

## HEADS OF UNIVERSITY BIOLOGICAL SCIENCES

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### COMMUNICATING BIOSCIENCES

Manchester Business School  
University of Manchester

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#### **Biosciences and the Public**

I want to start by reading a few lines from I review a wrote about Brian Appleyard's recent book for the 'Evening Standard' a few months ago, just to set the scene "Cast your mind forward to year 2020, Jack and Jill are over the moon when their new baby boy Adam is born. He has Jack's eyes and Jill's nose but unfortunately he also has cystic fibrosis, one of nearly 5,000 disorders caused by a defect in one of over 100,000 genes in the human chromosomes. Adam's lungs and intestines keep filling with gunk, condemning him to a short lifetime of suffering. Despite the hardships Jack and Jill love little Adam so much they can 't bear the thought of him dying so

they approach their friendly genealogist in the Department of Cloning and Designer Reproduction at their local hospital. 'No problem', she says we can take a single cell from Adam's saliva and replace the defective gene with a normal one and put the treated nucleus into one of Jill's eggs, zap it with an electric shock and it will grow into a second little Adam but without cystic fibrosis. 'Wonderful!' says Jack, 'But while you're at it is there any chance you can give him blue eyes, an IQ of 200 and Jimi Hendrix's ability on the guitar?' 'No problem', she says. Jack and Jill are delighted and decide to call their little cloned perfection 'Eugene', meaning good breeding".

That, of course, is a parody of popular conceptions and misconceptions about what the future holds because of developments in biosciences. Thomas Henry Huxley wrote to his friend Charles Kingsley when his 3 year old had died, talking poignantly about his own loss of faith and the problems that this produced at moments of personal crisis. He wrote "I could have fancied a devil scoffing at me and asking me what profit it was to have stripped myself of the hopes and consolations of the mass of mankind. To which my only reply was and is 'Oh devil, truth is much better than profit'". The problem is in dealing with the public, truth is most certainly not sufficient. The way that people form their judgements about what is beneficial to them and what is worthwhile to society is a complicated process and I want to talk about that.

Paradoxically, we all realise that scientists are not trusted in the way that we all want them to be. The distrust of science is partly due to an increase of knowledge. One can argue whether that knowledge is accurate or not. Certainly, people claim to think more about science and to know more about science and to make judgements on science much more than they have done in the past. This is partly as a result of the very worthy efforts of scientists and scientific institutions to recognise the importance of engaging with the public. COPUS (the Committee on the Public Understanding of Science) was formed 12 years ago and has had a significant impact on the presentation of science to the public and is certainly convincing a considerable number of scientists that communication with the public is worthwhile and is one of our duties and responsibilities. That little bit of knowledge generated by learning more about how science works and what its potentials are for good and for evil has produced, however, what I think psychologists might call 'cognitive dissonance'. People simultaneously hold the view that science is powerful because they see what it can do to their lives while feeling that they are not fully in control of it-a situation that easily produces a near neurotic state.

There is obviously no possibility of reversing this process. We live in an information society and people hungry for evidence on which to base their opinions. The demand for information can be seen as a triumph of democracy over other forms of more authoritarian management of people. The concept of human rights includes that of the right to know what influences one's life. This is combined with easy access to information sources (not just the conventional media but the Internet and so on). There is no going back on the process of people wanting to know what goes on and how it affects their lives. It is unsurprising then that, in this information age, the biosciences are a particular focus of public concern. We can all list a dozen controversial developments in the biosciences where there is clearly public disquiet-everything from BSE; genetic modification of plants and animals; mobile telephones; drug abuse and drug laws; embryonic manipulation of stem cells to cloning etc. We all know these problem areas. Again, it is not surprising that biosciences should

occupy that principle position of public concern. This is because of the great speed of the advance of knowledge and the fact that the development of the biosciences produces the greatest challenge to conventional beliefs. They have the greatest potential impact on the way in which people live their lives. Biological sciences have the power to create what people see as monstrous developments- animals bred purely to supply organs for human beings, disease on a massive scale and so on.

In some ways, the present reaction amongst ordinary people (without, in general, the religious overtones) is somewhat comparable to the status of astronomy at the beginning of the 17th century, a kind of utterly irrational reaction to the factual challenge of conventional view. One can learn an awful lot about public attitudes and where they stem from by looking at the results of recent opinion polls. In September 1999, the Novartis Company commissioned an opinion poll from Mori about public attitude to GM. 62% (of a decent sample of people ~1000) was opposed to genetic modification of plants to produce crops. 72% opposed such studies of animals and 71% opposed trans-genesis for medical research. Those figures are horrifying and we all realise the potential enormous benefits of each of those things. Indeed, some of them are already very much with us (trans-genesis, as we all know, is the powerhouse of modern biology). Yet we do such research in a community in which the vast majority opposes such studies. Interestingly, when told that these developments might lead to the development of a cure for Alzheimer's disease (this was specifically said in a follow up question although it is hard to see how GM crops would help in that respect) 15% of people immediately changed their minds and found the techniques acceptable. So we are not dealing here with absolutist moral or ethical opinions as perhaps Galileo was at the beginning of the 17th century. Opinions are certainly malleable and they are dependent on the perception of benefit as well as cost.

Another example occurred March 1999 when Mori conducted a poll for 'New Scientist' on public attitude to the use of animals in medical research. Interestingly, they divided the large sample of about 2000 people into two groups initially for what they called a 'cold start question' and a 'warm start question'. The cold start question was simply the bold and straightforward question 'Do you think that it is right that scientists should use animals in medical research?' and something like 65% of people said they were opposed to that. This is a very worrying fact for those of us actually using animals routinely in research and who believe that the procedure is entirely justified. The warm start group had the same question but preceded by a single sentence saying 'Scientists believe or claim that the use of animals in medical research could lead to the development of new drugs and medical treatments, then exactly the same question 'Do you think that it is right that scientists should use animals in medical research?' A small majority of people was instantly in favour. So a very substantial opposition can be turned to small majority in favour by a single line of justification. And, if there is any message to get across, it is that the right people to justify their research must surely be the scientists themselves. This is the most obvious argument for the involvement of scientists in communicating directly with the public. Interestingly, the poll went on and layered the question with more law and preliminary justification. The same sample of people (65%) who had initially opposed animal research were then asked a graded series of questions such as 'Imagine that these scientists were going to use rats' and 'The research was not going to cause

distress' and it was aimed at developing a drug to treat childhood leukaemia' would you support it? 83% said 'Yes'.

The public might appear very fickle in their opinions but they are clearly performing some kind of cost/benefit analysis. They are not naive but the starting position of their opinion is massive opposition. So they are performing the cost/benefit analysis for themselves with the minimal information. This must really be a lesson to us all about the importance of communication. We talk about cost/benefit analysis but what is the cost? The cost may involve getting people to accept the ethical dimension to the reactions that many people have. Many people do determine their responses partly on the basis of a gut reaction but to most people the cost side concerns risk. Enrique Beck (the socialist of science) coined the phrase a 'risk society'-a society dominated by concepts of risk and concern to reduce risk (especially risk to the individual). It would be straightforward to deal with public concern about risk if the public did the kind of thing that the risk analysts in the insurance industry do. They simply weigh up probabilities and consequences and come up with some kind of formula for the costs involved in particular risks. People, being people, don't simply react in this way- certainly not to complicated risk situations. They most fear (and this is very clear from the work of psychologists on this issue) things that are unfamiliar and things that they perceive to be not under their control (things that are potentially catastrophic and particularly vivid in their outcome). That clearly describes pretty well the way some people view the trends in the biosciences. For instance, people see the risk associated with riding a bicycle to work as very much lower than the risk of living close to a nuclear power plant. The statistics clearly show that the opposite is true but again the power plant carries with the image of this uncontrollable huge force with the potential for disaster in people's minds. Single incidents are enormously influential for the way that people form their opinions. The death of Leah Betts had more of an influence on the public perception of drug use and the possibility of modifying drug laws than years of intelligent argument and reasoning even by the Police Federation. The death of Jessie Galsinger in the United States last year as a result of a trial in gene therapy (he died as a result of an infection of the viral vector agent) has probably done more harm to gene therapy than all the argument and rational presentation as to what the benefits of this therapy might be. Arpur Pushtai and his potatoes arguably did more harm to the GM debate than any other episode. It's tough to engage with the public and to present coolly, calmly and rationally what the potential benefits are. One has to recognise the damaging impact of single incidents of failure. The problem with public perceptions of probabilities and risk reminds me of a story of the American who was terribly afraid of flying because he was worried about the possibility of a bomb being on the plane. He had to fly from New York to Europe and was apprehended going through JFK because he had a bomb in his own luggage. When questioned about this he said 'Well I knew from the statistics that the chances of being on a plane with a bomb on board was one in five million but the chances of flying on a plane with two bombs on board was one in five-hundred million'.

More formal assessments of the priorities and perception of probabilities were carried out by cognitive psychologists about 20 years ago. Daniel Carneman in San Francisco particularly did very nice experiments in which he simply asked people to estimate their judgement of probabilities. There was one classical test. He gave students in California the following scenario. 'Imagine Linda, she studies politics and

feminine studies at the University of California, Berkeley. She was active in the free speech movement and demonstrated against the war in Vietnam, she has now left Berkeley so now do you think it is more likely that Linda is a bank clerk or that Linda is a bank clerk and an active feminist?' They opted for the second, 80% of them thought it was more likely that she was a bank clerk and a feminist rather than just a bank clerk, whereas clearly that can't be the case. So what does this mean? It means that people judge the probabilities in their lives by their expectations-by a semantic picture they project onto the nature of the world. One of the problems we have to face is the notion that scientists are oddball boffins, slightly crazed and utterly detached from the reality of the world and likely to create Frankenstein monsters.

Many of us would tend to blame the media to a large extent for the way in which public opinion has turned against science. Certainly, hysterical journalism does play a part. Robin McGee the science editor of The Observer writes about what he calls 'avalanche journalism'- the kind of explosive reaction to a particular problem, which at least temporarily, completely swamps public opinion on the issue. He cites things like dangerous dogs. Do you remember dangerous dogs? Flesh eating bacteria, falling sperm counts and, of course, BSE. Again, it takes only one sensationalist story to be right to colour everyone's perception about the rest of them. I think this country has collectively among the best science journalists in the world, yet also it has, in my experience, just about the worst science presentation in news stories. If you talk to science journalists and science editors they all complain about the way their own news desks sideline them. When a potentially sensational news story that could sell newspapers from a Front Page headline has Science content, science journalists are rarely asked to contribute to the writing of stories. Science is treated differently when it is news and when its supplement-stuffing material. There is (particularly amongst the news desks) a lack of concern about the authority of the scientists that are consulted in news stories. Newspapers and the media, in general, are much more interested in (a) who is available and (b) who has a dramatic story to tell. Pushtai (in the case of GM foods) and Steven Deeler and Richard Lacey (in the case of BSE). I think one could argue they appeared in the press disproportionately to their influence in the formation of scientific opinion but they were there, they had a strong story to tell and were willing to talk about it.

Many of us involved much more in the day-to-day mundane business of science are less willing to give up our time and risk the possibility of ridicule or even worse, through exposing ourselves and our ideas publicly. When did you ever read a science story that started out, 'Middle ranking science journalist expresses slight concern.'? It's always 'Top scientist warns of danger of whatever'. There is a tendency towards not only hyperbole in the nature of the risk but also in the standing of scientific opinion that is being consulted. We have, despite all the efforts of COPUS, too few scientists in this country who actually play the part of representing the world of science. It's the same tired hacks. I say that without embarrassment and I count myself amongst those who are wheeled out. It's the Louis Wolperts, the Steve Jones' and the Susan Greenfields and so on. Whatever you are reading about, they are available at the end of the line and their telephone numbers (including their homes) are well known to the media. They will be amongst the ones who stand and speak for the scientific community. I don't think that's healthy but it's slightly healthier than having nobody who is willing to perform. It would be very much better if we

could gain by strength of numbers. I give you one example. On the train coming up this morning I had a phone call from Channel Four News saying 'We have just read these reports about the 'Which?' tests on mobile phone hands free kits being unsafe and channeling microwaves into your ear, would you give your opinion about that this evening'. I said, 'Well it is very clever of you to know that I am on the Department of Health Expert Group on Mobile Phones' (which I am). They said 'We didn't know that' and I said 'Well why did you ask me?' They said, 'Oh well, we know you talk about things'. So just the willingness to talk is the primary criterion for whom gets to represent science and that must be nonsense.

We need more scientists to be involved in communication with the media. This is an appeal to you who have influence in these areas to try to encourage your staff (in particular the younger members of staff and even students) to feel that communicating with the public is part of their duty and their social and political responsibility. It is also an important investment in their professional standing. Ask scientists who are actually involved. Ask a GM scientist about GM food research. Ask a scientist who actually has to use animals in their research about their use. Ask scientists who work on stem cells and know the terrific and dynamic interesting science that they would like to do but can't because of restrictions. What do they think about the problems that have been created by the misrepresentation of science to the Public? We have a long-term interest in making sure our own fields of science are properly fully represented and defended. Finally, how can this best be done? I think the only hope in this process is to recognise from the sorts of figures that I have given you that people are capable of performing a kind of cost/benefit analysis in their heads. They 'know' the costs (whether that knowledge is correct or not) and they take into account the cost as presented but they also clearly (and sometimes cannily) assess the benefits.

