientists appear to be ignoring. Several of our witnesses told us that what is needed is

The public appraisal of risk

discussion

Professor Pidgeon welcomed the report and agreed that scientists must engage more with the public. A central problem was uncertainty about risk. Although, in the developed world, lives were longer and better, people seemed increasingly concerned about risk. However, their behaviour patterns often took little account of risk analysis — for example sunburn and cars. The 1992 Royal Society report indicated the wider and different meanings that people might assign to risk; the qualitative factors involved (including whether the risk was voluntary, whether the results might be catastrophic and cultural affinities). Life-style could be more important than avoiding risk.

Risks from scientific advance were more likely to be accepted if accompanied by open dialogue and, most important, trust in institutional control. Incidents such as Flixborough and BSE showed that public concern was not with science, but with human behaviour. That there were limits to risk assessment; public perceptions, and the values behind them, must be understood, and the biases of experts must be recognised. But public perceptions themselves may be biased, and reflect only media hype and noise. They must be managed. Key issues were understanding the complexities and politics of trust; recognising that trust depends on the independence of regulators and analysts (which implies genuine institutional reform); and examining the consequences of stakeholder involvement and the interface with existing decision makers.

not more public understanding of science, but more scientists understanding the public. You may not agree with Prince Charles on GMOs, but his voice has touched off many echoes in society at large. We ignore them at our peril!

So this is message no. 2: if you deal with an issue as though were solely an issue of science, you must not be surprised if the public respond negatively, because they may see this as distorting — or even excluding altogether — other legitimate concerns.

Message No. 3

So what to do about it? For 200 years or more many British scientists have made heroic efforts to engage with the public. The famous Royal Institution lectures were and still are a striking manifestation of this. The multifarious activities of the British Association for the Advancement of Science are another. The great national museums have increasingly moved from holding collections for study by experts and students to becoming exciting public experiences. The recent wave of new Science Centres is adding new dimensions to this process.

Fifteen years ago, the Bodmer Report led to the establishment of COPUS — the Committee for the Public Understanding of Science. This brings me to what I regard as the most important message of our Report. Communication is not a one-way

process. We invite scientists to engage in a dialogue with the public. This has to be much more than simply improving the public understanding of science. Indeed, the phrase, “the public understanding of science”, implies that it is a top-down, one-way process. We cited with warm approval the statement of the former President of the Royal Society, Sir Aaron Klug: “Engagement with society is a two-way process, involving different (though not necessarily opposing) sets of values.”

We expressed the hope that the current review of COPUS by its sponsors may lead to a change of name. One of my distinguished colleagues on the Select Committee, Lord Porter, himself the President of the Royal Society when COPUS was set up, suggested that it might be renamed “the Council for Science and Society”. This would signal a change from a top-down, one-way concept to a body eager to engage in the dialogue of which Sir Aaron spoke. As so often, our American cousins find a neat way of encapsulating this ambition: “Communication requires ears as well as voices” was how one of our Washington witnesses put it.

However, our Committee went further than just identifying new aims and names; we have called for a new culture: “a culture of direct, open and timely dialogue with the public”. This is our third main message. It is addressed not just to COPUS and its partners, but to all the learned societies, to the Research Councils (who do

much good work in this direction, but who could much better), to the higher education funding councils — we were dismayed to be told that public communication does not count towards the Universities' scores in the periodic Research Assessment Exercise — to the science museums and centres and, above all, to the Office of Science and Technology and the rest of Government. There must be Government support for this work. Yes, let it be led by the Learned Societies and the other major players; but the Government must show its support by promising financial backing.

Before turning to the last two main messages, I should draw attention to two useful chapters in our report — on the communication of risk and uncertainty and on science education in schools. Because others are already involved in studying the education and training of young people for careers in science and engineering, we expressly excluded that from our terms of reference. However, we did offer some thoughts on the influence, that science teaching has on people's perceptions and attitudes in later life, and we put forward some ideas for others to take forward. On risk and uncertainty, we believe that one key to a better understanding lies in a better appreciation of the scientific process itself.

Message No. 4.

This can be stated very shortly. We must abandon the cult of secrecy and exclusiveness in favour of openness and transparency. We were much impressed by the US experience where the Freedom of Information Act and other related legislation help to build public confidence in the system. This is especially important for those engaged in the processes of regulation. Regulators should be governed by a presumption of openness in all that they do. Already, this is beginning to happen; for instance the new Food Standards Agency has made a good start, and others are beginning to follow.

Message No. 5.

Not surprisingly, we received a good deal of evidence about the role of the media. This pointed in several directions. Many in science are ready to blame the press for their woes. Journalists complained to us that it is often difficult to get information or comments from British scientists and that they find that they can get what they need more quickly from American sources!

What we found is that there is a clear contrast between, on the one hand, the style and practices of science editors,

science journalists, and, in broadcasting, specialist science programming, and, on the other, the activities and attitudes of news desks, political desks and the news and current affairs broadcasters. We were impressed by the responsibility of the former to do their best to get stories right, though one must remember that they are journalists who look for 'stories' which have to compete for space with others.

Most of the perceived problems with the media arise when science stories are handled by others, especially by sub-editors and news desks. We heard of the hyped-up headline to gain attention; of the

sub-editor who may not understand the story and alters it to give it a spin; of the editor whose newspaper goes into campaigning mode, where the science is subordinated to the campaign.

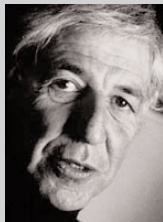
Faced with this, a House of Commons Select Committee had called for a special Code of Practice for science. We disagreed. "In a democratic media-culture, scientists have to learn to take the rough with the smooth like everybody else". We believe that there is no substitute for what one witness called "the hurly-burly of public debate". What is needed is that scientists must get better at handling the media, and

we commended the Royal Society's guidelines for scientists working with the media.

The Select Committee's report has been widely commented on both favourably and otherwise, but no one seems to have disputed our five main messages. When this address was delivered in June 2000, we had not yet seen the Government's response; when this is available there will be the usual debate on the floor of the House. In the meantime, I know that a great many people involved in science communication are giving much thought as to how to take our recommendations forward. □

What does the public need to know?

by Professor Lewis Wolpert



Lewis Wolpert

Professor Lewis Wolpert CBE FRS is Professor of Biology as Applied to Medicine in the Department of Anatomy and Development Biology of University College, London.

The report of the Select Committee of the House of Lords on Science and Society is full of good intentions but there are problems, as in its emphasis on what seems like a public relations exercise to persuade the public to be more trustful of science. The committee claims that there is a crisis of confidence because of the Government's behaviour over BSE and GM foods as well as rapid advances in biotechnology.

But is this a question for science or the result of the handling of the issues by politicians? And is the public really distrustful of 'science' as if it were a homogeneous entity with no distinction between biology and astronomy? Are there really many people who no longer contribute to medical charities because they no longer trust science? I doubt it. And what is the evidence that the measures the report proposes will have the effect the committee seeks?

Yes, there are indeed surveys that show some distrust of scientists, particularly those in Government and industry. This probably relates to BSE and GM foods and so one must ask how this in reality affects people's behaviour. I need to be persuaded that many of those who have this claimed distrust would refuse, if ill, to take a drug that had been made from a genetically modified plant or would reject a tomato so modified if it were both cheap and would help prevent heart disease. Who refuses insulin or growth hormone simply because these are made in genetically modified bacteria? It is easy

to be negative about science if it does not affect your actions.

But one of the chief weaknesses of the report is that it fails to distinguish between science and technology. Science is closely related to technology, but they are not the same. It is essential to recognise that reliable scientific knowledge is value-free and has no moral or ethical value. Science tells us how the world is. That we are not at the centre of the Universe is neither good nor bad, nor is the possibility that genes may influence our intelligence or our behaviour. Dangers and ethical issues arise only when science is applied to technology. To be sure, ethical issues can also arise in the conduct of scientific research itself, as in experiments on humans or other animals. There are also important issues related to safety. It is the responsibility of the research community to ensure that these matters are well regulated, while the wider world has a right to know that this is so.