Compare for instance, the public reaction, on the one hand, to GM foods and, on the other, to mobile telephones. I would say that there is about the same level of knowledge of any risk associated with both (both very low). Actual factual knowledge suggests there is risk and it is rather similar for GM foods and mobile phones. Yet GM foods are enormously opposed in this country while mobile telephone sales continue to go through the roof (25 million of them are now owned); despite the sensational coverage in at least some of the press about the terrible hazards of them boiling brains; producing cancer; ruining memory or whatever. Clearly, what is driving the difference in attitude is the public perception of value of these things. Mobile phones are available and are useful to them so those benefits override the perception of risk.

How then can we deal with the problem of the lack of perception of benefit in the case of those areas of research that I'm sure most of you would agree are really vitally important for the future? These include gene transplantation, stem cell research, GM, and embryonic research and so on. What's important is that people should realise their concept of benefit has to extend beyond their selfish selves. The population will rise by two billion in the next fifteen years or so and we can have a responsibility to try and feed those who can't feed themselves. GM might not be the only ideal or even the possible solution to those problems but it is one strategy that we might be able to pursue. It's important that the man in the street realises (as they have done for instance, in attitudes towards carbon dioxide emissions and towards

mass vaccination programmes and so on) that collective benefit can sometimes override personal selfishness.

Q. It must be very difficult for the public. The media produce a scientist who makes a claim. Then they produce another scientist who completely opposes the view and says, "This is all wrong". So, how are the public able to sort out which of these two scientists they should believe?

A. That is quite true. You can't expect the media to ignore minority opinion and present boring programmes in which only one view is given. The nature of news broadcasting is confrontational. One has to trust, in the end, that despite communication by sound bite, people are able to see a counterfeit story and judge it as such. This means that our spokespersons have to be effective in delivery, convincing and able to appeal to other sources of opinion (to be able to state that the evidence has been collected by scientific societies such as the Royal Society and so on). That's why I personally applaud (even though some people might say they have been ponderous and clumsy) the Royal Society's effort to become much more active and involved in providing a rigorous assessment of topics like GM and stem cell research. So that one can appeal to that level of authority to support our community.

Q. Don't you think we take on another message though? Having this so-called balanced debate, where you have effectively got one scientist against another in the same way that you have got one politician against another, suggests to the public that scientists are untrustworthy as politicians.

A. On the other hand, it does at least counter the common view that scientists are infallible that there is only one truth and that scientists have it. This is, in some ways, even more dangerous. Remember the hysterical interviews after the announcement of the probable association between BSE and the variant form of CJD. Commentators (of the quality of Paxman and Snow) screamed at the scientist 'Just tell me what's true is there really a risk or not?', and, not liking the reply 'Well on the one hand but on other'. The public has to learn, however, that disagreement is the engine of science. Science does not have absolute truths; it has a consensus at any moment in time but that can change.

Q. The fact that the public has no clear appreciation of risk is surely perfectly reflected in the fact they play the National Lottery!

Q. I was thinking that your analogy of Galileo and early astronomy. I'm not sure it was very close. It reminded me of a radio programme about the reaction to testing of nuclear bombs in the late 1940s and early 1950's. I think that would be a much better analogy. The public was extremely concerned about the prospect of the world developing nuclear bombs, having seen two examples of their being used. The drive towards civil nuclear power in the early 1950's was clearly impaired by this. In fact, the public was probably closer to the truth than the scientific men who said 'There's no problem with testing above ground with nuclear bombs' and 'Nuclear power is going to be great!' The 'Daily Mail' claimed how marvellous nuclear fusion was going to be, saying 'We're all going to have free electricity' and all this sort of thing.

Actually the public in fearing these developments was probably actually right. In retrospect, what happened were nuclear accidents and Chernobyl. I think that one of the problems is when people say 'Science has found no risk and therefore we must go ahead and do it', is that the public is now deeply worried that the fact that we haven't found a risk doesn't mean that there isn't one. Taking geno-transplants for example. It seems to me, that if you ask someone who needs a heart transplant, they would probably say 'Yes, we'll go for geno-transplants'. Ask me, as a member of the public who doesn't need a transplant, and I would say 'Do not touch geno-transplants at all'. I may be a bit more educated on the subject than the average person but I'm terrified by the prospect of geno-transplants. I think that technology should be stopped absolutely dead in the water. Now perhaps you wouldn't agree with me on that? I think we have a problem with this perception that scientists do not know, yet are too eager to go ahead. I think that we have to be very careful to say that we will only progress by small steps and when we have a clear consensus.

A. I agree with you. It would certainly not be productive to try to argue to the public that merely because risks have not been revealed in a particular scientific process, all the arguments are there for it to go ahead. Again, the question of the benefits is all-important. Perhaps there are some developments, which are not socially acceptable even if the benefits could be spelled out and the risks eliminated. As things stand at the moment (even though I do not support the view) reproductive cloning seems to be in that category. At the moment, I think the principal reaction against reproductive cloning, which is very strong, (something like 85% opposition) is not based the risks of a process which I think would concern most scientists in the business of in-vitro fertilization (the huge number of abortions and deformed fetuses that preceded Dolly)- it is simply a kind of 'yuck' reaction to the whole business. 'I don't care what the benefits are or if all the risks are eliminated, I don't want that around!' I agree that, to play a part in the process, one can 't just railroad that kind of public reaction.

Q. I think that part of the problem is that scientists basically haven't delivered in the past. We can all remember promises of cheap energy back in the 1950's and then from nuclear power we get Chernobyl. The Green Revolution in the 1960's and 1970's was going to feed the world. You have only got to turn the television on today and see starving millions in Somalia and Ethiopia. We had people like the US Surgeon General back in the 1960's, claiming that infectious diseases were a thing of the past. Now, every month, there are comments in the press about antibiotic resistant diseases. Again, we were promised back in the 1950's and 1960's that malaria was beaten yet there are 300/400 million cases at the moment. I think the major proportion of the problem is that the public does not believe scientists because we were promised too much in the past and we just cannot deliver!

A. Although you are not able to control experiments in history!

Q. Quite honestly, the public would not recognise a controlled experiment if it stood up in front of them!

A. But you see my point. One doesn't know what the state of the third world would be without the Green Revolution. You don't know what the state of infectious diseases would be like without the development of antibiotics and so on. Although it is true



that one must be very cautious about painting a too positive a picture for what science can offer, it would also be irresponsible just to ignore problems because of initial public reaction against them. If one really believed there is a possibility of helping people in the world, it's important to make the arguments for it.

Professor Charles A. Fewson (Institute of Biological and Life Sciences, University of Glasgow)

### **A Single Voice for Bioscientists?**

A single voice for the various biological scientists? I suppose this question arises because, if some senior civil servant wants a view about chemistry, he normally phones up The Royal Society of Chemistry. Who does he phone up, if he wants a view about biology? He might phone up The Institute of Biology. 'Good Heavens!' say the conservative monsters, 'They're nothing but a jumped up bunch of school teachers who want to take over the world!' He might phone up the UK Life Science Committee, to which some might say, 'They're nothing but a bunch of reductionists led by the Biochemical Society!' All of this arises because of British clubability and the fact that there are over 100 biomedical and life science societies. These are professional organisations dealing with different disciplines. They range from the WAMM, with getting on for 20 members (I hope there is no-one here from the Welsh Association of Medical Microbiologists, statistically it's improbable I suppose!) to bodies up to 20,000. The Biochemical Society and the SGM are in the middle of this range.

There is, of course, some degree of communication and also some degree of suspicion amongst the main coordinating bodies. These are the Institute of Biology, the UKLSC, and the UK National Committee for Microbiologists. The last came about because there are so many microbiological societies, they couldn't get all the names on the letterhead. We do have these three coordinating groups that could speak for us. The Institute of Biology (partly prompted by John Norris, the former Chairman) wrote and got together with the UKLSC to commission Brian Jameson to look into the situation in the life sciences. His remit was, in part, to consult with key opinion informers in the world of biology. In particular, the key members in the IOB, the UKLSC, the larger of the learned societies and representatives from the OST. In the light of these comments, he was to produce a report on the way in which the life sciences could go forward with a more united front than hitherto. I presume that everyone has seen the Jameson report. Naturally, being a consultant and having to find something for an elegant end-page, he used a SWOT analysis and came up with the sort of phrases we know quite well; that bioscience is 'The science of the 21st century' etc. Perhaps crucially, the last bullet point was 'A general sense of timeliness for change'. This is something that, in talking to colleagues, reflects a feeling that we have to get our act together somehow or another. Of course, there are significant weaknesses within the present situation. There is, without a doubt, great value within the disciplined-based societies. But many of us are here because we are heads or members of biological science groupings within universities in which old words like 'departments' have largely disappeared. Many very small societies (excellent as they may be) are finding it increasingly difficult in competitive financial

times to be proactive. The role of the IOB is ambiguous. There is, perhaps, a difference between its own perception of where it would like to be and the reality of where it is likely to go.

Clearly, this exercise presents the community with great opportunities. We can give a perception to the outside world (not least to our pay-masters) of coherence and a real sense of direction- that we are all talking about the same subject. There are mechanisms for doing that but to have a greater voice in public affairs, we still have to answer the question of what does a civil servant who doesn't have the Royal Society of Chemistry to approach do to answer a question in chemistry? The answer would probably be, that he would contact a well-known figure from television that would speak with apparently great authority but actually no authority other than his own. A properly constituted organisation (with a generally agreed strategy) could give explanations due prominence. It is also argued that we could take advantage of e-communication and the like. The weaknesses and threats are self-evident. We all know that it is already increasingly difficult to get people to take jobs within scientific societies. The best people, who two generations ago would have naturally taken their place in leading their own discipline based-societies, have so many more pressures (especially those with research activities), will not take on these tasks. Many of the societies themselves get their income from publications and that is also under threat.

Without a doubt, there are threats. Of course, when Brian Jameson was consulting, he came across a very reasonable view, that 'Yes, if we were starting now, we would just have one bioscience organisation but we are not- we have got a least one hundred years of history and strong, well-founded traditions. Is realistic to ask, especially in the British context, that people inevitably giving up part of them for a larger whole? And even if they would, would the hassle really be worthwhile?' Without doubt, the small, specialised societies (and indeed the large specialised societies) have immense value. I'm a member of the Biochemical Society, and there is no doubt there is a sense of common purpose and you get to know people at meetings. There is real expertise so that you can contact folk you know are in a specialty and at least some societies are operating with fairly minimal bureaucracy. This, I think, was the minority voice in those consulted and it was a cautionary voice more than anything else. There was a minority who felt very strongly that we live in the best of all possible worlds! But moves of the present type are not unique to the UK- we have the European Life Sciences Forum and England is involved in that. We also have the American Institute of Biological Sciences.

I like the expression 'That we must hang together least we hang separately'. When we are talking about resources; public understanding and sympathy, there may be more than a hint of truth in that! I mentioned the Royal Society of Chemistry. The physicists have The Institute of Physics. The earth scientists have The Geological Society. These groupings serve the functions both of learned societies and professional organisations. Without doubt, those are separate aspects. Although the above are single organizations, they are not quite as monolithic as might be assumed. In particular, The Royal Society of Chemistry is, in many respects a federal organization, which has only recently come together. There was a lot of in fighting (some of you might have been involved in that). The Royal Society of

Chemistry is very far from having a single internal organisation. The Jameson report claims that conflicts have perhaps been internalised in the process.

Jameson concluded after consulting the bioscience community, that two ways ahead were possible. I think this is what the discussion should focus on today. Option A was to have a formal federation with policy and national leadership responsibilities; a model he took, to some extent, from The Royal Society of Chemistry. It would not be a society, but a new federal organisation. Option B was a much looser, more pragmatic and more informal arrangement where there would be some sort of integration but without an over-arching management group. He didn't explicitly say so, but I suppose Option B is for no change (and there are some colleagues who would support that). The Option A (the so-called 'structure-driven' approach), whatever its name might be ('The Biological Council', 'The Council of British Bioscience', 'The Bioscience Federation') would have a policy role and promote joint working. Crucially, the individual societies would retain their independent status and determine their own agendas within their scientific discipline. Now that is, of course, easier said than done! It is in the broader aspects of scientific policy and education that the central organising and management group would come into its own. Option B (which in terms of an activity-driven approach would be much more low-key) would have a management. I think this would be more along the lines of an integration, liaison or co-coordinating group. It would be more along the lines of what the UKLSC and The National Committee of Microbiology are already doing successfully within their own areas of responsibility but would attempt to bring the whole of biology together.

Jameson was quite certain that the Bioscience Community (because there is a willingness for change or a perceived willingness for change) should act or act fairly soon or the moment would be lost and we would all go talking for another generation or so. He suggested that the sort of timetable would be, there should be a set of consultations all of which should have been consulted through HUBS and through your own societies and other organisations. So you have probably all received 3 or 4 requests for comments on the Jameson report. The steering group should then take the balance of the cases that have put to it and the balance of the reaction to the consultation and, if the balance was clearly in favour of Option A, make a statement and within 2 or 3 months from now really. There would then crucially have to be found a working group with a convener, who would then prepare the papers for creating a federation, consulting with all the individual societies and other stakeholders. Only at that point would the decision be made to proceed. That's the time the stakeholders would be signing their rights away. At this stage, it is simply a statement of intent, saying let's go ahead and explore the idea, then, having decided to do that, prepare a blue-print and put it to the societies saying do you want to go ahead on this basis? No doubt, there would be a process of iteration and then a set-up period, a process taking 2 or 3 years.

Clearly, Option B would not need nearly so much time. If the weight of response was clearly in favour of Option B, then the steering group would say that and then the

notion would be that the IOB, UKLSC and the microbiologists would appoint a management group who would just get on with rather lower key activities to try and get better activities and liaison. That could happen in a total time of less than a year from now. So the steering is in existence, and it is the Steering Group that has consulted you and your colleagues. It consists of the chairman of the three chairman's of the association's, John Norris, Martin Wrath, it's convened by Brian Jameson and then there's a number of other people who have been invited ad hominum, it's about as representative of the life sciences community with regard to age and gender as most university cynics would admit. It has no official standing, being just a bunch of people appointed by these three organisations to take soundings from the community and will be disbanded when this has happened.

We should debate what the HUBS view is. Do we live in the best of all possible worlds so there is no need for change, would we like to move to a formal federation or should there be to a half-way house which might be an end in itself or a first step? Importantly, although the Jameson report doesn't address the issue, we now live in a very different world from when the Jameson was contracted to produce his document, it is idle to believe that any UK organisation in the face of devolution can serve all purposes for all parts of the UK. Whatever organisation takes the place of the 100 individual societies there will have to be a great more than lip-service paid to the fact that Wales controls its destiny in research and teaching and in Scotland virtually absolutely so.

The question is about the future organisation of bioscience and whether there should be and how there should be a single voice for bioscientists.

Q. The executive committee this morning has been reporting back and some consulting has been done between its members but we would encourage everybody to comment in as freely and openly a way as possible. How do people feel about the three options and what are your preferred choices? Are the premises that Charles has laid out (the ones in the Jameson report) correct, do you agree with them? Is Charles' view on the effects of devolution correct?

Q. I do think the option for no change is something that I would not like to see. Having started on this exercise, it would seem to a majority wimpish if we came up with the status quo. I do have a few concerns. Even if you came up with an effective, coherent and coordinated organization, I'm not quite sure how one would change the behaviour of media folk and government officials. Who is going to force them to consult this organisation or are they always still going to go the same people?

A. Absolutely, you can't force them to do anything. I believe, however, that by having a group of people having been volunteered with positions prepared as a result of genuine and widespread consultation, they would be an option for the media and, if those people were up to the job, they would take over from the television personalities. I'm not suggesting that a television personality isn't a good thing but it's frightfully important that views are well informed. What I hope is that some of the volunteered people could become personalities.

Q. I would think, however, that they would need to become pro-active. You can't wait for a question to be asked- you have to be up and coming.

Q. I take your point absolutely. How would you actually establish those links? I would say in the last three or four years these links have been established. There is a lot more going on. In a sense, what the government is looking for is a 'one stop shop'. Whilst it hasn't quite got to that stage on matters microbiological, we are very actively consulted by biomedical societies such as UKLSC. Because we are a small grouping, we are now coming together to become more cohesive. Also, up to the present point in time, we have the consultation documents and reports and what we need to do is to take the whole *raison d'être* about where we want move. To take biosciences as a whole and start producing documents which are available for the government and the general public. So in fact it is much more informative, the biosciences community speaking out and having a voice over a whole range of issues. As one society we have remained remarkably quiet on these major issue. We have never spoken up and we have always kept our heads down- a response we must change.

A. It is something that the R.S.C. and other organisations have done really already rather effectively. They have produced position papers that I think have been instrumental in helping develop policy. As we all know, it is much better to be on the research council committees when the new programmes are being set up rather than reacting to them.

Q. I agree with exactly the point that you made. I think the key issue is that, if we do have a single organisation, that it must know its remit. What worries me about Option A is the way it has been articulated. I think we have to have some form of Option A or B. You may grow B into A, a working hypothesis might be possible but we need to know where we want to go.

Q. We heard at the Executive Committee this morning, what the responses were to Options A and B. I am just concerned that there is going to be a power struggle around subject disciplines and areas I believe should be left to Society. There are broad issues that should be tackled by a federal management group in so far as development within a type A structure. If that is the beginning, I have a lot of concern that it will offend a lot of people. I also feel that a lot of the 'usual names' will be coming around again that we wouldn't be addressing what we wanted the organization to be. I felt if we started off on Option B and started working together on the broader issues and found a lot of commonality, we would gladly put on a collective hat.

Q. One of the issues with reference to Options A and B is that of accreditation, it seems an obsession as far as The Institute of Biology is concerned (and I am a Fellow of this august institution so I feel the right to say that). This would need an Option A type body. We can actually have an informal management to cover science information. So I'm very strongly in favour of Option B.

A. In answer to your point you very firmly said 'our own discipline'. Is there a general feeling that there is such a discipline, that it would be right for ecology to instruct a biochemist?

Q. An interesting exercise would be to go round university departments and ask how many people are qualified in the discipline they now teach!

Q. I think there is a concern between the more ecological and environmental biologists that the groupings thus far discussed do not represent their groups.

Q. I think there is that concern but, if I can go back to why societies are failing to do this? They are failing to do this because they represent their members who don't have common view. What I'm actually saying is that biology has got to be radically overhauled and that the way forward, is to move to Option A.

A. There is a great issue of sensitivity here. People are very concerned that some of the groups we have been working with are not very conscious of the sensitivity of the learned societies and what biology is. Perhaps the choice of people we have brought in to advise isn't what we would quite like but we have to make a start. Can I reassure you that what we are asking for at the moment is for an opinion? If people want to endorse what is being proposed and, if so, which option they favour. The key work would be the next phase because it would shape what such a federation might be. We would be delighted to have people volunteering so we are looking for people who really want to give a commitment. The shaping of the body will obviously be discussed by the learned societies who are participating and who want to be involved to advance their views. This is as near as damn it to a consensus as we will probably get. The idea of one particular group dominating and pushing other group is a real fear but I certainly would be very upset if that ever became a part of it. It isn't a group of power hungry people trying to establish themselves. People like myself would be quite happy to take a back seat. I've been involved with this for almost a decade. The point made about the IOB that the best strategy would be to dissolve it and start again isn't feasible. We took a view ten years ago as microbiologists that while we could not stand on the outside and criticise the IOB. If we wanted to change it, we had to get on the committee and change it from the inside. One has to say that the beast you see today is quite radically different from what was there even three years ago, with or without the Jameson report. The IOB now sees itself as representing only of a number of bodies and makes no claim to have pre-eminence.

Q. We must be a bit careful of the analysis. I'm not sure of the size of the SM budget but I suspect that it is significantly larger than the entire budget of all the 100 British societies sustained by a hugely profitable publications activity.

Q. They don't make any money out of publications?

Q. But it's sustained by that commonality of image.

Q. I would agree with the point you are making namely that we are more or less approaching plan B now. We have a loose management and a lot of integration with people opting in and opting out. We tend to have weak points though. We have got to generate a structure to survive the threats that were quite rightly pointed out. I think there needs to be a much more coherent structure. There are a couple of things that have occurred to me as I have listened to the discussion in the Executive, the timescale advanced already seems to be suffering from some slippage. So how long is it going to take? There has been no mention until just now who is going to pay for it because I can't see the IOB (an august society of which I am quite proud to be a member) fulfilling the role that is required here. Are there any suggestions as to where the funding for a more coherent management structure would come from?

A. The answer to that is 'not at the moment' but it would obviously be one of the jobs of the management of the group to come forward with suggestions. What is the next critical development? One of the things we are looking at is the existence of societies with a good infrastructure in terms of staffing. We are looking at ways in which people can project that. Ways that we use to sell the broader face more effectively than some specialist societies currently manage.

Q. So some kind of commitment has already been made?

A. No, but the next phase is critical! How much is it going to cost and what is it going to deliver?

A. One of the tests would be whether it is accepted or not.

Q. You mentioned that the IOB has changed in the last 3 years. I was involved in the Finance Committee a few years ago and it's changed enormously since then.

A. It's still not healthy and never will be.

Q. This confirms the point that I think we know what needs to be provided to survive the threats and develop the strengths and opportunities but I don't think it is going to come from what we see around us. We need something new and the financing and resourcing of that is a key issue.

A. It is a key issue but, coming back to the microbiology example, there are other larger societies out there that can really help now. If they have the competent people then it's a good idea and they must also be thinking of the way forward.

Q. Won't they be reluctant to spend resources on what they see as minority activities?

A. I think we have got to move away from that culture. That is the culture that we have coped with to date. We really have to move in the direction of a forum but the pace of movement may not be what people would (a) like and (b) think is actually possible.

Brian Gamble (British Association for the Advancement of Science)

### **Publicising Science: the National Science Week**

I want to talk about the British Association for the Advancement of Science or the BAAS. I'm not a scientist! I was in Slovenia last and the Slovenian National Television asked for an interview. They were wiring me up and I was about to start. The producer came and said, 'Please stop, this is a science program would you please put on a jacket and tie'. I said, 'I'm not a scientist so I will take my jacket off'. I received an e-mail last week congratulating me on appearing on Slovenia television's science programme without a jacket -so I've got somewhere!

An educated public who wanted to know what the scientists of the day were up to founded the British Association in 1831. We are incorporated by Royal charter and are a charity, meaning we spend our lives begging for money to do the next project! The vast majority of our funding is project-related so we're very big beggars! We have a Mission that is all about enhancing the public understanding and awareness of science- to illuminate and enhance the contribution to culture, economic and social life or, in other words, to tell an ignoramus like me what you guys are doing and how it's going to affect me. We do this in several ways. We have our annual meeting called 'Festival of Science'. This is for the educated layperson as much as the practising scientist. You can come and hear about recent developments in science. It's also for the media. We run a very big press release and usually get about 200 journalists. They stay for the week and all want to talk to Colin Blakemore. We also run National Science Week. This was my invention because I suddenly realized (working for the British Association and in this august world of learned societies) that there was nothing for me. I'm not the sort of bloke who could easily find his way into a conference in the middle of Manchester Business School (even if there were signs) and find his way to the 2nd floor, then sit in among you. I wouldn't know what you were talking about. Anyway, you are all professors and I'm not! There is another argument that rages around the festival namely whether people should have name badges and, if they do, should they have titles on them. If they do, then I, as a member of the Public, may not wish to contradict something that Professor Colin Blakemore says. We also run school-based science clubs. We have about 4000 of them. There are also a variety of special projects, all aimed at the public understanding of science. One of them is a national speaker database. Here we can generally turn up a speaker who will go to Inver-cock-o-leekie for the price of his bus fare on a Thursday afternoon and talk to the Women's Institute. We also have recently taken over the Novartis Foundation's Media Resource Service. If the media want to talk to a scientist, we can put them in touch with one.

As we are so old and famous, we should remember some scientific landmarks. The term 'scientist' was coined to describe the people who, at a British Association meeting, were presumably gentlemen of science or life scientists. All of this was in the days before the Internet, before 'New Scientist' and before television. The B.A. meeting consisted of scientists communicating their discoveries. As I said I wouldn't easily find my way to such a meeting, I want to talk to you about the National Science Week. Some of you may have heard of it before when we called it 'Set Week' because 'set' was the 'in' phrase. We realized, from our surveys, that if you go outside and ask what 'set' means, people have no idea. So, we started the process with the engineers but now we call it 'National Science Week'. National Science Week was started in 1994. It was really intended to say to you guys in your research laboratories that, 'There are people like me that pay income tax and so forth and pay you people to do what you are doing. Would you mind coming out of your laboratory to where I am, and showing me what you are doing and try and talk to me in language that I understand'. I was eavesdropping over coffee, I knew what all the single words meant but when you joined them all up I had no idea what you were talking about!

There is not just one of me but a lot of "Mes" out there! Colin was talking earlier about public confidence. A recent House of Lords committee report says that public confidence in science is probably at an all-time low. We have to do something about



that! 1999's Science Week (we've just finished in March but we haven't got the results yet) had 7,000 events. That's another good basis for an argument. If you do one lecture and call it 'one event', is doing one lecture five times five events? So we turn our measure into events or visitor opportunities. The Millennium Dome is just one visitor opportunity, whereas the Science Week has 7,000 visitor opportunities. We know that over one and a quarter million people actually go to events in Science Week. It also gets a phenomenal amount of media coverage and all the B.A.A.S. does is to very smartly coordinate. We persuade you guys to do things and put it all together in a programme, we arrange publicity and help with the media and so forth. I try to go everybody's event but, as there are 7,000, I fail miserably! For some reason, it's got very strong government support. I say 'for some reason' because originally we sold it to William Waldegrave. Tony Blair is also strongly behind it as well because it is a people's science festival and it's totally non-threatening and politicians can go and won't get shouted at. There are opportunities for nice photographs of them patting little girl's heads. For whatever reason, we have a lot of government support for it.

It involves all of the organisations in the Public Understanding of Science arena. It particularly aims to encourage young people to think of science as a career and to help everybody gain an appreciation of science and how it affects people's lives. It provides an understanding of what science and technology can and cannot achieve. Going back to Colin's talk, that is perhaps where we are falling down because we don't seem to get across to the public what the scientific process is. I had this discussion last with a taxi driver. I was trying to liken the process to the law. You will go to your solicitor and say, 'That man did this to me' and the solicitor says, 'We'll take him to the high-court and sue him' and you do all of this and you lose. You go back to your solicitor and say, 'You said we could win'. 'Ah', he says, 'I told him that too!' So you will get scientists speaking for and against- both very reasonable people. Of course, the media are very clever in not allowing them to talk to one another. I was taking part in a group recently brought together by the Institution of Chemical Engineers, who wanted to address this media problem. Professor Hugh Douglas was recently called on to appear on the Jon Snow programme. When he got there, the BBC treated him very nicely. Just ten minutes before the show, Jon Snow came in and said, 'This is what I'm going to ask you'. Professor Douglas said, 'You shouldn't ask me that, this is the question you should ask me'. So the show started and somehow they ran out of time and he never actually got to appear. Nobody actually told that Professor, he blew it! What he should have done is what the politicians do and say 'Very interesting question, but this is what you should have asked me', when he's on air! That's how you get your point across.