What needs to be more widely appreciated is the important distinction between science and technology: between knowledge and understanding on the one hand, and the application of that knowledge to making something, or using it in some practical way on the other. Science produces ideas about how the world works, whereas the ideas in technology result in usable objects.

The report enthuses about the need for a dialogue between the public and scientists, but such a dialogue is not really possible. Science is very technical and largely inaccessible except to those in the particular fields

concerned. The public has nothing to contribute to discussions of what scientific research should be undertaken or how it should be carried out. That is not to say that scientists should not make every effort to explain what they are trying to do. But a dialogue is meaningful only when ethical issues arise as in relation to the applications of science outside their own areas. And there is no point in a dialogue unless it leads to some sort of action agreed by both parties.

The House of Lords report never takes up the issue of what its authors would like the public to know about science. The issue of trust is central to the report, yet it never explains why one should trust science and why science is an especially reliable way of acquiring knowledge. There is, alas, no simple formula for explaining how science works, no formula for a scientific method. The key features are defining solvable problems, testing ideas (preferably quantitatively) against reality, the importance of controls and the key role of peer review. Knowing these, and the importance of clinical trials as opposed to anecdote when it comes to medical treatment or GM foods, are of much greater significance for the public than, say, understanding the structure of DNA, desirable and pleasurable as that may be. (Even so, it remains disconcerting that many people believe that tomatoes that are not genetically modified do not contain DNA.)

Science is now central to our culture, so that the public should have easy access to it. Even more important, it should also have access to real scientists. That should be given a high priority, as the Swiss found in their referendum on transgenic animals. Open days at scientific institutions could help.

Another omission from the report is any suggestion as to how attempts to relate science and scientists to the public should be evaluated. Should there not be, for example, an attempt to record the quantity and nature of news and TV coverage and reviews of science books? The report indeed suggests that scientists at universities should be rewarded for their dealings with the public, but how is the quality of those efforts to be evaluated? And what, in any case, should be their goals?

The report pays much attention to guidelines for editors and journalists, urging that they should be adopted by the Press Complaints Commission. But I am totally opposed to any formal constraints on the press. The Select Committee agrees that openness is all. Of course, it is possible that, as the public comes to understand more about science, it will be even more sceptical. So be it, I say. That is the nature of a democratic society. We scientists should not involve ourselves in a public-relations exercise for which we have no skill. □

Prejudice, dialogue and vested interests

discussion

A principal theme in the general discussion was whether the line drawn by Professor Wolpert between science and technology was hard and firm, and whether public mistrust was confined to the application of science, and its institutional regulation, or went deeper. While there was general agreement that there was little, if any, place for dialogue in the process of genuine scientific discovery, there was some doubt whether such work could be isolated from public interest and concern; ethical issues — such as work on human tissues — could arise.

Concern about, or enthusiasm for, possible applications of 'pure' research could also affect funding. For example, the Foresight emphasis on research leading to development for market entry (where ethical issues might well arise) could taint the research itself. There was, therefore, an argument for having on Research Councils some members who would have in mind wider issues than the strictly scientific. The crucial area where debate, dialogue and consultation must take place was, however, with application of scientific discovery. How successful this could be was questionable. There were some examples of such dialogue leading to consensus, where they were based on a full understanding of the local culture; but the institutions and processes, which fostered these successes, were not easily transferred to different cultures. Consultation meant active participation in discussion, and must not be confused with market research.

Further themes were the roles of politicians, journalists and commercial interests. All were mistrusted, but so what? They could not, and should not, be ignored. Politicians, as taxpayers' representatives, authorised the public expenditure from which salaries and research grants flowed. Like it or not, researchers were accountable to them and must take account of their interests and priorities which, unsurprisingly, would align with those of the voting public. To suggest that politicians should give 'leadership' on scientific issues where there might be conflict with their political interests was unrealistic.

Neither was there much point in railing against media hype and journalistic opportunism and ignorance. Scientific correspondents often deserved praise, but their contributions neither sold papers nor galvanised TV ratings. The commercial drive came from news desks that wanted 'campaigns' and scare stories. "GM foods safe, says scientist" would not rate a mention. But, even so, much could be done to alert researchers to possible media reaction; to caution them to restrict comment to scientifically unassailable points and to warn them against venturing into fields where their views were of no more value than those of others. The problems of 'rogue scientists' and 'false balance' could never be eliminated, only mitigated by prolonged discussions with journalists, based on an understanding of their priorities.

Was, therefore, the idea of 'scientific leadership' a chimera? Political leadership was doubtful, if not dangerous; reason led media debate improbable. The role, if any, had to fall back to the Royal Society, the learned societies and eminent individuals. A continued and determined effort by them could, in time, improve the position, but was unlikely to provide a step change.

Finally, however much it seemed unfair, and against the best interests of science, for commercial interests to fund and exploit scientific research and development in search of profit, little good would come from hoping things would change. It might well be true that insufficiently considered commercialisation of GM foods had led to the GM furore, such activity in a global and competitive environment was inevitable. The lessons for such companies were that markets and interests (as the discussion on consultation had suggested) were local, and arguments should be addressed to local benefits, rather than vague global amelioration.

⇒ A detailed summary of the discussion is available on www.foundation.org.uk

Food safety is risk management

by Sir John Krebs, FRS

Food safety — who is responsible, Government or Industry?

Britain has recently suffered several food-safety crises, notably that caused by the discovery that bovine spongiform encephalopathy (BSE) can cause fatal disease in people. Part of the Government's response was to found an independent Food Standards Agency, whose chairman, Sir John Krebs, was the first speaker at a dinner/discussion on 12 December 2000. Professor Hugh Pennington, who conducted an enquiry into a fatal E. coli outbreak in Scotland in 1996 and Dr Geoff Spriegel, Technical Director at Sainsbury's, also spoke. The chairman was Lord Soulsby of Swaffham Prior. Extracts from a note of the general discussion, taken by Jeff Gill, are included with the accompanying text.



Sir John Krebs, FRS

Sir John Krebs, FRS has since 1988 held a Royal Society Research Professorship in the Department of Zoology, Oxford University, where he is also a Fellow of Pembroke College.

He is the Chairman of the Food Standards Agency, which formally came into existence in April this year.

Food production, sale and consumption involve all of us. These are very big businesses, involving every person in the country. Here is an indication of their scale. British people spend about £106 billion a year on food; it accounts for nearly a fifth of consumers' expenditure and it is estimated that 80 million items are bought every week. In the enforcement of food safety and standards, there are 2,000 or so environmental health officers and trading standards officers employed by local authorities, part of whose job is to enforce the law. There are about 1,600 staff of the Meat Hygiene Service responsible for enforcement in abattoirs and meat-cutting plants; the local authorities and the Food Standards Agency, who employ this staff, cover between them more than 600,000 food premises. Food, in other words, is the largest industrial sector concerned with consumer issues; it employs over 2.5 million people.

So who is responsible for food safety? That is the question that we are being asked to discuss. Is it central government, through the Food Standards Agency, set up on 1 April 2000 to protect consumer interests? Is it the local authorities, which have a large part of the responsibility for enforcing food regulations and ensuring that premises obey standards of hygiene and other aspects of food security? Is food safety the responsibility of those producing, manufacturing, selling or supplying food in other ways? Or is it the responsibility of all of us as individual consumers? That is the cast-list of those who might be held responsible. To anticipate my conclusion, right now, all of those groups and agencies have an important part to play.

Risk, law and the public

First, about the role of the Food Standards Agency, which was set up to protect people's health and the other interests of consumers in relation to food. Our functions, which encompass the whole food chain from farm to fork, can be summarised as (1), ensuring that food law is properly enforced; (2), supporting consumer choice by ensuring that consumers have the right kinds of information (as on labels) and advice, including not just food safety but also nutrition and, (3), developing policy for the UK government both at home and overseas. Since much food law emanates from Brussels, we have a very important role in negotiating or providing the UK

negotiating position in Europe. We also have a research budget of about £27 million a year which is deployed through contracts to underpin all of those functions.