So it's this awareness of the sort of work that you do and why you do it and what the benefits are that you have to get across. An openness and honesty about the downside is essential. Look at the mileage that the environmentalists have got from GM crops! Surely, science has got a case to put. All we try and do in the B.A.A.S. is to set up a platform for informed debate for both sides. Let's have an argument, by all means, but let's make sure that it's starting off from an informed point of view. So the aims of the events in Science Week are raising awareness, comprehension and appreciation. So who takes part in Science Week? Predictably, higher education, professional government organisations and amateur societies are represented. We decided to focus on amateur societies on an annual basis. The first year we targeted

debating groups and that worked well. The second year was the Rotarians and that worked well. Last year, we chose the hams (amateur radio enthusiasts). They were duly enthusiastic and all had those QSL cards that they pushed to each other in the dead of night, while they were in their garden sheds. Science produces technology and it works, so we are trying to get more and more people like that on board. Even the model railway enthusiasts! There are thousands of individual enthusiasts- people like yourselves or people who are working with departments who will come out and go out in the street, doing science busking, just for the sheer hell of it!

Museums, industries and schools are predictable sources of people but we always manage to get them together. Certainly, in 1999 around 600 organisations took part. This will be significantly more because a lot of people were holding back for the millennium year. We think that we had around about 750 organisations taking part this year (2000). Each year some drop off and some new ones come in. That is a fact of life. Some people work in a two-year cycle but each year the total is going up. I told you earlier, that there are 7,500 events but there are actually 19,000 if you repeat them enough. Interestingly, the same proportion of events run for schools as for the public so it's not just a school-orientated thing. There are equal numbers of males and females and the organisers predictably say, 'Yes, it was good and worked well for us'.

So all you cynics sitting there and saying, 'That's fine, but why do people take part, why should we bother?' Here's the profile. Who outside knows what biotechnologists do? Perhaps we should show them! Increased contact with other organisations is interesting. The sort of thing that happens is that people will phone us up and say, 'I'm doing something in Tayside, is there anybody else doing it?' and we say, 'Well, yes, there is, there's this guy in Dundee University' and we put them together making sure they don't clash or fight for an audience. Larger audiences are interesting whether it's the Rotarians, the Women's Institute or even scientific societies who are doing their regular monthly lectures. If you've got a talk, schedule it for Science Week and see what happens. You get more people coming in because there is a generally raised awareness. That is perhaps because we say to them, 'Will you try and encourage your members to bring a friend or a neighbour who may not be a scientist and don't make them feel threatened'.

Many of the newer universities are finding that, by inviting the public in, they are getting a higher demand for evening classes and other activities. So they are benefiting just by throwing open laboratories and showing people what's going on. There are 'talks' (I don't allow 'lectures' during Science Week), demonstrations, Internet, exhibitions, workshops, open-days, trails and drama. There's a big movement now in science drama! One of the leading companies is 'Y-Touring', which is the YMCA touring arm. They have just brought out a new play about biotechnology- it's actually all about the GM crops thing. They will come and do a play normally to a class and they work with one table and one chair. They then come back in character and answer questions from the young people and will leave the teacher a resource pack. One particular play about teenage pregnancy was put on for a group like this, and the cast came back and one man in audience actually believed that 'the grandmother' was a real person. The grandmother was encouraging the 16 year old to have an abortion and somebody had to calm him

down saying 'It's only pretend'. So they're really good. There are also competitions, quizzes and so forth.

Unfortunately for me, Science Week is growing. The first I got together in six months, starting off by begging for money and being opportunistic. Then we discovered that the OST had a little pot of unspent money and we approached them one August and said, 'How about we organise a National Science Week?' They said, 'If you can spend all the money before the financial year (which was March) then you can have it'. Science Week is growing nicely but there is demand from it. There's a demand from the people who go and from the people who put on events. Just as the visitor events have gone up, then so have the visitor opportunities. Visitor numbers are also going up nicely and I hope this year (2000) we have hit the magic one and half million. This is a significant number of people to expose to science.

What do the organisers think about their efforts? Nearly half think that their activities raise awareness and a quarter think there is an improved understanding and appreciation. So it seems to work. In the very first Science Week, somebody rang me up and said, 'I live in Cambridge and this is supposed to be Science Week and there's nothing happening here- what should I do?' I said I happen to know this very nice gentleman who works for The Guardian would you write to him? The Guardian ran a little piece about National Science and that nothing happened in Cambridge! Cambridge University now has its own Science Week within the national week, with 23,000 visits (a very large number of what would be describe as non-university visitors which they feel very warm about). This was one of the places I visited during Science Week just to see the tremendous buzz that goes on around that area. We tend now to use Cambridge as one of the exemplars and we get visitors from Slovenia, Austria and China all wanting to see a university presenting Science Week.

I know you are all desperately saying, 'What can we do for National Science Week?' The answer is to do what you do best, only try and aim it at a wider audience. If you are a good speaker then do a talk and bring your friends and neighbours. We (the association) will be very happy to help if you can't speak by finding you a speaker, helping you raise the profile with the media and helping you attract an audience. Lastly, I want you to ensure you know what you want to achieve so you can achieve it. If it doesn't work for you, it won't work for anybody else. Then, of course, the cynics will say 'Will you pay for all this'? There is a very nice organisation called 'COPUS " (the Committee for the Public Understanding of Science) who get £100,000 from the Office of Science and Technology, earmarked specifically to give to people small grants of up to £3,000 for events that take place during National Science Week. There are two rounds for that, one in April and one September. So there is money for it!

Try and have an activity that provides a souvenir. Make sure your visitors enjoy themselves and want to come back. I was doing a talk like this last year in Oxford, and I was very conscious that the Professor of the Public Understanding of Science was in the audience. He listened to all of this and stood up at the end saying 'Brian, this is ridiculous, we don't have to dress up in fancy dress just to raise the public awareness of science'. Fortunately for me, somebody else stood up and said, 'Have you ever tried to teach science to a nine-year old Professor Dawkins?' He hadn't, but

do be aware that some people take their science very seriously. However, when you are trying to get to the mass of people, lighten up! Just a little bit! Thanks!

Dr Harry Griffin (Roslin Institute)

## **Communicating Biosciences Breakthroughs**

It will come as no surprise to you that I am going to talk about cloning. Part of my job at the Institute before Dolly, was dealing with the press and the public relations and that was about number 101 in my priorities. Since, (or AD) it's been a good part of my life- certainly a good half of it. What I would like to do in this presentation is to give you a feel as to what it was like to be at the centre of the biggest news story of 1997-probably the biggest science story of the decade. Perhaps I can give you a feel for the pressures, pace and bizarre nature of the press's interest. To bring you back to reality, I will try to take some of our experience and re-set it in more normal times. Things that we have learned may be relevant to you.

Let me first introduce some of the characters and some of the science. The Roslin Institute is a relatively small organisation (part of the BBSRC) with about 320 employees and our focus is on farm animal genetics. I am personally a BBSRC employer and therefore answerable to the Chief Executive, if I get the public relations wrong. We are based about 7 miles due south of Edinburgh. Much of our work supports the animal breeding industry not just in the UK but also abroad. In the early 1980's, we started to move into other more controversial areas and in particular the use of transgenic animals for novel purposes. Tracey, the world's most famous sheep (before Dolly), was an animal born in 1991 producing about 45 grams of a human protein in her milk a 1-antitrypsin. She was produced by pro-nuclear injection that most of you will be familiar with. The DNA construct is injected into the pro-nucleus and a small proportion of the copies in this of a human gene are incorporated into the animal's DNA and the offspring (maybe 2% or 3% of them) will be transgenic.

A particular invention in the Roslin Institute in the mid 1980's was the idea of linking milk-protein gene promoter to the human coding sequence ensuring the expression of the human gene only in the mammary gland and only during lactation. That technology became the basis for the setting up of a company that is the second player in the scenario that I am going to describe later. PPL Therapeutics business is to produce human proteins in the milk of transgenic sheep and cattle. PPL 's sophisticated production facility is a sheep shed in which the input is a very common product in Scotland - namely grass. The milk is collected from these animals, purified and the product that Tracey produced a 1-antitrypsin is currently in clinical trials for treating patients suffering from cystic fibrosis. PPL are at the point of completing phase two clinical trials hoping to move into phase three. There are other companies using this technology, notably in the Netherlands and Gensyme Transgenics in the United States. This is the technique that Immutran are working with to try to create pigs whose organs would be suitable for transplant to human patients. Companies like Immutran have used this technique to create genetically modified pigs.

The problem with the technique is that it is inefficient with no control over where (and how many copies of) the genes are incorporated in which chromosome and probably fundamentally you can only add genes. In the late 1980's, we started to look for ways in which we could carry out more sophisticated genetic modifications in livestock species. Most of you will be familiar with the production of 'knock-out' mice using embryonic stem cells that have been genetically manipulated, the production of chimaeric animals. The production of transgenic offspring is possible from those chimaerics. But, as yet, nobody has been able isolate embryonic stem cells from cattle, sheep or pigs so this route for transgenesis is simply not available in livestock species.

So Ian Wilmut and his group in the late 1980's, started to look at the idea of nuclear transfers as an alternative for converting genetically modified cells into genetically modified animals. This is the sequence describing nuclear transfer. In this sequence, the operator removes the maternal DNA from an unfertilised egg. Two bright spots show the maternal DNA in the pipette rather than in the sac. Passing an electric shock between two electrodes then activates the diploid cells introduced into the enucleated egg. In a small proportion of cases, this reconstructed embryo begins to divide and multiply normally. This is not a new technique -the press would have it that Dolly came from nowhere. The reality is that nuclear transfer was first used in the early development with frogs in 1952. There was a report of the cloning of mice in 1997 that was abandoned because the scientist concerned couldn't justify his results. In the mid-80's, there was an almost routine production of cloned cattle and sheep by transferring cells directly from embryo's into enucleated eggs. Our contribution (in the middle to late 1960's) was to be first to derive animals from cells, which had been cultured for several weeks in the laboratory. In 1996 (published in 1997), we produced the first animal from an adult cell. Then to create transgenic animals by genetically modifying the cells first before using them as donors of nuclei and nuclear transfer. Under the microscope, the procedure looks very simple. For a typical experiment, however, we would be using 40 donor ewes, collecting over 400 eggs from them and repeating this sequence several hundred times in order to generate one or two offspring. These were the first animals cloned from embryonic derived cells that have been cultured, so they are the first animals derived from nuclear cells by nuclear transfer. At least one national newspaper (the Daily Mail) recognised the significance of this when we published the work in 'Nature' in 1996. I now view the resulting headline as fairly neutral. The paper has tremendous sub-editors, in effect the article following this first paragraph and leading on to two pages in the centre was actually well written and covered most of the ethical issues that were subsequently raised when Dolly was produced a year later.

This story didn't run very far- firstly because the American press didn't pick it up, it was only sheep cells, only done in Scotland and it was only embryonic cells. The Dunblaine massacre occurred about a week after this appeared and clearly dominated future coverage in the media. However this animal Dolly was born on 5th July 1996. My wife was peeved as this was our first baby and not necessarily hers! It took a few months to complete the research and to write up the paper, again accepted by 'Nature' with publication due on February 27th 1997. This is the sort of sequence that we faced and if anybody within your organisation gets a paper published in 'Nature' or 'Science' this is the sequence that they would face. 'Nature' publishes on Thursday and on the Friday before publication, about 350

journalists around the world get a press release telling them exactly what the lead articles are. 'Lead' means what's going to promote 'Nature' and what's going to be of interest to a general readership not to the scientific community. This is plan 'A'. We had been working for a few months beforehand because we knew from the previous attention that our cloning work had that this was going to be big news. So we also sent letters to various ethics committees on the Wednesday. We brought up a training team from London on the Friday before to put primary spokesman Ian Wilmot (the leader of the research group) and Ron James (the managing director of PPL Therapeutics) who was involved in this particular project through a grilling in front of an experienced journalist and TV/video monitoring systems. The 'Nature' press release went out and we were obviously concerned that there maybe early leakage. When we finished work on the Friday things were fairly calm and we felt the story would hold. The position here is that the press release would be given to journalists in confidence and it's embargoed until seven o'clock on the Wednesday before publication. So, in fact, the first anybody should reveal about a news story in 'Nature' should be Channel 4 seven o'clock news. As it happened, on the Saturday before publication we had a tip off that 'the Observer' was going to run this story early breaking the embargo. We then had to invent plan 'B' at rather short notice. Sunday morning the article appeared in 'the Observer'. Robbie McGee raised the issue of human cloning but it was actually quite a balanced article. You might ask where the accompanying photograph came from? 'New Scientist' had exerted special pleading that they didn't want to be left a week and a half behind the pace so could they take a photograph of the sheep? They didn't supposedly brief their free-lance photographer who took the picture about the embargo and he sold it on to 'the Observer'. So a little naivety was evident from both 'Nature' and us. On the Sunday there were six of us working- two at Roslin and four at our PR agency in London. We started answering questions from the media at nine am and those questions kept on going until nine pm.