Scare stories

What, now, do we mean by saying that food is safe? And how does this relate to the role of the Food Standards Agency? My own position is that I will not answer questions such as, "Is food 'X' safe in absolute terms?", because there is no such thing as absolute safety of food. No doubt there is an interesting debate to be had about the level of risk that is acceptable, but if you look at the newspaper headlines, you could easily convince yourself that not only is food not absolutely risk-free, but that it is dangerous enough to turn you into a non-eater overnight.

The newspapers carry regular food-scare stories, most of which have little foundation, but seem to represent the media's approach to food safety. You could ask, what do the people out there actually think about food safety? We (and others, such as the Consumers' Association and the Industry) have learned from the survey work we have done about peoples' concerns when they are buying food. They mention how much it costs, its quality and the problems of being able to buy food that appeals to their families. Very few people, it seems, go into the shop thinking, "Is the food I am going to buy safe?". In other words, for most people most of the time, when they are making shopping decisions, food safety is not an issue. Safety is taken as a given.

However, if you then probe a little further and ask, "Supposing that you were worried about food safety, what would you be worried about?", the three concerns that topped the list in a survey we did in May are BSE, salmonella (which I take to be an icon for food-borne illness) and GM food. In summary, people on the whole are not concerned about food safety, if you ask them what first comes to their minds.

If you were to probe deeper, asking, "What are the real risks associated with food?", the answers would or should be very different. We now know a great deal about the ways in which nutrition, both the quality and the amount of food, can affect human development both before birth and in childhood. The quality of a young person's nutrition affects the whole quality of his or her later life. But there is

more to it than that. Many heart and vascular disease deaths are diet-related, as are about one fifth of cancers, giving respectively 73,000 and 34,000 deaths each year.

These numbers, however uncertain, dwarf those of deaths from food-borne illness, estimated at somewhere between 50 and 300 people a year. And fewer than 20 people a year die of food allergy (anaphylactic shock), while the BSE variant of CJD kills between 20 and 50 people a year (though the numbers are inevitably uncertain). As for the effects of eating GM foods, so far as we know, nobody has died, not just in the UK but anywhere in the world. This poses an interesting question about peoples' perception of risk. Of course, the academic study of risk has made it clear that people's perceptions do not necessarily agree with the scientific evidence.

Given that absolute safety is unattainable even in principle, the Food Standards Agency is centrally concerned with risk. We have a role in risk assessment, for which we rely on the advice of experts such as scientists and others, a role in communicating risk and a role in managing risk. We recognise that, very often, there is a great deal of uncertainty in scientific risk-assessments, so we have to manage risk with incomplete knowledge (not least in relation to BSE). We also have to recognise, as I have described, that people's perception of risk may differ from a scientific evaluation; without basing risk management on people's perceptions as opposed to objective assessments (with all the uncertainty), there is no doubt that people's perceptions have an influence.

Benefits of transparency

Traditionally, the view in government was that you assessed risk, you decided what to do about it and then you told people what they should do. But we have determined to carry out all our business in a very public way; all our board meetings are in public and we discuss food-safety issues in public. In that environment, you cannot operate in the traditional linear fashion. While you are discussing the assessment of risk, you also have to discuss the management and at the same time you have to communicate.

What is our general approach to managing risk? We rely on the best advice we can get, drawing on expert committees, while acknowledging the inescapable uncertainties. We have resolved not to repeat the mistake referred to by the Phillips Report (into BSE, published last year), of requiring advisory committees to manage risk: that remains our job. We consult widely, where time permits, and we provide an open and honest evaluation of the risk-assessment and uncertainty. We

continue to reassess the risks in the light of new evidence. We also try to apply a consistent approach to risk management across different domains.

That is an important question for government as a whole: how much should be invested on behalf of the taxpayer in managing risks in one area rather than another. We try to be proportionate in managing risks. The recent problems in rail transport are an illustration of the need for proportionate management. In retrospect, it is plain that Railtrack's actions after the accident last November had the effect of driving 25 per cent of its passengers off the trains and onto the roads, where the risks of dying in an accident are 12 times greater; that doesn't seem to me to be necessarily a proportionate action. And as I have already said, we recognise that we are not here to eliminate risk but to reduce it to acceptable levels, whatever that may mean. Because we have an enforcement role, we ensure that our good intentions for risk management are put into practice by monitoring and auditing what the local authorities and by the Meat Hygiene Service do.

But should we not follow the precautionary principle? I wish only to say that the precautionary principle means everything to everybody and therefore potentially means nothing. For example, some pressure groups on GM safety cite it in advocating that there should be no action until absolute, 100 per cent, safety has been proved beyond doubt; that is, of course, impossible. Another approach arises in relation to climate change, when some groups say, "Although there is uncertainty, that is no excuse for inaction, so let's do something even though we don't quite know the full context within which we are doing it". In fact, I believe that the system I have described is a precautionary approach to risk management. But in the end, one has to come to a judgement; there is no substitute for judgement on the basis of the evidence available.

To complete the story about risk, it is important to distinguish between voluntary and involuntary risks. For voluntary risks, the government's job is to put underpinning regulation in place and to ensure that individuals have enough information and advice to make their own choices. For involuntary risks, when individuals may have no meaningful choice, when vulnerable groups are involved or when there is a public health-risk, the government should intervene. For example, some foods may contain allergens that have serious consequences for those allergic to them: our approach is not to ban them (nuts, for example) from the food chain, but to insist on clear labelling. On the other hand, there is the agent responsible for BSE. The risks

are so pervasive that we have to regulate to manage the risk to a level that is acceptable.

First endeavours

Let me end by giving some examples of what we have been doing. In relation to BSE, we have undertaken a review of the current BSE controls, now completed, to inform both the UK government and Britain's negotiating stance on the European-wide measures to be introduced at the beginning of 2001. The point I want to make in relation to the role of government in risk management is that we carried out the whole review in public, and through our website. That has proved to be an invaluable means of engaging thousands of people in a process that will, after all, help to determine their future.

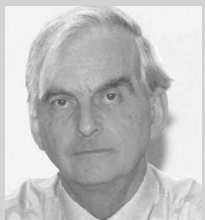
We have also been active in the enforcement process. We have set in place a new arrangement between central government and the local authorities, the chief innovation in which is that the FSA will have responsibility, with the local authorities, for setting the enforcement standards. Enforcement activity will be monitored by quarterly reports to us. We shall audit about 40 or 50 of the 500 local authorities each year. When necessary (but we hope it will not be), we will take over if local authorities are failing. This will be a transparent process. We put such enforcement data as we have on our website; the result has been very encouraging. Within 24 hours, the 20 or so worst performing authorities telephoned to explain how they planned to do better!

My third illustration of what we are doing concerns food-borne illness. We have set a target of a 20 per cent reduction over the next five years. Our plan entails (among other things) ensuring that from production to consumption, people follow best hygiene practice guidance. Experience elsewhere has shown that significant benefits can be won by this means.

To summarise, nothing in life is risk-free. Government cannot eliminate risk, but must manage it to acceptable levels. Two-way communication is essential: we must listen to people's concerns as well as explain the risks and uncertainties. I have emphasised that the role of the FSA, the role of government, is in assessment, communication and management of risk. I have distinguished between voluntary risks and risks that are managed on behalf of the people by government. Finally, I want to emphasise what I said at the beginning, that food safety is a shared responsibility of all the players from the primary producer to the individual consumer and that, although central government has an important role to play, it can't do it on its own. □

The fight against food-borne illness

by Professor Hugh Pennington



by Professor Hugh Pennington

Hugh Pennington is professor of bacteriology at the University of Aberdeen. In 1996-97 he chaired an inquiry for the Scottish Office into the outbreak of *E. coli* O157 food contamination

Much of our knowledge about microbial food poisoning comes from outbreaks. They give the best epidemiological and clinical data as well as information allowing the apportionment of blame. As case studies they provide powerful examples of the roles government and industry should play in preventing and controlling food poisoning.