The next day's situation at Roslin involved the sheep being interviewed by the media! This is a picture I will keep for my scrapbook. I know my place, the sheep's in focus but I'm not. This was an incredibly hectic time, the world's media appeared, as if by magic. The BBC, NBC and CBS all with satellite vans in the car park and all wanting to get this sheep as the first item on the seven o'clock news on the east coast. For about ten days, we just gave ourselves to the media. It was a heady time. It was great to talk to the Australian Broadcasting Corporation about sheep. It was great to talk to the Vatican about issues unrelated to conception on Vatican City Radio and it was good to participate in some rather good debates on local radio. Not so good to be called a 'dick-head' on Norfolk Virginia Radio. Bill Clinton thought that this sheep was such a challenge to American morality that his National Bioethics Committee had to report within ninety days on its significance. With the benefit of hindsight, you may think that Bill Clinton was trying to detract us from other things. Dolly Parton (if anybody doesn't know why Dolly the sheep was called Dolly, I will tell you privately later) fortunately has a good sense of humour and said that she was honoured that we called our sheep after her and that was no such thing as baaaad publicity!

PPL share prices drifted down with other biotechnology stocks until the Stock market opened on the Monday morning. At 7.31 am, it went vertical. Jacques Santer said something profound but nobody can remember what it was! The French ministry of agriculture predicted that this would lead to six legged chickens. I can't really

understand the Gallic logic there! The 'Daily Mail' sub-editors again came up with this wonderful headline 'Could we now raise the Dead?' This might seem amusing from this distance but at the time we had a rather recent national bereavement we were keen not to link with our work on cloning. The idea that we might resurrect Princess Diana was something we desperately tried to avoid, by keeping our answers this question as 'no, no and no again'. Just to emphasise how large these headlines can be and what sort of impact they can have the front cover of 'Time' had a picture -not many sheep make it that far and I included this front cover because it illustrates the length to which the media will go in pursuit of a story. To get this picture, 'Time' flew in a photographer from New York and three reporters to write the article, one from Moscow, one from Germany and one from New York just to write about this issue. Surprising to me (at least) the science writers of 'the Economist' did a really good job. Much more effective than any of the national dailies and it wasn't 'the Economist' that I would have singled out in advance as having a good approach to science reporting.

One of reasons that story ran, is that it could have been written in any part of the paper including on the racing page. Segar was a famous American racer who was put out to stud and subsequently found to be sterile. There was some speculation as to whether he might be cloned and for about 24 hours I was the world's expert on cloning racehorses. The story also clearly appears on the cartoon! Those of you who have had a paper rejected by 'Nature' might be amused by this little story. Firstly, this is a picture of Dolly but only three of the legs are actually hers. This was a picture created from a photograph that we provided 'Nature' with which had a surrogate mother in the background and this in fact the surrogate mother's leg rather than Dolly's. 'Nature' also used the word 'clone'. 'Nature' is in competition with 'Science' so were just talking about marketing here as we didn't use the word 'clone' in the paper at all. 'Nature' knows that the word 'clone' has an evocative ring to it and fits easily into headlines. The speculation and interest from the media wasn't because there was a fascination with sheep. If you could do it with sheep you could do it with humans! This particular picture illustrates two misconceptions that were rife for a long time and perhaps still are. One is that if you clone an animal you get a photocopy. The second is that, somehow, clones are sub-human. People believe that clones of Hitler, Einstein and Claudia Schiffer will do exactly as they are told. Richard Seed has had an amusing time I think and has led the media a merry dance by pretending to them he is going to clone human beings. I don't believe he has any intention but he has managed to get around the world as an invited speaker and has had a really amusing last few weeks as a result of teasing the media about his intentions.

The success rates in cloning are very low. Of the twenty live animals we have produced, six lambs have died soon after birth. Our formal position at the beginning and still is that human cloning is impractical, unsafe, and unnecessary and (in large part because it's not going to be in the best interests of the child) it would be unethical. One of the peculiarities of the American coverage is that there was an obsession about personalities. This implies that one person did the work whereas it clearly was a team effort. They wanted to know the full details of Ian's life. Did he drink whiskey, did he go walking, how many children did he have and can we interview them? That was I think quite a surprise.

The disappointment was there were quite a few scientists out there making a living out of raising people's fears about the future. I have two particular bete noires, one is Dr Patrick Dickson who was once the world's expert on AIDS and is now the world's self-appointed expert on cloning. In the States, a guy called Lee Silver who pushed the idea of designer babies making quite a career of that and of promoting a book called 'Remaking Eden'. I like the following quote because it illustrates the lack of thought from the contributions of these so called experts. At first Dolly was a clone alone at first we had a lot of speculation about whether or not she was genuine. We provided more DNA evidence that was convincing to the most sceptical Americans. The same issue of 'Nature' included an article about the first cloning of mice. Since this paper about 18 months ago, there have been reports of the cloning of cattle, sheep, goats, almost certainly rabbits and pigs. So it's clearly a phenomenon that's repeatable in different species and with different cell types. We had an interesting contretemps with Zanussi who had this ad. I don't know if any of you saw it at the time but it was a series including a nuclear bomb going off and a load of dead fish in a polluted river. We objected to this.

There is now a serious issue before us because some can see a lot of the benefits coming from the idea of cloning cells in this sort of way. That is taking skin cells from a patient and re-programming them into white blood cells for the treatment of leukemia or neuronal cells for the treatment of Parkinson's disease. At present, we believe you could make this transformation only by transferring the skin cell to a human egg and activating, growing the human embryo up to six or seven days and then recovering embryonic stem cells and from that transferring those into whatever cell type you need for the patient. Obviously the patient won't reject those cells because they are genetically and immunologically identical and (it seems to us) that this is a breakthrough in trying to develop ways to avoid immunorejection. There's a whole host of different diseases being considered now as candidates for such cell therapy. It's important to precisely define what ethical issues are involved here, we don't see this as a routine way of treating individual patients. Firstly, there is a great shortage of human eggs, so in practice you can only treat a handful of patients if you had to go through this sequence. Much of our work at Roslin is going to be to try and understand the reprogramming process. We can do that work in non-human animals. There will be a need to create embryonic stem cells and to see whether one can convert them into the desired cell type routinely, confidently and there will be need to check that any data from animal experimentation to understand re-programming is relevant to the human situation.

In considering this type of application, The Human Fertilisation and Embryology Authority of which Ruth Deech is the Chair have recommended to Government that research should be allowed on human embryos for this purpose. So it's research and it would be under strict licence from HFEA and those of you who get the 'Daily Telegraph' will know that discussion is beginning to hot up because Liam Donaldson the Chief Medical Officer in England is due to report on whether to accept this HFEA recommendation. There may well be a recommendation for a free vote in Parliament, which we will be campaigning for approval of the extension of the purposes for which experimentation on human embryos should be allowed in the UK over the next months. This particular issue allows another set of headlines 'Cloned Tissues for Human Use Within a Year' is based on the fact that when asked a member of HFEA said it would take about a year to approve any licence application.



This is a genuine suggestion from a potential client but, if you work out that there are over 600,000 kids born each year, by the time you store this material for fifty or sixty years in the expectation that it might be used a good proportion of the health service budget is taken up with liquid nitrogen consumption. This is a classic extrapolation from an experiment from which a frog embryo i.e. a tadpole was made headless by knocking out a gene. Steve Conner of the 'Sunday Times' and David Cadbury a producer of the 'Horizon' programme used this story to try and promote the 'Horizon' documentary on our work. This is a quite outrageous extrapolation and bears no relationship to commonsense but still the 'Sunday Times' published it.

What are the general conclusions? What can I tell from our experience that's relevant to your situation? Firstly, we are dealing with news here and news lasts twelve hours. If a story breaks now you've got about two hours to get your oar in and influence how it goes. The story would have been written by about 4.30 pm (latest 5.30 pm). If you're not available on the phone, then it will be the Patrick Dixon's of the world, or 'Greenpeace' or whoever who will be the ones who get the first chance to comment. So you've got to get it right the first time! You can't go back and say, 'Hold it, I want to rewrite the story!' once it's published it's forgotten. It's your/my responsibility to make sure that the journalists get the story right. Journalists come in all shapes and sizes. Roger Highfield's name was mentioned. He's a journalist that I would have confidence in. I could tell him the outlines of a story and he would understand it. There are plenty of journalists out there who don't know their arse from their elbow and they need guidance, preferably written. If we've a story to put out, we put out a press release and we have briefing notes to back that up. We fax those to the journalists who respond to the press release. We have a series of questions and answers for internal use. These include embarrassing questions and when we insist that anybody involved in talking to the press presents a consistent, well thought out story. You need photographs and perhaps C.V.s of the scientists involved. You've got to check on reality. What's your story and what do you want to put over? Is that what the press is going to be interested in? The press are not interested in scientists being clever! It doesn't matter about how good the technology is! They are interested in the implications to the readership. It's very easy to get hung up on what your line is and forget what line the press will take. You have got to be prepared for both. You can try and drive the press in your direction but they know that their job is to sell newspapers and not to advertise good science. You need an appropriate spokesperson. It's a difficult thing in an academic environment. It's difficult enough for us but it may well be that the leader of the research group isn't an appropriate person. We indulge in 'just in time' training immediately before a big story. For example, we sold the licensing rights to an American corporation. Clearly a very tricky PR exercise to explain why the story didn't remain within the UK. We flew up Martyn Lewis to front the exercise.

Pictures are almost essential. We actually arranged with a PR company to distribute video pictures worldwide of Dolly's first lamb. They paid us for the privilege. That's rather unusual but this picture was seen by millions around the world (80 million in the US alone) and it's very difficult to argue that this animal is the devil incarnate when it produces a lovely lamb like this! Many of you would have seen the pigs cloned recently by PPL in the US. They made these pictures available on the Internet and that's why they were so prevalent in the coverage. I've had a rather breathless presentation here and it seems to have been breathless for the last 3 to

4 years. I will finish by trying to argue why you should take interest in dealing with the media in particular. Firstly, science is under attack and as scientists we have a responsibility to get out there and explain the case. The BBSRC has wonderful initiatives for the public understanding of science, relationships with schools and so on, giving a nice, cuddly, warm feel. If you can get a positive article in 'the Daily Express' then you are talking about five million readers in one go. The scientific community has got to get out there and mix it with those who are opposing some of the developments. When we do that, I think we win. The referendum in Switzerland to ban all genetic modification of animals and plants was defeated on a two-to-one vote. When the scientific community is provoked, it can win the argument. If it doesn't win the argument and it's made the effort then it doesn't deserve to win the argument. If it doesn't win the argument because it hasn't engaged in the debate, I think we are culpable. We have to get used to dealing with the media. We shouldn't leave commentary to self-appointed pundits like Patrick Dickson or Lee Silver. I also don't think we should just leave it to those few scientists who are currently media friendly like Colin Blakemore and Lewis Wolpert. There needs to be a much greater involvement of scientists across the board. It's time-consuming for an organization. It does take up a lot of resources but certainly for us (as a research institute) it has been very valuable. It has certainly made a lot of difference to our funding- not from the public sector but from commercial negotiations with Corporations in California to pursue this line of stem cell therapy. It has also brought in a better quality Ph.D. students and we have been able to recruit into our cloning programme, people from Canada and Australia and so on. So from our organisation's point of view, it has been very beneficial. At a minimum you should cooperate with 'Nature' and 'Science' who essentially have essentially set up a sequence for you. It's a matter of whether you're going to play a part if and when any of your colleagues are publishing in those particular journals. They set the framework and you have just got to commit yourself to that period prior to publication to liaise with journalists and to do it well. Thirdly, as far I'm concerned it's been a tremendous experience over the past 3 or 4 years. Those people who take to dealing with the media will get a lot of enjoyment and excitement out of it! It's nice wrestling with the opposition. The opposition is very good at simple phrases like 'Frankenstein Food' or 'Genetic Pollution'; they are rather less good at arguing the case beyond those simple slogans. I am confident that if scientists would get out there and debate more actively and do it professionally then we can win the argument then we can get the public on our side.

Q. How did you manage to keep the lid on so long?

A. Initially, very few people within the institute knew exactly what had been done. We just kept quiet but more people knew about than was comfortable. The other thing is that 'Nature' will always threaten to withdraw publication if it leaks out because they have vested in publishing the work before anybody else hears about it.

Q. Can you describe how you spent a lot of time preparing for the questions and did you go about tapping into sources of funding to finance those things?

A. PPL offered the use of their PR Company; so it was a three-way collaboration between us, PPL and a specialist biotech PR Company. As we have gained experience, we don't think that we need a PR company now other than to, perhaps, distribute press releases. It's an expensive business. We've probably run up

◆20,000 in bills from PR companies in 3 or 4 years but, if the Public turn against cloning, then a lot of our future funding goes 'pear-shaped'. Our particular circumstances were unusual. We were dealing with a worldwide audience and we were trying to influence politics and political decisions. I don't think many of you would find yourself in the same situation. I think, with the advanced notice you get from 'Nature' or 'Science', you could plan quite easily on your own- as long as you did it systematically and thought through all the options. Knowing which journalists speak to and having their fax numbers and so on is important. It's a bit tedious but that's what you might pay a PR company for and that would cost you ◆500/600.

Q. Do you know if the research councils have pot of gold for this type of thing?

A. Not for that. The BBSRC does run a media course. This is a two-day taster course, which I would very much recommend people to go on if they are BBSRC grant holders. It's not just interesting for handling the media but it gives you a feel of how to present your work to a non-specialist audience.

Q. Doesn't the BBSRC have a very good PR office that will actually provide you with lots of help?

A. In our experience, departments are generally happy to wait behind and see which way the story is going to go. We are being led from behind.