The 1996 *E. coli* O157 outbreak in Central Scotland had all these properties. More than 500 people were infected and there were 21 deaths. Its most dramatic component was the Wishaw Old Parish Church Hall lunch episode: of 87 people who attended a lunch for the frail elderly, 45 were infected, 17 were hospitalized and 8 died. Steak pie provided by John Barr and Sons butchers' shop in Wishaw was the vector of infection.

Inspection of Barrs' premises soon after the outbreak began showed over 100 different hygiene deficiencies. Another reason why the outbreak was so large — and all the *E. coli* O157 on the contaminated meats that caused it could be traced to Barrs — was that the business operated on an industrial scale. But all of these

things had been going on for a long time. Why had an outbreak not occurred sooner?

Research...

Some important answers lie in the biology of the organism. It is a newly emerging pathogen, the first recorded cases in Scotland occurring only as recently as 1984. This in turn raises other questions. Why are human infections more common in Britain than in

Europe and more common in Scotland than in England and Wales? The intestines of ruminants are the natural home of the organism. Despite the possession of a comprehensive portfolio of virulence factors, active in humans, the organism does not cause disease in cattle and sheep.

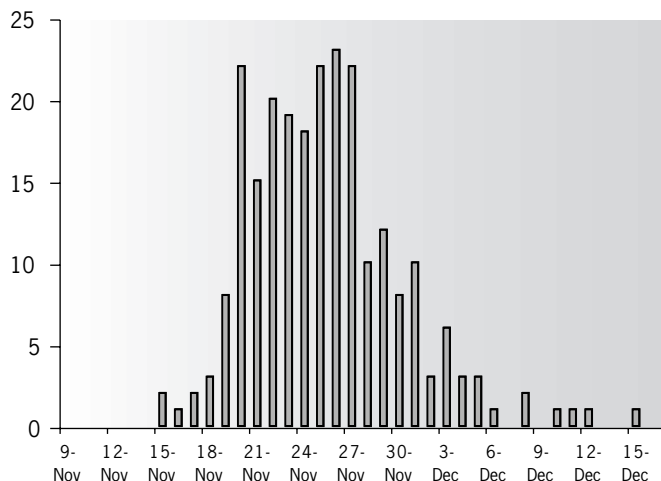
How can this be explained? These are questions that can be answered only by

research and surveillance, which is largely the responsibility of government. Other research, such as the development of control measures for the treatment of carcasses as they leave the abattoir to reduce contamination, fall primarily to industry. A similar division of responsibility is accepted for other food-poisoning organisms. For example, basic research funded by government is being done to find the source of *Campylobacter*, the commonest cause of bacterial food poisoning. Industry initiatives, building on the findings of basic and applied research, are successfully reducing *Salmonella* levels in chickens. These in turn are leading to substantial reductions (by 30 per cent in 1998 and 1999) in the number of *Salmonella* infections in humans. (Nevertheless, industrial production methods in the chicken industry and its concentration in the hands of a few companies facilitated the spread of *Salmonella*).

...and enforcement needed

That a well-known food business such as Barrs had been operating in an unsafe way for a long time focuses attention on food safety enforcement by government agencies and local authorities. The premises had been inspected by environmental health officers three times in the year preceding the outbreak. Only minor deficiencies were recorded. The business was told to carry out a hazard analysis, but the frequency of inspections was reduced from two to one a year because it was thought to be satisfactory from a safety standpoint. There is a striking parallel with the Piper Alpha disaster on 6 July 1988. In the year preceding the explosions which destroyed the North-Sea oil platform and killed 167 people, the installation had been inspected by the Department of Energy three times, once routinely, once after a fatal accident and once as a follow up. On the last occasion, it was deemed that "lessons had been learned" and that there were "no points of major concern". That was 10 days before the disaster.

In both disasters inspections had failed to reveal major failings in management, training and working practices, as well as unsafe equipment and layout of premises. Stimulated by these events, a common approach is now being followed in both the offshore oil industry and in food businesses to deliver safe practice. Wherever possible, control by prescription is being



The course of the *E. coli* O157 epidemic in Central Scotland, showing number of cases versus known date of onset.

replaced by self-regulation. Industry identifies its hazards and risks and says how it will manage them to produce a safe working environment offshore or safe food. They do this, respectively, by producing a Safety Case or a HACCP plan (hazard analysis and critical control points). The primary role of inspectors is to audit these plans.

It is agreed that HACCP should not only be implemented as quickly as possible for food processors and retailers, but for food producers as well — from plough to plate. It is also agreed that its implementation will take time. Many small businesses, for example, do not yet have the technical knowledge to prepare their own HACCP plans. Some kinds of

food poisoning, such as botulism, have such serious consequences that it is to be expected that government and its agencies will continue with prescriptive approaches to protect public health from them.

The current food-poisoning statistics make dismal reading. Well-informed commentators estimate that as many as 2 million cases occur every year in England and Wales. It is clear that to effect a reduction, both government and industry have to continue and improve on the substantial work they are doing in this field.

To finish on a humorous, but realistic, note I quote Christopher Haskins' list of "vested interests in the Food Game" from his 1995 Caroline Walker Lecture

"Food and the Public Interest":

Devious governments
The neurotic middle classes
The campaigning aristocracy
Unscrupulous farmers
Evangelistic organics
Self-righteous environmentalists
Lethal animal lovers
Dogmatic scientists
Pompous journalists
Greedy company chairmen.

I cannot quite work out what angle the campaigning aristocracy are supposed to take. What I do know is that the battle against food-borne illness will require all of them to change their ways. □

Safety seen from the supermarket

by Dr Geoff Spriegel



Dr Geoff Spriegel

Geoff Spriegel is Technical Director of Sainsbury's Supermarkets

Having accepted the challenge of representing the food industry in this topical debate, I start with a simple proposition: the food industry is not a single entity, but a disparate collection of sectors: biotechnology companies, farmers and shops which, taken together, are the "food-chain". Companies in the different sectors vary in size from small family or private businesses to major international conglomerates. Now, they are parts of a global supply-chain, involving many developing countries with varying technical capability and local legislation.

Working for a major retailer (Sainsbury's) as I do, I can generalise about the food industry, but can talk in detail about the philosophy and practice of food-safety only in my own company. My answer to the question posed for this debate is that the responsibilities of government and industry are distinct, but are also inextricably linked.

Government is responsible to consumers for pushing back the boundaries of scientific knowledge and understanding. It must also establish the goalposts, based on the best scientific knowledge available, and give advice on the practical controls necessary to manage risk. It must operate approval procedures to assess the safety of, for example, new processes or ingredients. Government must also establish a workable legislative framework and an effective enforcement system. As the largest freely elected consumer-interest group in the United Kingdom, the government should also provide impartial

information on issues of interest or concern to consumers.

Industry is responsible to its customers for producing food within the boundaries of existing knowledge, to manage hazards and produce safe food. At the very least, companies should provide customers with information to enable them to make an informed choice and to enjoy food products at their best, both by labelling and providing information relevant to storage, cooking, or shelf-life. Companies must monitor their own performance and implement corrective action swiftly.

The safety of our food is not only a recent concern; there has been food safety legislation for over 100 years. Current law in the UK is enshrined in the Food Safety Act (1990), which requires a company to conduct a hazard analysis of its operations and to apply due diligence in the management of risk. While the law allows flexibility, which is welcomed by industry, it is open to interpretation by both operators and enforcers — which can lead to problems.

The changing food market

Whether the safety of our food is improving or otherwise is an open question, but radical changes in the food industry since the Second World War have multiplied the potential hazards (or sources of risk). Thus, the point of consumption of food has moved further and further away from the point of production, lengthening and complicating supply chains. People shop less

discussion

Persisting doubt on causes. It would be relevant to know where in the food chain, hygiene most often broke down. Unfortunately the information available was limited and of poor quality. It would cost too much to investigate the many small outbreaks of potentially food-related disease involving only one or two people, many cases probably went unreported and even when samples were analysed, the identification of pathogens left a lot to be desired. In a recent survey of infectious intestinal disease, no pathogens were isolated from half of the specimens examined.