Professor Steve Hughes (Biological Sciences, University of Exeter)

### **The GM Debate: Bioscience, Regulation and Public Perception)**

The debate about GM and the relation to crops and food (which is my area) within this country is well and truly de-railed! It's off the rails and silent at the moment. So it's somewhat optimistic to be talking about informing such a debate. At the same time, I want to take this opportunity to discuss with you the work I've been involved with to inform the debate. This is the Nuffield Council Bioethics Report on genetically modified crops and their social and ethical issues. The report came out last May, and some of you may have read small parts of it. It's not a particularly recent document but it is available to you, as a piece of useful reference material in terms of the debate and can be downloaded from the Nuffield website. It took us about a year and half to produce this report. We launched it last May when the furore following the pronouncements of Dr Pushtai were at their height and it really arrived quite quietly within what was going on there. I should say, however, that although we are going into a de-railed debate in this country, internationally the report has been quite well received. I've been invited overseas to give several talks on the way this report was produced because people who are interested in it are finding it useful in addressing their own national debates outside the UK. Over the period since it was published, we have had over 2000 down-loadings (probably 3,000 or more now). So it's proving a popular and useful piece of work but it has received rather less interest so far in this country. What I want to do is talk about informing the debate against that background but at the same time leading you through the work that we did and how

we did it. I'll be using that as a platform for some of my own ideas as to how the debate got de-railed and how we can start to get it back on the rails again.

The Nuffield Bioethics Council is an independent organisation supported by the Nuffield Foundation of the Wellcome Trust and MRC so it answers to nobody. It was able to set up and appoint its own working group to study the subject of GM crops and food. With that idea, members of the working group were appointed. Professor Alan Ryan from Oxford was the moral philosopher on the team. Julie Hill was a member of the Green Alliance, representing the environmental watchdog organisation. Pru Lee you probably recognise as the TV chef and vice-president of the Royal Society of Arts. Michael Lipton is the agricultural economist with a particular interest and experience in developing countries and agriculture, particularly in relation to the green revolution and its successors. So I am just highlighting the diversity of the working group. The terms of reference that we were given by the Nuffield Bioethics Council were fairly obvious. How did we approach the issue of bioethics in relation to that set of new technologies? Our first position was to decide as a body that the technology per se was not really radical enough to be thought morally abhorrent. We go on from that position-making assumption to what we see in terms of the acceptance of the technology in medical science. Nobody we spoke to wanted to see the removal of the technology to produce Hepatitis B vaccine.

We then started to look at ethics from two positions. Firstly, looking at it in terms of the consequentialist ethics where we look at the world in terms of the outcomes we can expect and assess. These are in terms of cost and benefit; somewhat in same way we approach risk. So the consequentialist approach focuses on outcomes and fairness and justice. These are the things that we naturally look for ourselves in relation to the world. These are the requirements for us to be treated with justice and to expect the institutional environment to provide welfare. The second way of looking at ethics (from our point of view) is beyond a logical approach. It is based on our duties as members of our culture where we bring with us a set of cultural values. This brings us to the point of setting values for actions we view as being permissible or non-permissible. This is the area where we find most difficulty in addressing the subject of GM technology. This is especially in relation to setting boundaries, saying where we should or shouldn't go with the technology.

We looked at issues related to the environment, in addition to the more obvious things like food safety and objection to the technology. The environment seems a special case, in that we have a duty of care, as the earth gets closer to its carrying capacity. So that was the sort of background thinking on in terms of bioethics that we used as our platform for dissecting the issues. The detailed issues that we went through obviously related to food safety, public health and environmental protection. The implications of intellectual property were really quite far reaching in relation to justice, fairness and access to the technology, intellectual property does impinge on the way in which science, biology and bioscience is communicated. Of course, technology is the major route in which bioscience flows into our culture.

The process we went through and the reason why I dwell on this, is to give weight and value to the report for those of you who might find it useful in terms of giving support to the debate within your institutions or when you talk to the public (as I often do) about the issue of GM crops and food. I want to highlight that we went through a

consultation process with the public during which we had 150 or so responses mainly from polls. These were not very informative for our process in that way but, at the same time, it is useful to see where the extremes of opinion were. An additional process of consultation involved special groups; people in the industry and people in environmental movements. We interviewed them to collect precise evidence to support the opinions that we had built in our drafting process. Then all-importantly we put the document through a peer review process, sending it out to the most hardened critics we could find for the areas we would try to make recommendations and analysis.

I want to look at some of the roles of information in terms in supporting the debate. Firstly, I want to deal with the idea of support for the decision-making processes. One of our recommendations was that there is a need to expand the regulatory process to include a National over-arching committee which would deal at the same time with both the nature of the technology in terms of it's safety and effectiveness and with it's ethical implications. That over-arching committee should behave in a transparent and participative way with broader consultation with stakeholders. It's the information that goes into that process that is all-important. Following on from what Professor Blakemore said, I want to talk a little bit about the context of choice in relation to change and new technology and the perception of risk. I want to use that as a way of introducing some ideas about the real causes that underpin the de-railed debate that we have today and to suggest some ideas for getting around that. I'm just thinking now about uncertainty and how we deal with it as individuals. What I've tried to do is to imagine how risk decisions can be made in a space in which we can dissect the uncertainties we have about the likelihood of an event with some sort of negative consequence (you can draw the same diagram for benefit). Uncertainty, on the ordinate is concerned with the severity of outcomes and, what we do as individuals, is sample our environment to obtain the best information we can get, to move our perception of risk around within this space. We do that successfully all the time, making every decision that we need based on the uncertainty of what the outcomes that we are dealing with are likely to be.

The problems come with technologies that we haven't had any informative experiences of in terms of the real likelihood of negative consequences. In the 25 years since GM technology was first introduced, we haven't had an incident that allows us to make actuarial calculations. We have not had any incident that enables us to gauge severity. So, as a public, we are moving around in a space, which is rather difficult to navigate. Other people also influence us with their own agendas with respect to the technology. I am a person who is familiar with the technology and has been working with it for the last 25 years or so. I have worked in plant breeding and know the sorts of frequencies within which unexpected arise within plant breeding and what the likelihood of consequences are. So, I have said that, 'Occasionally things occur that are unexpected but the consequences of those are relatively mild'. Other people who are opposed to the technology take the counter view maintain that the outcomes of this technology (when something does go wrong albeit rather rarely) are likely to be up in that corner of risk base, where you would place the Chernobyl disaster.

We have two opposed views that dominate this risk space. We, as the public sitting the middle, do not know how to inform ourselves as to which is the more reasonable.

The problem has been in the debate so far. In my view, the opponents of the technology have publicised themselves on the basis that there the likelihood of an incident would be of drastic severity of the same sort of the order as the Chernobyl incident. I have explained my reasons for assuming the risk is down here but there may be many reasons why people adopt a position up here. We can assume that it is basically related to the way in which they relate to society, it's part of their cultural position and part of their relationship with society at large that encourages them to exercise a view that we should view risk in that way. The way in which we have opposed one another is to try and undermine those positions. Of course, if you try to undermine somebody's socially adopted position, they will fiercely hold onto it. That is why we can't get to the point of a structured discussion about how we should inform people. How people sitting here in the middle can negotiate this space and start to put some relevance to the discussion on relative risk. What risks might be associated with GM technology and how do they compare with the other risks that we take in life? Unless we start to assume this position, the only way in which we can proceed is to employ the proportionality principle (i.e. unless we can prove that events are absolutely impossible, we shouldn't proceed with the technology). So we have a stalled debate because we have tried to undermine one another's assumptions and that we are clinging to those assumptions.

My suggestion is that the way forward from a position like one where we have stalled in terms of trying to undermine one another is to forget where we are coming from and to try and get into conflict resolution phase. Here, we move into the middle ground and start discussion with one another about what information we would need in order to start to make informed risk evaluations. What is the nature of that information that we need to move away from these extreme positions and start discussion in the centre ground?

I want to highlight that, our analysis looking at feedback from surveys of public opinion, confirmed that many people are poorly informed to make choices and risk evaluations. The other things that have come out of studies based on focus groups, is that people's opinions tend to reflect the spin that was put on the argument when they last heard it. That, again, reinforces my argument that people are being pulled constantly towards the extremes by the sort of information presented to them.

The recommendations coming from the Nuffield Study (given the fact we have failed to create a debate in the centre ground about how risk evaluation should be carried out and we have failed to provide information of the sort that is useful to support choice and which is relevant to people decisions about products) are limited. We recommend, as you might expect, a Foods Standards Agency. We recommend (you won't be surprised to hear) further research. Further research should be undertaken to determine what information the public would want about GM and how we can provide it or give the job to someone else. Also how the UK Life Sciences Committee, industrial bodies and bio industry associations and others can work together to support the provision of information and to find a way forward. Another area that the Nuffield report focuses on concerns the principles of justice and access to the technology. This is the ownership of the technology and that reflects our concerns about in which intellectual property has dominated the way in which the industry has developed. It also influences the way in which the technology is controlled and where and how decisions are made about its use. It even changes

how those decisions are informed locally. So there are a string of concerns about the way in which the nature of the ownership of technology through intellectual property has had a dominant role in way which the industry has developed to the point now (because of amalgamations) there being four companies that own the enabling patents related to plant transformation, controlling access to and use of the technology in its various applications.

In terms of international development, that provides a set of difficulties concerning how developing countries can have a technology made available to them, which is appropriate to their needs. It also must be informed relative to their requirements, so that people in the developing world can make their own decisions about it. There has been a major background concern during the process of the writing of this report about information. As a consequence, we have thought quite a lot about how we could make recommendations for alteration of patent law so that patents could be more accessible. We could provide automatic licenses and so forth so that the technology would be made available. In the end, our recommendations were that the International Agricultural Research Organisation should be at the forefront in negotiating with those companies controlling technology to ensure that there are routes where appropriate technologies can be made available for poor people's crops in the developing world. It's a challenge to the international agricultural research community to achieve that. In the meantime, thinking about intellectual property is one of the ways in which the knowledge that comes out biological exploration is transferred into technology. The boundary between inventiveness and discovery is very rapidly disappearing in the flow of knowledge into the formal intellectual property of patents. This is one aspect we have to watch rather closely as workers in biology or academics in biological sciences departments, given that a natural theme now that discoveries must find their ways to patents. Such individuals have the capacity to contribute to the formation or to the support of monopolies, given the spending and research support power that the major companies have. The final recommendation I will mention from the Nuffield Bioethics Council in relation to that, is not only our recommendation for making patent law more equitable, but that institutions generating science as formal intellectual property should apply licensing that is fair and equitable. We can interpret this in terms of avoiding licensing to single, powerful organisations and then using that as a means of controlling broader aspects of the technology. They should ensure that the licence fields that are made between institutions and people who want make use of the technology are done on a broad and non-exclusive basis. This is one of the strong recommendations for biologists coming from the Nuffield report. Make your science/knowledge, if you are inclined to distribute it in the form of patents, as broadly accessible as possible.

Q. It's very interesting what you say about losing track of the debate. In common with many public debates, it is that scientists have intervened and are perceived to, a certain extent, to be trying to pull the wool over the public's eyes by saying 'There is no risk associated with this technology'. Then, when the opposition comes along saying, 'What if this or that happens?' we are frantically back-pedaling saying, 'Well, OK, that might happen but we don't think it's very likely'. So, you think this is a problem with the GM debate?

A. The majority of us, when asked about risk will say, 'There is a risk associated with everything'. Change equals risk. What we have to try and do, is avoid taking polar

positions. At one pole saying we shouldn't do anything at all because there is a risk associated with it- we would never do anything for the first time. At the opposite pole saying because we cannot from our position conceive of the risks at the moment, we will operate under the assumption that there are no risks. We must try to rationalise and understand the nature of the arguments of people who have concerns. The majority of us are reasonably just and fair about our approach to that but when forced into corners we tend to assume the position of trying to forget about the discussion of risk.

Q. It's often politicians rather than us that people hear. When Tony Blair says, 'There's no risk', people take that as being the viewpoint of scientists. It was the same in the BSE crisis when Gummer said there was no risk; people believed that was what the scientists said. The scientists then don't come back and say, 'There is a risk'.

A. That is too much of a good point to respond to adequately. This is why the move towards greater transparency in the advisory process is absolutely critical. If the public could have seen what the scientific advisors were telling the government, then we would be able to translate it much more sensibly. The reaction against science in the BSE episode was almost entirely unjustified.

Q. He didn't actually say anything; so to say, 'Look, there is a risk' is quite hard.

A. I'm sure the Chief Scientific Advisor didn't say there was no risk. I think it's very important that the public should be able to go to a website and see its messages, instead of reading only the papers.

Q. Do you think that 'golden rice' will change the perception of GM crops and do you think that Lord Melchett will get off?

A. Melchett getting off is dependent on a jury and jury's are imponderable- it depends on the way in which the people on that jury have been exposed previously. It's the same rule as sampling public opinion- it depends what they last heard. It depends on how they have positioned themselves and how they will respond to the evidence. I don't think the evidence itself is that important it's the nature of jury- that's my cynical view. 'Golden rice' is one of the banner headlines that we used to convey the potential benefit and my own feeling is that it is a useful item, provided we recognise that there's still along way to go with it in terms of fitting it into people's cultures. We shouldn't import our culture (which is one of accepting an improved food product on the basis of what somebody says about it). We have to recognise that the people who are going to be eating it are going to see a rice of different colour and will not necessarily feel that want they want. We have to think about the way in which the gene is going to be put into varieties that are appropriate for dispersal around the planet and that's going to take sometime. So we shouldn't try to oversell it too quickly. So to say that golden rice is the solution to vitamin A deficiency in the world is somewhat optimistic at the moment. At the same time, the counter argument that is being put (I heard Sue Meyer last week at a BSCB conference) is that there are lots of other ways you can get vitamin A. You don't need to improve rice. You can give people capsicums and you can give them other vegetables that are enriched in vitamin A. Of course, that also ignores the cultural



argument. The rice-based cultures are not interested in what you are telling them about capsicums being a good source of vitamin A that will support their children's health, they're interested in their rice culture!