The survey had given a broad picture of the incidence of the relevant disease but did not shed light on where food-borne illness arose. Getting better information would cost a lot. It was clear that the major pathogens (*Salmonella*, *E. coli* and *Campylobacter*) arose in primary production, and it was important to deal with them at source. The FSA had chosen, however, to advance on a broad front and promote best practice based on hazard-assessment throughout the food chain.

It was commonly suggested that populations in Western countries were becoming more vulnerable to food-borne illness because their immune systems had not been sufficiently exposed to pathogens in childhood. One speaker roundly dismissed this "hygiene hypothesis". It was true that fewer and fewer people were exposed to such things as tuberculosis and measles in childhood, and a very good thing too: in the speaker's view, however, the incidence of food poisoning was a function of pathogen levels, not deficiencies in immune systems. Pathogenic *E. coli* O157 (VTEC) had emerged in the early 1980s; *Salmonella* was being controlled successfully, *Campylobacter* not. When 9 million people a year got diarrhoea, it was hard to claim that levels of personal hygiene were higher than they used to be.

Another speaker saw the rise in food allergies as part of general increase in atopic allergy, the reasons for which were not clear. There were claims that in the former East Germany, the incidence of allergies had gone up following unification as a result of better hygiene.

Changes in habits had increased the need for care. One speaker recalled that supermarket shelves used to be stocked predominantly with dried, canned or frozen food, and that left overs were eaten the following day. Now people expected to be able to buy fresh food and keep it in the fridge for several days.

often, implicitly demanding longer shelf-life. Food is supplied globally from countries with varying standards and legislation.

There has also been an explosion of catering and eating out and an enormous growth in convenience, more natural and 'added value' foods, which has led to the reduction in the use of preservatives and to food with less acidity, less salt, lower heat treatment. Many of the traditional hurdles to unsafe food have thus been reduced: added value can mean added risk.

In principle, there is nothing to fear from these trends, so long as we have a scientific understanding of the hazards and find out how they can be managed. Marketing trends have been met safely in the past: why not in the years ahead? One essential is that every business engaged in food production should have the technical competence to analyse the hazards of its own operation and to design the production process to minimise the associated risks.

In our business, some 2,500 suppliers on five continents produce 12,000 Sainsbury's 'own-brand' products. We spend millions of pounds in vetting, visiting and auditing suppliers, the vast majority of whom have clear quality and safety

strategies. The major supermarkets are often criticised for being demanding of their suppliers, but I make no apology for that: we have 9 million customers a week, after all. But we are constantly dismayed by the battle to maintain standards at an unacceptable number of suppliers, some on our own doorstep. Complacency is all too common.

The parallel between food safety and road safety is striking. Road accidents happen because drivers don't understand the hazards, deliberately abuse the regulations and are careless. The same applies to food production, but there is one important difference: at least a vehicle driver has to pass a test of competence before being free to drive. There is no such hurdle in the food-producing or catering businesses.

Reputation and the law

I contend that, in food safety, the major supermarkets have been and still are a force for improvement. That, of course, is why we also now face demands from groups such as Greenpeace, Friends of the Earth, Christian Aid and a diversity of consumer interests asking for more

wholesome food, reduced pesticides, no genetic modification and, recently, social responsibility and the welfare of workers in the supply chain. These groups put us into league tables, or rate us as Green, Amber or Red, on their particular issues. They know that we operate in a ruthlessly competitive environment where consumer trust in our name is paramount.

It is estimated that 'the brand' can represent up to 70 per cent of a company's value on the stock market. Recent history shows that the reputations (and values) of companies, large as well as small, can be greatly diminished or even destroyed by major food safety incidents. There are, therefore, enormous disincentives for a food company to put its reputation at risk by inadequate food-safety controls.

Some have even argued that, in these circumstances, legislation is not necessary. I do not go so far. Given the diversity of the food industry, legislation is crucial. But we do not need more legislation and it should not be an encumbrance. What we do need is consistent application and effective enforcement. The food-chain, after all, is only as strong as its weakest link.

Across our business, we liaise with 300 Local Enforcement Authorities; we respect the difficulties of the tasks they have to undertake. But we do wonder whether the training of their personnel is adequate to the breadth of their responsibilities and to the effective enforcement of the food-safety needs of consumers. Indeed, I question whether our local authorities have the resources and high level of knowledge to identify those in the food-chain not meeting acceptable standards.

Towards best practice

I would like to think that Sainsbury's commitment to provide safe food is reflected in our practice. We have a two-pronged approach, dealing differently with packaged food and that bought from our service counters.

All suppliers of our retail products are vetted before approval and must agree with us a concise specification of each product. Labelling must be agreed and a comprehensive study of each product is undertaken to identify hazards and to build in safety. We make follow-up visits to suppliers (occasionally in the middle of the night when production pressures are at their greatest) and have a fully computerised complaint analysis system allowing problems to be identified and trends plotted. We conduct regular analytical surveys of our products and will recall products found wanting: this is a last resort, but provides transparency to our customers.

Our food service counters require extra care. We begin with a comprehensive hazard

discussion

Setting priorities. The introductory talks had noted that disease directly linked to food accounted for far fewer deaths than diet-related cardio-vascular disease and cancers. It was suggested in discussion that the FSA was concentrating on the minor risks and neglecting the major ones. One response offered was that it made sense to give priority to the problems where it was easiest to make an impact. Cardiovascular disease was a bigger challenge than food-poisoning. The FSA did, however, accept a responsibility for informing the public on the links between diet and disease, though the health departments were in the lead.

One speaker drew attention to the impact of malnutrition on the quality of life of old people and suggested that in extreme old age, death was of less moment than morbidity. The nutrition of young people also gave cause for concern. In one deprived area in Scotland, the local children were noticeably shorter than the middle-class children up the road.

Public attitudes. Genetically modified foods were popularly thought to be a health hazard, and the supermarkets had removed them from their shelves in response to customer pressure. At the height of public concern about GM foods, a Sainsbury's information line took eleven calls a minute. It was right that consumers should be able to choose what they wanted to eat, with the benefit of clear labelling.

It remained to be seen how the public would react to GM foods in the future if they offered definite benefits. GM tomato puree had formerly sold well alongside conventional products because it was better and cheaper, but GM soya and maize ingredients could not be marketed in this way. If GM foods with claimed benefits for health came onto the market – perhaps even a tomato with a Viagra gene – attitudes might change. Meanwhile, the task of the FSA and the enforcement authorities was to make sure that whatever products were currently on the market were assessed for safety.

Irradiating fresh food would kill bacteria, and there was no evidence of any risks to the public. As with GM food, however, public opinion currently ruled this measure out.

Press hysteria over the alleged risk from GM food was contrasted with the real risk from bad food-hygiene. There was still surprising ignorance of the elementary rules. The FSA had recently checked the premises of an applicant for a butcher's licence and found that he had no idea that raw meat was liable to carry pathogens.

One speaker was dismayed by the lack of public understanding of the rules of food hygiene. The key principles could be put down on a single sheet of paper and taught in half an hour. TV chefs should set a better example. Young people tended to know little about home economics and to assume that supermarket food was so safe that the cooking instructions did not have to be taken seriously.

Worry about enforcement. There was concern over the enforcement of food law by local authorities. Their resources were always under pressure, with no ring-fenced budgets for this function. There was plenty of evidence of local authority enforcement activity, but environmental health officers had many other calls on their time. The FSA had a statutory responsibility for monitoring the work of the enforcement authorities and was publishing information on their performance. The problem in the least effective authorities seemed to be a lack of management information which meant that they did not realise that they were doing badly.

The media played a vital part in communicating with the public about food safety. Bodies such as the FSA had only limited scope for talking directly to the public. The Agency was trying to build a constructive relationship with the media by supplying good information promptly and thought it had done quite well so far — apart from one occasion when the Chairman was reported as voicing concerns over BSE in fish. It was suggested that the FSA's policy of transparency, including public Board meetings, might give more scope for scare stories. The Agency nevertheless thought it right to take that risk in order to meet public demand for openness.

One speaker compared the media to a Gregorian reflecting telescope, which collected light, magnified it and pointed it in a particular direction. Journalists had to produce copy which would sell newspapers and were bound to fasten on food scares. It would help if scientists made themselves more approachable to journalists. The food industry had to live with the media, but had a problem in that journalists tended to see vested interest in any information supplied to them by the industry. On the other hand the large retailers were in a position to communicate with their customers direct.

⇒ A detailed summary of the discussion is available on www.foundation.org.uk

analysis and document appropriate management controls. The layout is designed to facilitate easy operation, all food handlers and management are trained comprehensively and there are regular audits by field staff, each of whom has responsibility for 15 stores

But we have a responsibility not to stand still. Today there is an unacceptably high level of food poisoning from *Salmonella* and *Campylobacter*, large numbers of which are commonly carried by poultry, although little is yet known of the routes by which these pathogens enter the supply chain. In the absence of an effective solution at source, we have decided to act; we have formed a consortium to develop a process not dissimilar to milk pasteurisation that can reduce *Campylobacter* and *Salmonella* on poultry by at least 99 per cent. If we can turn off the tap, there should be a reduction in food poisoning cases at the end of the chain.

The lesson is that the control of food processing needs to become more sophisticated. We recently had to undertake a public recall of Chicken Yakatori because of under-processing, which is unacceptable. By coincidence, almost at the same time we learned of a newly developed medical technique to scan human joints for early signs of arthritis. This technique has potential for the non-invasive testing of food products to ensure that, as they emerge from the cooker, they have all reached a central temperature of at least 72 °C. That is an example of how technology can be adapted from other fields can lead to incremental improvement in our food-safety systems.

Conclusion

I consider that consumers look to both government and industry for assurance on food-safety. Government must establish the framework within which we operate, industry must strive for continued improvement. These responsibilities are distinct, yet there are potential synergies.

We appreciate that the Food Standards Agency is not government in the traditional sense. It was established to restore consumer confidence in food, which is a goal we share. (Without trust we have no customers and no business.) We also understand that the Food Standards Agency must retain its independence from the industry. But equally, there are strengths that the industry can bring to assist FSA objectives: we have knowledge and expertise, we have daily contact with customers and can effect change at pace — and well ahead of legislation. It is in our interest to be seen to address issues as they emerge. There must be opportunities to share our knowledge and resources to the benefit of the consumer, without compromising the integrity of our respective sectors. □

Restoring manufacturing industry

James Dyson, delivered The Lord Lloyd of Kilgerran Prize Lecture at the Royal Society on 17th October, 2000. In this first in the series 'Prize lectures' he summarises the main points.

In Britain we like to think that we make things. After all, Britain, the nation of Brunel and Sir Frank Whittle, is where the industrial revolution began.

But we are deceiving ourselves. Our dominance of the manufacturing world has long gone. At the height of the industrial revolution Britain chose the wrong course. Eric Hobsbawm, in his book *Industry and Empire* starkly illustrates how Britain in the nineteenth century chose to exploit its Empire and not invest in its industrial base.

I have often said that designing and making things is both an intelligent and a creative activity. Yet, the British are prejudiced against it. In part this is due to ignorance. Most people think of a designer as someone who makes things look good. Yet, when your vacuum cleaner doesn't work, you kick it and say "who designed this?"

Design and manufacturing go hand in hand. But media coverage of business today rarely mentions manufacturing, and then only to report company takeovers. As a result people fail to understand that making things matters.

Why have we turned our backs on our heritage? In part it is snobbery, which begins at home and is perpetuated in the schools. Parents want their children to join professions, to gain status and respectability. Schools respond by favouring the arts and media over more 'practical' subjects. There is enthusiasm amongst the young — design and technology is the fourth most studied GCSE subject. Yet the education system fails to build on this.

In particular I am concerned that there are so few women in engineering. Despite our efforts, only 20 of the 350 engineers at Dyson are women. Each one has a father who was an engineer. These exceptions may prove my rule that it is family and schools who direct children away from engineering and manufacturing.

But education is only part of the story. We also seem to lack confidence in our ability to make things. There is a feeling that if it is made in Britain, it cannot of the highest quality. I find it astonishing that British advertising agencies reinforce this perception with images of those clever Japanese and German engineers.

It was against this background that I set out to develop a new vacuum cleaner. As the son of a Classics teacher, I match none of the stereotypes normally attached to the designer and manufacturer. But I have always been motivated to look at everyday objects and rethink their



design from first principles.

The Dyson vacuum cleaner was developed in response to a problem. While vacuuming one morning, the cleaner I was using was not sucking properly. I realised that the bag was both collection device and filter, and that air flowing through the machine was clogging the bag with dust.

I began a search for a different filtration system. I had already built a cyclone filter for my factory, where it collected dust all day long without clogging. To make this principle work in a vacuum cleaner I needed two cyclones — one to spin large dust particles out of the air and a second, faster cyclone, to extract the minuscule particles that remain.

In 1993, 14 years after I had the initial idea and over 5,000 prototypes later, the Dual Cyclone was born. Two years later it was market leader. To the outside world I was an overnight success. But in the world of innovation, design and manufacturing there is no such thing.

Perceived wisdom is to "pile it high and sell it cheap". With the Dual Cyclone I challenged that. People will pay for high quality machines that do the job well. But the way in which Dyson was created and now operates, remain counter-cultural. And matters may get worse. A growing obsession with IT and the e-economy seems destined to hold manufacturing back still further.

There is a role for Government in changing all this. Successive governments have watched Britain decline to 27th in the league of spenders in research and development. The pendulum must be forced to swing back towards manufacturing, research and development.

Government should act in three ways. First, to introduce regulatory, financial and fiscal incentives that encourage innovation, research and development, such as the 140 per cent tax relief on R&D costs

operated in the USA. Second to create a climate in which risk is encouraged. And third, to boost the regard for manufacturing industry, by both words and deeds.

Unfortunately, there is little sign of Government taking up the gauntlet. The Chancellor constantly attacks short-termism but in his approach to manufacturing in Britain, that is exactly what he practices. He believes that research and development needs greater incentives. But he has only given relief to businesses employing less than 20 people. It is the big companies that are responsible for most R&D and they are still penalised. Double tax relief on research expenditure is the answer.

We should look to the re-emergence of the concept of 'creative industry'. For me this drive for creativity is not a matter of idealism. Nor is it necessarily a crusade. We have the talent and experience. We need the products that innovation, design and manufacturing provide.

To make a product with a difference you have to work differently. Everyone who starts work at Dyson, from the lowliest member to a non-executive director, makes a vacuum cleaner themselves. It means that everyone in the company understands what they are involved with, and why it is better than its competitors.

Innovative thinking requires individuality, but it also needs a suitable environment. We have reduced the number of computers we use so that employees spend more time thinking and talking about improving what we do. Memos are nonexistent. They convey little and often get lost. The use of e-mail is voluntarily restricted. All of this helps to enhance creativity and design consciousness.

I said earlier that, for me, this is not a crusade. On reflection, perhaps it is. I have a passion for design and making things not just because of economic and social benefits, but because of what it can do for the human spirit. I want to inspire and empower designers and engineers to solve problems and provide solutions.

Perhaps most of all, I want Britain as a nation to share these passions and beliefs because they are both liberating and of advantage to us all. The re-birth of a commitment to design and manufacturing is truly the pursuit of enlightened self-interest. It is good for the country, good for the economy and good for the soul. And it is the real economy, producing essential products upon which we all depend.

We cannot do without it. □

Patrick McHugh, BSc(Eng), DMS, CEng, FIMechE, FRSA

Group E-Commerce Director, J. Sainsbury p.l.c.

Reading Patrick McHugh's curriculum vitae might leave the reader breathless yet he himself seems to take in his stride a punishing portfolio of activities.