Q. To what extent do you think developments in China with GM foods will make a lot of our debate redundant?

A. Are you thinking, that because of the scale of change in agriculture they can bring about in terms of the proportion of the planet's agricultural product, because they have the approach to life that says if they can improve their productivity to feed the population, they will? Yes, I have to agree with that, put in those terms; our debate is only relevant to ourselves. Hopefully, we will get back on the rails with our debate and start thinking about our debate in relative risk and balance, At the same time, doing what the Nuffield report suggested will ensure that choice is available within our culture because choice is deemed in our culture as being important. It is less important in the Chinese culture, where short-term survival is paramount.

Q. Surely, our debate is hugely important because we can actually have an impact on those countries

A. International trade has to be brought in line.

Q. You talked about having a transparency. Do you think that consensus's generally are worthwhile and actually achieve anything?

A. We've recommended that there should be another attempt to obtain a consensus. The one I participated in was rather stressful at the time but I personally learnt a lot from it. This was mainly from the interaction with opponents. I was appearing in part of the debate about the developments for developing countries and I found myself in the position where it was easy to communicate and talk to people who were taking opposing positions. So from my point of view, it was a worthwhile thing although it failed in terms of publicity and national information. As soon as it was realised that the lay-panel were about to say, 'We don't have any major concerns but here are all our minor ones', only the scientific press were interested. The gentleman's press vanished and there is no report of it at all.

Q. Does that mean that the consensus failed because there was no interest in it?

Q. Surely you are being contradictory when you talk about a relative risk because certainly, if you talk to relatively uneducated members of the public, they will see two positions? There is either no risk or there is risk. If you start talking about relative risk then you are admitting that there is a risk and the no risk option doesn't exist.

A. I think, when people see us debating relative risk, they are (as Professor Blakemore said) constantly doing their own risk / benefit analysis.

Q. But this is problem. They are not putting it into a mathematical structure like you are doing, and don't realise what they are doing.

A. O.K. Maybe that's the first tier of what we need. Namely, to start thinking about what risk is really about.

Q. Isn't one of the ways we can inform the public is emphasise to them how much they use genetically-engineered material at the moment e.g. in many types of vaccine (meningitis)? If we promote the benefits they are already getting from these products, we build on that.

A. Publicizing the benefits is one approach but we have to also remember that people have different approaches to thinking about food and medicines/ health treatments. People are more accustomed comfortable with taking one poison to fight another- this is putting in extreme terms. People relate to food in a totally different way. It's part of your self-image, your food choice is what makes you 'you', it's part of your family ritual and your religious identity, it has a much bigger influence on yourself in relation to national culture in a way that choosing your medical treatment is not.

Q. With respect, I think that argument is valid for the first three days. Then the debate in the quality press very rapidly goes from whether we should or should not do GM to whether we should scrap it. So the fact that we can do GM in favorable conditions and get a good product is actually irrelevant. The environment very rapidly became an issue

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Q. Most people think of GM as this of general Frankenstein stuff and I think that if GM were promoted in this more positive light, they would also feel better about the food.

A. My view is still that we should try to pull the opponents and proponents of the technology out of their extreme positions. Getting them to talking together to discuss what informative process is needed, before we can start to make assumptions about the sort of information that we need and how we can play on the successes of particular arenas of the technology. Golden rice is persuasive, but it won't restart the debate in this country.

Q. One of the ways forward in the animal's argument has been to try and do that. I know that Colin has had some experience in this area. You have to do it in a private space -that is actually quite important. In that debate, you have to concede certain things, which you may not be prepared for immediately.

Professor T. Hugh Pennington (Medical Microbiology, University of Aberdeen)

### **Food Microbiology and the Public**

I want to give you my personal story about my interactions with the media since the middle 1990s and try to draw some lessons, giving guidance on what one should and should not do. I will also say why I think it's worth doing. I'll start with the famous

flesh eating killer-bug story because that was my introduction to the media. I got involved because I let my name go to the British Medical Association to someone who was doing some work on Streptococci and through that route I got in contact with the media. You may recall that story. It ran for a short time in 1994 and it dominated both the electronic media and the print media. This is a fairly typical tabloid headline, 'Her flesh was being eaten away. Only one thing stood between her and death- thank God I'm fat'. So how do you handle a story like that?

Let's say how the story started because I think understanding how the media works helps you to interact with it. A journalist working for 'the Daily Sport' started the story. Now you wouldn't expect 'the Daily Sport' to carry science stories and it doesn't. It was a quiet day he was casting around for stories and this was one that had started two months before. Two patients had fallen ill with Nepitisine faceitis, which is a rare very rapid tissue-destroying infection. It had been reported on local radio in Gloucester and it had got onto the Press Association wire, the stuff that goes out every day. The journalist spotted this as a good story. 'A bug that eats you alive' was the headline in 'the Daily Sport', along with the scantily clad ladies. The sub-heading was 'Killer virus scoffs three'. That's the beginning of the story. The end of the story involved several professionally made television programmes wrapping it all up and putting it into context. One of the patients lost a good bit of tissue around his genital area- it was never spelt out in the programme but there were hints left about that.

Another typical headline of the type which gets scientists absolutely enraged is 'Cannibal bug hits about 20'. 'Alert doc saves a life' with pictures of the victims, one dying, one surviving. This is the killer virus. This shows what a few unguarded words can do in terms of instructing journalists. Of course the Streptococcus doesn't look like that at all -it is an artist's impression of a t-bacteria phage. The scientists in the picture who talked to the press and briefed them said the virulence of the Streptococcus might be due to phage conversion. The phage DNA may carry the toxin genes and so on. The journalist picked this up as though the phage itself was the agent (of course, it looks more photogenic than the round Streptococcus).

Let's look at the story itself. As I say, I got involved as a quasi-expert as I was actually doing work on the Streptococci that caused this infection. I was the only immediate person they could get to tell them about the science because the Public Health Laboratory clamped down. They basically said nothing. This was part of the problem. If they had said what they knew and didn't know, the story would have probably fizzled out and died much sooner. The long incubation period occurred in 'the Daily Sport' which fizzled along and then it took off in the print media first. I had an exponentially increasing number of telephone calls over this period. The electronic media surge was a little later. It is a characteristic of the media that, if you are going to the place where television news is being created, you will see people reading the newspapers. They will get a lot of what they report out of the newspapers- the media feeds on itself. That's how stories build. This story only basically lasted a week. There were no other competing stories. It died very rapidly because John Major who was Prime Minister at the time attacked beggars in London and said he would do something about them and that became the story. All the interviews that I had been set up for in Aberdeen just disappeared. The journalists lost interest in this story and, by this time, had already realised it was just a story. It

began to transpire (as I said all along) that *Nepitisine faceitis*, was nothing new- there were over 100 cases in Britain. It was first described in China in 1925. The guy who described it then was an American journalist, who gave the facts and same descriptions as all these current patients. What was new about it? The only interesting thing about it was that the mortality rate in China in 1925 was the same as the mortality in Britain in 1995. The press didn't run too much on that but they eventually saw it as a story rather than serious science. 'He won 15 million on the lottery then was consumed by a flesh eating killer bug' -that's apposite because, in fact, the lottery contract went out the same week as this story was riding high. So the media was laughing at itself. The BBC television programme made by Linda McDougall laughed at itself as well. They had Ian Hislop doing the voice-overs, so it had that kind of ring of 'not quite serious'.

It is quite different when you come to a food scare, which is really what I've been asked to talk about. I'd like to go into a little detail because that was my next big brush with the media in 1996-97 and hasn't finished yet. For various reasons, food scares generate an enormous amount of media interest. Of course, the media themselves very often create food scares. This was the start of the central Scotland *E. coli* outbreak at the end of 1996. This is the headline in our local paper on the Monday. These outbreaks always start at the weekend and this one started on the Friday afternoon when everybody was going home. That's when the shit needs to hit the fan. It was in the 'Aberdeen Press and Journal', which is the paper I read over breakfast to find out which people in my department have been up for drunk driving and that kind of thing. It has a larger circulation than any other Scottish newspaper, bigger than 'The Scotsman' or 'The Herald'. The Scottish press is very different to the English press. We don't have national press we have big town newspapers. If a central belt issue of Scotland gets into the 'Aberdeen Press and Journal' with a headline as big as that on page 2, it's big news. You will all be familiar with the story about what the 'Aberdeen Press and Journal' said when the Titanic sank it said 'North East man drowns'. When you actually look, it doesn't say that but never mind it's a good story.

A food scare is sometimes a scare in the sense that it has a 'pejorative' ring about it! This is a food scare where actually people are really scared of the bug. The reason why the central Scotland outbreak has that ring about it is partly due to this episode. This is the church hall in Wisheart where 85 people were given a free lunch. So there was no choice on the menu- it was steak pie. Out of those 85 people half fell ill, 17 had to go to hospital and 8 died of *E. coli* food poisoning, which was in the steak pie. We even went so far to plot a map where the people had died because there was a rumour going around which said that, if you sat next door to the minister here, your chance of dying was much higher. This did not get into the papers but immediately (and for ever after as far as I'm concerned) I've had this relationship with the media because of the various aspects of food safety, which were highlighted by this outbreak and have continued since. We can list many of the attributes to the story like a food scare and these are the things that cause the media to take an interest. They include questions of blame. So in a food poisoning outbreak, who sold the food? Who is responsible for contaminating it with bacteria? There is always the cover-up angle. The Government is hiding something, the health authority is hiding something and the environmental health officers are hiding something. There's the human-interest angle. You saw on the previous flesh eating bug story that the

papers ran stories on individual patients. In fact, the journalists found more individual patients who'd had this bug than the Public Health Laboratory Service- who are supposed to know about it. The journalists beavered away and they got names and addresses and photographs of people who had died and people who were still surviving and so on. It is absolutely vital to most media outputs to have high profile issues and people. A political story or one that has an effect on politicians is even better. Evidence of conflict is of great interest. This is where scientists have to be extremely careful unless they want to be part of the story. If there is evidence that scientists disagree about something - that is meat and drink. It's generally quite easy for journalists who know the science to get different views on the subject.

As a portent to further ills. If 8 people have died of E. coli, why not another cohort of people? In the E. coli outbreak in East Lanarkshire, over 500 people fell ill and many more were exposed. Visual impact is not so important in this particular story. Sex and crime (well crime because people do get prosecuted) sells but that, of course, doesn't relate very often to scientific stories. Here's an example of the "cover up", there's a cartoon from the 'Sunday Times' over the outbreak when it had really got a head of steam behind it. 'Scottish public - kept in dark at all times' Lanarkshire Health Board and Scottish Office. This, in fact, in terms of what the Health Board and Scottish Office were doing, was quite unjustified. They were being very open and had set-up links with the media and the public, help lines and so on. The impression the media gave out early in the outbreak was that it was easy to target the cause of the problem and very easy to apportion the blame. What happened thereafter? We can go through the sequence of events and see how it was reported. I was asked to make recommendations to the Government as to what could be done to stop that kind of outbreak happening again so I became part of the news. What the press focused on was E. coli axed over 1,000 butchers because we were recommending that butchers would have to get a licence before they could trade. We weren't saying that the butchers would close but we were saying they would if they couldn't get a licence but the press reported this in a very lurid way. Relations between the government and the press and scientists and the press were mentioned. It's very instructive to see a politician e.g. a government minister talk to the press. When he does, he always has his minders - his civil servants there. Eagerly talking notes, perhaps being able to jog his/her elbow if he/she is going off the message and, of course, they have a very extensive briefing sheet with all the nasty questions and all the answers they should give. I was in the fortunate position of not having any of that so I could say what I liked. We were saying butchers should provide separate sides of their business for cooked and uncooked meats and there were a small number of businesses that this would affect quite significantly in terms of cost and the papers focused on that.

I went on monitoring the phone-calls that were coming into my office. A histogram shows the phone-calls as they came in from the start of the Lanarkshire outbreak and for about 200 days thereafter. There were various peaks and a background of a few calls a day. Each one of those peaks, except for the very large one, happened before my expert group that was making recommendations to the government had a meeting. Somebody was leaking to the press that we were going to have a meeting. The press would pester me and ask what was on the agenda and what we were going to decide but got nothing. It didn't stop them going on about it in the hope that they would get a leak into what we were about to recommend. This one was quite

different; this illustrates many of the aspects of handling the media that you have to be prepared for. You mustn't imagine that you will be given any time to respond. This story was about a report on abattoirs that had been commissioned by the Ministry of Agriculture and had not been officially published in the sense that you could buy from a stationary office. I was rung up by the 'Today' programme at 7 am and had asked had I seen this report. This was half-way through my enquiry and I said, 'No I hadn't seen it'. I had to give an immediate response to that question, Douglas Hogg who was Minister for Agriculture at that time then came into the firing line for not letting my group see this report because we were looking at conditions in slaughter houses as part of our recommendations. Douglas Hogg's misfortune was to fall down the stairs at home the previous day and he appeared on crutches and that is absolutely fatal if you're dealing with the media. If you appear in any way defective in health terms- forget it! The story then became about the bad relationship between Douglas Hogg (the Minister of State for Agriculture) and Michael Forsyth (the Secretary of State for Scotland) because Forsyth said why hadn't Hogg given this report to the group that was reporting to him. They had a big public row in the House of Commons. It turned out the Scottish Office had a copy but it had come with such serendipity that it had been put in a filing cabinet and they had never seen it.