He was born into a naval family and spent his early years abroad. He agrees that his childhood may have been more sophisticated than some because his father was a senior naval engineer and many of the family visitors were both interesting and worldly-wise. His 'life education' was enhanced by his attendance from 11 years of age at a Jesuit boarding school where he had some success at rugby and sailing as well as at the academic work. He remembers wanting to take both English and the sciences at 'A' level — a wish that could not be fulfilled in those days — so chose the sciences and managed, in the lower sixth, to sit and pass five 'A' maths papers. To these he added a pass in physics and so, when he applied to the Universities in the autumn of the upper sixth and was given unconditional offers from all those to which he had applied, he decided (without parental approval) to leave school and really enjoy the next two terms. This initiative did him no harm: he joined King's College amongst the bright lights of London in the following September and thoroughly enjoyed his undergraduate days, emerging with a First and playing serious rugby until halted by a broken leg. Later he obtained a Diploma in Management Studies with distinction.

Then Paris called — largely because the girlfriend of the moment was going, so he accompanied her. There he found a job in the statutory engineering inspectorate and gained much valuable experience particularly as he was younger than the average newly-qualified French engineers. A newly-appointed colleague then suggested that Patrick might like to apply for his (the colleague's) old job as a project engineer at CCM Sulzer, an international mechanical engineering construction company. He did, was appointed and spent four happy years working with energy generation capital equipment in the nuclear and chemical industries. He found himself in charge of an important nuclear project at an early stage when his chief fell ill. However, he wanted more experience and Sulzer refused to sponsor him for an MBA at INSEAD because he would be a short-term investment. So, in 1976, he returned to England, joining R. A. Lister (of the Hawker Siddeley Group) as a production manager, ultimately responsible for 1,000

people assembling diesel engines. He also married Henrietta in Paris in 1976.

He stayed in Gloucester for six years, which reflected how much he enjoyed that berth but wider horizons beckoned in 1982 when he joined management consultants Coopers & Lybrand as a chartered engineer. The move proved successful and he rose to become a partner and then Managing Partner, amassing a considerable amount of valuable experience while advising manufacturing and engineering companies, HM Government departments and the public sector. He became Coopers' youngest consulting partner (until then) and spent some nine years as a Partner leading on a variety of interesting projects.

Such experience, of course, made him an attractive subject to be enticed away, and in 1995, he moved to A. T. Kearney as a Vice President where he was much concerned with strategic information technology practice in Europe. At the same time, he co-founded and was Chief Operating Officer and a Board member of Strategic Partnership Ltd., a management consulting business specialising in the application of an 'inclusive approach' to the corporate renewal of organisations.

In 2000, both appointments gave way to his current role as Group E-Commerce Director of J. Sainsbury plc, where he has responsibility for e-commerce throughout the whole of the Group — a task that he is finding both demanding and rewarding. He was an expert witness to the House of Lords Select Committee on Science and Technology Inquiry into Innovation in Manufacturing Industry, a member of the Royal Society of Arts' Tomorrow's Company Inquiry Task Forces, and was appointed Chairman of the Media Relations' Sub-Group of the DTI 'Action for Engineering Task Force'.

He is at his desk by 7.30 each morning and works a long day. His work is largely face-to-face, so he is not submerged by too much paper, and he reflects that, while he is no longer a hands-on engineer, the engineering skills of analysis, deconstruction and redesign are the daily tools of his trade. Despite the people-oriented nature of his work, he describes himself as not a 'people's person': he says that he is intolerant of those who do not give of their best, those whom he does not naturally and easily understand and any muddled thought processes of those with whom he deals.

Looking back, he says that he would do it all again (perhaps the acid test of a



successful career). He believes that, to cope with a demanding lifestyle, one needs to be emotionally excited by the job which forms such a major part of that lifestyle and he has been lucky enough to meet this criterion. Indeed, he manages to enjoy yet another dimension to his life — the arts and particularly opera — to which he came rather late. His wife is a pianist of high standard and he has a growing interest in music fed by his currently undertaking a distance-learning undergraduate course in opera studies at Rose Bruford College. He reads avidly and enjoyed writing three books himself. He also sails. Religion is not an important motivator, although he is a Roman Catholic and describes himself as having a residual faith.

He came to the Foundation in the 1980s, initially as a speaker and then joining the Council, serving for a period on the Finance Committee. Now that he has rejoined the Council, he has become Honorary Secretary to the Foundation and is enjoying this second period of service which may increasingly focus on the future development of the organisation. He is conscious of the importance of its present work in respect of the dinner/discussions and in support of learned and professional societies but he speculates that a possible area for further development is in the communication of science issues — avoiding, of course, any overlap with organisations already in that field, such as COPUS.

This is a man with broad interests, a keen mind and an inexhaustible supply of energy. He opined that the key to a happy life is to keep learning and one may see a similarity in outlook to Brunel who called himself a natural philosopher rather than an engineer. □

Written by Keith Lawrey

New agenda for a new Parliament?

Chairman's Report – Annual General Meeting – 15 May 2001

The annual report by the Chairman, Lord Jenkin of Roding, to the Foundation's Annual General Meeting on 15 May describes the past year's work and raises the questions whether a new Parliament will create a new agenda.

I am pleased to report on the activities of the Foundation during the past year. As you know, the new Director, Dr Dougal Goodman, took over from David Hall at the last AGM; this is therefore a chance to reflect on the "new regime". I am glad that Council decided at its November meeting to invite David Hall to become an Honorary Member of the Foundation and that he has accepted. Last year Jennifer Grassly became the proud mother of a baby boy and, after some soul-searching, decided that she would not return as Senior Administrator. We wish her well in her new career as a mother.

Meetings

Eighteen dinner/discussions have been held since the last AGM. The format of three speakers, discussion, dinner and further discussion works well. We are grateful to the Royal Society for continuing to allow us the use of its excellent facilities at 6 Carlton House Terrace.

For five months last year, I was not able to chair the meetings of the Foundation; I am grateful to David Moorhouse, Lord Oxburgh, Lord Soulsby of Swaffham Prior, Sir Richard Morris and Sir William Stewart for chairing meetings in my place.

The highlight of the year was the discussion on the Phillips Inquiry into BSE. For the first time in public, Lord Phillips of Worth Matravers spoke about his views of the lessons learned. Professor Liam Donaldson, the Chief Medical Officer at the Department of Health and Professor David King, the new Chief Scientific Adviser at the Office of Science and Technology (DTI), responded about the actions being taken. The debate was particularly relevant because of the need to respond to the foot and mouth epidemic and Professor King's role in co-ordinating science advice on this issue to government. There will be a meeting in the autumn this year about the government response to the foot and mouth epidemic.

Working with the French and German embassies, the Foundation organised in Edinburgh last October a workshop on energy policy issues, which was followed by a dinner/discussion on the importance of technology in improving the efficiency of energy-supply and reducing energy-demand. Representatives from France, Germany and the UK were brought

together to compare and contrast relevant policies in the different countries. The neutral platform offered by the foundation made possible a debate that in other fora would not have taken place.

The Foundation also organised two meetings to promote debate on the government's view on the future for science and technology in the UK, as set out in the white paper *Excellence and Opportunity*; the Minister for Science and Innovation, Lord Sainsbury of Turville, opened the discussion. That meeting was followed by one about the models for allocating finite resources to the research councils. Dr John Taylor, the Director-General of the Research Councils, set out his views of how this should be done while Dr Hermann Hauser spoke about the opportunities UK science can offer venture capitalists.

We were grateful for the opportunity to hear a European perspective on science integration from Professor Claude Allègre, the former Minister for Science in France who gave the annual Zuckerman lecture, a joint meeting with the Office of Science and Technology. Later this year in November we will hear from the Minister for Education and Research in Germany, Frau Edelgard Bulmahn.

Two meetings of quite a different character were held in October and February. James Dyson told us about the his many years of struggle to get his innovative vacuum cleaner to market and we heard an inspiring talk from Pete Goss about his challenge to build Team Philips, an innovative catamaran for a round the world yacht race.

Finally, I should mention the two meetings held in collaboration with the Academy of Medical Sciences. First, there was an excellent discussion on the use of stem cells for therapeutic purposes. This was ahead of the free votes in the House of Commons and House of Lords on legislation to regulate the use of stem cells; we hope assisted in informing members of both Houses about the scientific progress and ethical questions of the use of stem cells. Second, last month we debated the question of whether our diet has too much or too little salt.

Visits

Several visits were made. Of particular

interest was the visit to DERA at Farnborough at which Sir John Chisholm, FRS, responded to questions on the new structure for the defence research agency.

Learned Societies

The foundation continues its work with learned societies. Keith Lawrey, the Learned Societies' Liaison Officer, writes a regular newsletter with advice and information, which is particularly valued by the smaller societies. Some successful seminars have been organised but it has not always been possible to attract sufficient numbers to make this activity worthwhile. Keith regularly offers advice and help to individual societies to resolve legal and constitutional questions.

Journal

The Director has been working with Sir John Maddox, FRS, the former editor of *Nature* and Charles Wenz, the production editor of *Nature*, to redesign the style and content of the Journal. The new version will be published this month and will thereafter appear nine times a year.

Thanks

I must say a special thank-you to all the sponsors and members who have supported the work of the Foundation over the past year. Without their help, we could not function.

My thanks are also due to the Honorary Officers, Council and staff of the Foundation for their efforts in creating the meeting programme, managing the finances and organising the events.

Summary

The new Director has built on the successful formula developed by David Hall. He has made changes, but these have been gradual and in keeping with the objectives of the Foundation to provide a neutral platform for debate of topics that are relevant and interesting. Through the work of the Foundation, I hope that all those involved in policy choices will be better informed and that better choices will be made.

A new Parliament will mean a new agenda and new issues for debate. Although we plan meetings a long way in advance, we will always fit in extra meetings when there are topics of interest. □

The Foundation has organised the following lectures and dinner/discussion in the past year. Sponsors are shown in *italic* below the event. Two page summaries of each event are available on the web at www.foundation.org.uk

June 6, 2000

The Seventh Zuckerman Lecture

Professeur Claude Allègre, Ancien Ministre d L' Education Nationale, Paris/Université Denis Diderot
*(Joint Meeting with The Office of Science and Technology, DTI)
McKinsey & Co. and Schlumberger*

June 14, 2000

Harnessing Research for UK Defence and UK PLC, DERA

Sir John Chisholm FREng, DERA
Visit to Defence Evaluation Research Agency site, Farnborough, Hampshire

June 28, 2000

Science And Society

The Rt Hon the Lord Jenkin of Roding, Chairman of the House of Lords Sub-Committee on Science and Technology
Professor Nick Pidgeon, Centre for Environmental Risk, Environmental Sciences, University of East Anglia
Professor Lewis Wolpert CBE, FRS, Dept. of Anatomy & Development Biology, University College London
Pfizer

July 18, 2000

Foresight – Is It Working?

The Lord Sainsbury of Turville, Minister of State for Science & Innovation, DTI
Mr Tim Jones, Chief Executive, Purseus Limited and Chairman, Financial Services Foresight Panel and Foresight e-Commerce Task Force
Professor Colin Humphries FREng FInstP, Department of Materials Science, University of Cambridge
The Office of Science and Technology (DTI), and Novartis UK Limited

October 17, 2000

Lord Lloyd of Kilgerran Prize Lecture

Mr James Dyson, Chairman, Dyson Appliances Limited

October 25, 2000

Energy Policy – The Impact of Technical Innovation

Dr Andrew MacKenzie, Group Vice President Technology, BP
M. Claude Mandil, President de l'institut francais du petrole, IFP
Herr Hans-Michael Huber, Daimler-Chrysler
BP, Daimler Chrysler, The Embassy of France in the UK, EMTA (Scotland), and Schlumberger

October 31, 2000

Stem Cell Therapy: Promise or Threat?

Professor Peter Lachmann FRS PMedSci, President, Academy of Medical Sciences
Professor John Clark, Head of Molecular Biology, Roslin Institute, Edinburgh
Professor Robin Gill, Michael Ramsey Professor of Modern Theology, University of Kent at Canterbury
The Wellcome Trust

November 14, 2000

How can Transport Integration be achieved – sticks or carrots?

Professor Rod Smith FREng, ScD, Head, Department of Mechanical Engineering, Imperial College of Science, Technology and Medicine
Lord Bradshaw, House of Lords
Mr David Leeder, Marketing Director and Member, National Express and The Commission for Integrated Transport
Department of the Environment, Transport & the Regions, National Express and Railtrack

November 29, 2000

Educating Young People to Think about Innovation and Design

Mr David Hargreaves, Chief Executive, Qualifications and Curriculum Authority
Dr Patricia Murphy, Reader in Education, Open University

Dr John Patterson, Member, Materials Foresight Panel

EMTA, Engineering Council, Office of Science and Technology (DTI), Thames Water, and SPE Ltd

December 12, 2000

Food Safety – Who is responsible government or industry?

Sir John Krebs FRS, Chairman, Food Standards Agency
Mr Geoff Spriegel, Technical Director, Sainsbury's
Professor Hugh Pennington FRSE FRCPath, University of Aberdeen
Sainsbury's

December 13, 2000

Future Science Priorities

The Lord Winston, House of Lords

January 31, 2001

Climate Change – Mitigation and Adaptation

The Rt Hon Michael Meacher, Minister for the Environment, Department of the Environment, Transport and the Regions
Professor Michael Grubb, Centre for Environment Policy and Technology, Imperial College
Mr Nick Otter, Director, Technology and External Affairs, ALSTOM Power
Department of the Environment, Transport and the Regions, Department of Trade and Industry and Tyndall Centre for Climate Change Research

February 14, 2001

Challenging Technology for Sport and Leisure

Mr Pete Goss MBE, Chairman, Goss Challenges
Mr Barry Noble, Chief Designer, Goss Challenges
Professor Jonathan Gershuny, Director, Institute for Social and Economic Research, University of Essex
Sharp Laboratories (UK) Limited, and Southampton Oceanography Centre

February 27, 2001

The Excellence and Opportunity White Paper

The Lord Sainsbury of Turville, Minister for Science and Innovation, DTI
Professor Alan Windle FRS, Executive Director, Cambridge MIT Institute, University of Cambridge
Mr Ric Parker, Rolls-Royce plc
The Office of Science and Technology, DTI

March 14, 2001

Research Portfolios – Choosing Programmes and Priorities

Dr John Taylor OBE FRS FREng, Director General of Research Councils, Office of Science and Technology, Department of Trade and Industry
Professor Keith Burnett FInstP, Dept. of Physics, Oxford University
Dr Hermann Hauser, Amadeus Capital Partners Limited
BRIT Insurance Holdings plc, City3k.com, The Generics Group, The Ministry of Defence and SQW

April 3, 2001

The BSE Inquiry – Implementing the Lessons Learned

The Rt Hon the Lord Phillips of Worth Matravers, The Master of the Rolls, House of Lords
Dr Liam Donaldson FMedSci, Chief Medical Officer, Department of Health
Professor David King FRS, Chief Scientific Adviser, Office of Science and Technology, DTI
The Wellcome Trust

April 24, 2001

Salt and Diet – Too Much or Too Little?

Professor Morris Brown FMedSci, Professor of Clinical Pharmacology, Addenbrooke's Hospital and University of Cambridge
Professor Paul Elliott FMedSci, Professor of Epidemiology and Public Health, Imperial College of Science, Technology and Medicine
Professor Rob Pickard, Director General, British Nutrition Foundation
Blake Resource Development and Sainsbury's

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British Antarctic Survey	Manchester Metropolitan University	UMIST
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British Nuclear Fuels plc	Middlesex University	University of Cambridge
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British Telecommunications plc	Monsanto plc	University of Durham
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CBI	Office of Science and Technology, DTI	University of Leicester
Chantrey Vellacott	Ordnance Survey	University of Liverpool
CIRIA	Ove Arup Partnership	University of Manchester
Comino Foundation	Oxford Innovations Limited	University of Newcastle upon Tyne
Contendere SA	Oxford Natural Products plc	University of Oxford
Council for Industry & Higher Education	Parliamentary Office for Science and Technology	University of Reading
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Department of Trade and Industry	R & D Efficiency	University of Ulster
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Environment Agency	Research Into Ageing	University of Westminster
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