When the report was looked at, it was found to have been sanitized. Some of the nasty bits e.g. the note that spinal cords from cows were going into the food chain had actually been taken out. Douglas Hogg attacked me in the House of Commons for having said I hadn't seen it when, in fact, the Scottish Office had a copy and, in any case it had been published because it had been put in the library of the House of Commons which is 'publication'. I had the last laugh because the papers, with the elections coming, showed Hogg with his foot in plaster. It didn't do him any good at all!

If you get involved with the media you have to be prepared for bad things happening. I got a fairly typical letter. "Having seen you on TV the other day, I am writing to you in the very faint hope that it was you I leant a copy of 'The Mongol in our Midst' (a book written about Down's syndrome in the 1920's) when you were a custody officer of St Thomas's many years ago (1962)". This letter was written in 1994- I wouldn't normally bother but it was really special- she was saying she wanted it back! Somebody in Aberdeen has it in for me as I run my laboratory with the same efficiency as I run my office this is because my desk is piled high with paper. 'I doubt if you will find anything here, even the background units seem to be in a complete shambles' was the headline. I suspect this is some ill-tempered journalist at the evening paper having a dig at me here. I was 'knighted' by Jeremy Paxman and 'the Daily Telegraph'. It was quite good because actually the first thing Jeremy Paxman said to me was 'Sir Hugh'. Actually, if you can get somebody to do that it's good because it puts the journalist in the wrong. Attacked by Ian Wilson in the 'Evening Standard', as 'Silly old Professor Pennington' etc.

I have been in a lucky position. Having developed a high profile because of basically being asked to run a committee to look at something, gives you an automatic entree to the media. How to use them is up to you! You can always say, 'You're not available' and they will eventually lose interest. I decided to play it the other way, mainly because I think public health is important and it doesn't get its message across very well. I've tried to do my bit on that one. It's amazing how sometimes you

can be reported. I had to give prizes at our local slaughterhouse at their Christmas carcass competition. This was the most difficult audience I had ever given a talk to. Half were butchers and half farmers and neither were doing particularly well at that moment. So I said I was 'p\*\*\*\*d off' because the government was not moving on one of our recommendations, which was the licensing of butchers. The meat trade's journal reported it, 'Down here is a machine which automatically seals the rectum of the dead animal by putting a great steel rod up with rubber bands and plastic bags and all sorts of things'.

The sub-editor will misreport you. This refers to my giving evidence to a House of Commons Committee just saying that basically E. coli hasn't gone away. It's reported as 'My beef with the ministry' because I was saying that I was looking forward to all these recommendations being implemented. It is useful to have sound bites. My favourite was when the agriculture committee in the House of Commons quizzed me. This is Austin Mitchell, saying I described the E. coli incident as a 'turd to tongue problem'. I wish I'd thought of that myself. I think it's a useful device. If you can come up with something like that and have it as your motto, it helps with the press. Sometimes, you have to defend yourself vigorously not just in the mainstream (either electronic or the print media). This is 'Private Eye' Ewan Muckspreader is their current agriculture correspondent. I know who Ewan Muckspreader is and most of the time I agree with him. He said that one of our recommendations that cattle should basically be shaved before they go into slaughter houses so that they have less muck on them was a bad thing because farm workers were being injured doing it. The farm animals were kicking farm workers whilst they were shaving bellies and people were not getting E. coli from dung-contaminated meat. I had to write in and say that, in fact, E. coli incidents had fallen following this action.

I want to end by saying that the real downside to the media is that you have to be prepared. You've heard that you have to respond virtually instantaneously if you are prepared. If you're not prepared, you can go away and find out before you respond but you still have to respond very quickly if the media is going to be interested. I have personally found that the media people I talk to nearly always want to find out what my level of expertise is on a particular issue if it's not on E. coli. I have talked to them about other issues to do with food poisoning. They are usually quite keen to find out where you are coming from on this and what your qualifications are for talking about this issue. A lot of the time I talk to journalists in a general briefing mode without actually my words being quoted or attributed to me. In a sense, you can look at that as a public service. But you have to be very careful and always think about what you say. I'll just show you two examples of people who have said things that they bitterly regretted in terms of the way their careers then ceased to develop. Edwina Currie, of course, said 11 years ago that all British chickens and chicken production is contaminated with Salmonella and, within a fortnight she had resigned as junior health minister. Within a month, a cabinet committee had been set up to look at food poisoning and, within a year, there had been an Act of Parliament, which completely revolutionized the way we handle food safety in this country. The second and third of those are good things but the first for her was a complete disaster meaning her exit from politics. She is now writing books and running a Radio 5 programme in the middle of the night. So that was the downside of Edwina Currie saying something that was actually true - most British egg production was contaminated with Salmonella and, only in the last couple of years, has the situation changed radically.

So she feels bitter. Not bitter because she said something that she thought was unwise, but bitter because she said something that other people thought was unwise. The egg producers rushed to the Ministry of Agriculture. The Ministry of Agriculture rushed to the Department of Health. The Department of Health said that Edwina had to go and that was the end of that!

You are all familiar, of course, with the sad story of Philip James and Arpur Pushtai, which still grinds on. It has quite a lot of influence on the GM debate not just in the UK but worldwide. When I go to Aberdeen airport I spend a lot of my time dodging Arpur who, despite being 'gagged and slurred and so on', has now become a world celebrity on the GM front doing talks in Chile, Japan etc. He's never actually worked on genetic modification. He is actually a well-respected expert in lectins and that was how he got involved in the study looking at some potatoes that had some lectins stitched into them to see if there was a downside to that. His two sentences on 'The World in Action' programme where he raised a few doubts about the immune status of rats that were being fed these potatoes led basically to his becoming, you could say, 'a martyr of the cause'. His contract wasn't renewed at the Rowatt but he was 69. He was on an annual renewal of his contract as he had retired 9 years before. So he wasn't, strictly speaking, retired although there was a period of about 2 weeks when he wasn't allowed to say anything through the Rowatt channels. The serious consequences came down on Philip James, the director of the Rowatt who took early retirement. This has not been a good time for him because of the way the media was handled immediately after this episode. I won't go into the details but many mistakes were made there. Things were said which shouldn't have been said and things were not said that should have been said.

I'll just finish by saying that I think the media is basically like the device this chap invented. He is James Gregory who graduated from Aberdeen University in 1657 and invented the reflecting telescope. He is quite a contemporary figure in some ways because he went off to be professor of Mathematics at St Andrews and was then headhunted by Edinburgh. The reflective telescope, of course, gathers in the light, reflects it and points it in a direction. That's what the media does. It sees what's up, reflects things and, if you bear that in mind when you are interacting with the media, that will stand you in good stead.

Q. If I remember rightly, one of the problems that Edwina Currie had was that she said all egg production was compromised. If she had said some egg production was compromised, she probably would of got away with it. Just one word can drop you in it!

A. If she had said, 'One in six hundred eggs is positive with Salmonella' which is what the figure is she might have got away with it. But Edwina was on a public health crusade so I think she really did feel she had to say what she said. She paid a big price for it!

Q. It was just one word! It was just a case of the wrong word in the wrong place!

A. Absolutely, she was out of kilter with the mood of the time, which was very deregulatory letting industry sort itself out. Here was something that had an immediate effect on egg consumption and so the people that went for her went for



her on the grounds that she was damaging industry. That exposed the problem that the Minister for Agriculture had- it's dual role. On the one hand, sponsoring the food industry and on the other protecting Public Health. Clearly, in this episode, sponsoring the food industry came higher in terms of those two priorities. At the end of the day, she made a sacrifice. It was worth it because it was one of the things that eventually led to the Food Standards Agency, which is one way of solving the problem of massive conflict of interest.

Professor Iain Purchase (Institute of Ethics, Law and Medicine, University of Manchester)

### **Ethics and the Biosciences**

Professor Purchase did not want his talk reproduced, so only the discussion is provided here.

Q. Can I ask your view about the balance of between the freedom information and revealing information about those concerned with animal experiments?

A. That's a hot debate at the moment isn't it? There was a consultation exercise on the Animal Procedures Committee just a couple of months ago. For me, two threads run through this debate. I think the first thread is about the importance of some confidentiality around cutting edge research from a patent point and a competitive point of view. If we were forced to publish the full content of our ideas in research using animals in advance of doing that research, it would be very difficult to be competitive in a world where other people are not subject to that type of discipline. This is particularly the case in the way project licence applications are made at the moment. So much detail has to be given about what it is you are trying to do and why you are doing it and so on. There is a real need to prevent that information from coming out. My personal solution to that is that there should be a personal abstract for a project licence, which should be made public. That abstract could be tailored in such a way that it revealed a general direction of the work with major costs and benefits but didn't actually give the detail. So that's one theme! The other part of openness, I think, relates to public acceptability. In the work I have been doing recently on the Ethical Review Process, I've been looking through the responses to a survey I am in the process of carrying out. There are many people who are very concerned about their personal welfare as a consequence of this type of thing. There you have got an interesting debate. The reason why we're in that situation or the reason why there is less public acceptance of what we do, relates to the fact that they don't actually know what we are doing. I think it's going to be very difficult to break out of that and that we are going to be more open in what we do. In fact, as most of the work is published in the open literature and anybody with a computer can find your name and address and what you have done in the past, so the so-called threat about publishing our names associated with project licenses or whatever it is, I think, probably driven more by fear than by a careful analysis of the risks. I feel that in some way we have to open up, otherwise we will continue to be accused of being ashamed of what we are doing. So we have got to move in the direction of greater openness.

Q. On that point would it not be acceptable, for example, for it simply to be anonymous? As long as people know what is happening, it's perhaps irrelevant who's doing it.

A. There are always counter arguments. The counter argument is revealed by the way in which the Home Office on proposed project licenses currently carries out the cost/benefit calculation. One of the key features about it, quite correctly, is, 'Are the people who are proposing to do this work competent?' 'Can they do it?' 'Have they the experience and the facilities?' The real challenging cases are the primate experiments when studying Parkinson's or something like that. If you've got a centre of excellence that has been studying Parkinson's for 20 years and knows how to handle the primates, -that's one situation. Conversely, if you have a totally new, start up organisation that has never done an experiment previously-it's another. So, in all of these things, there is a sort of cut and thrust. I feel we have to become more open. Exactly what form that openness will take I'm not quite so sure but the section in the act that says that everything is secret is going to have to be modified. The question is how is it going to be modified and how we can achieve it? I think we should look at it from the other way around. One of my criticisms of people, who are working on animal experiments in the UK, is that they are always totally reactive. Nobody is looking at this and saying, 'Hey there's a chance here that we can tell people what we are doing and improve the lot and reduce the threat over the time to individuals'. That's the way we've got to think! I'm not sure what the answer is. I'm quite good at asking questions but not so good at providing answers!

Q. I was interested with your comparison of intrinsic and extrinsic ethical arguments. The problem is that the extrinsic argument could be said to be an objective framework, while the intrinsic argument is not. On the 'Today' programme there was an argument between Winston and somebody from the Pro-life organisation about whether we use stem cells for cloning that illustrates this distinction. Winston was extrinsic, talking about costs and benefits whereas the Pro-life person was saying, 'You can 't grow embryos for any reason'. The problem is to actually pin people down. The Pro-life position is extremely unusual. The number of people who actually support its position is tiny. I have run a tutorial for twenty years on 'eugenics, abortion and genetic diseases' and I have never yet met a student who is prepared to spout Pro-life ethic. It is therefore very difficult to have a balanced argument because the people who reach out with their intrinsic belief will always get heard, even if they have a vanishing small support.

A. This is what I like to think of as the democratic deficit in these things. What we have is the general public more or less accepting research or not having a general view on it at all. Then you have this tiny view expressed very strongly. It seems to be the way our society is going. I do think there are ways of arguing about the intrinsic issues. You can see it in the GM crop debate, when people say, 'Well, this is playing God'. Others reply saying 'We are, but we have been breeding crops for millennia'. 'Are but you are introducing new genes'. 'Yes, but genes do move naturally between crops and we've plenty of examples of that'. So there is some information, which one could actually put along side arguments. I never expect to change the Pro-people. It's their job and they would be without a job if they suddenly agreed with you! So, they are not about to commit 'suicide' just for the purpose of debate! I think that if you have a reasoned set of arguments to put alongside the intrinsic objections; I think the

audience listen. It can provide them with some reassurance. You may not convert them but at least it does provide them with a different framework for discussing developments.

Q. On your point about ethical training for students. Coincidentally, we are initiating plans to run an undergraduate course on 'genetics and society'. Other than going to our Human Sciences department, is there a forum with which we can initiate discussion about how we might go about setting up this kind of undergraduate course?

A. The same debate is going on here in Manchester at the moment. I have been speaking to some of the folks in the School of Biological Sciences about how we might do it. We might tap into the resources of the Institute of Medicine, Law and Bioethics, which is also in the University. I don't know of any particular good courses but other people might. The problem with training and ethics is that it's not a subject that lends itself to a didactic approach. The only way that I can think of making it live would be to do it through tutorials. The sort of model that I have in mind is that we might have a single lecture that outlines what ethics is about. We would expect the faculty to attend that as well as students and we would give them packs of case studies. Those case studies would be then be discussed in small groups of maybe ten or fifteen where everybody has a chance to express views. The Faculty member is expected to be a moderator and not an expert on that debate. Exploring these things personally is I think quite important.

Professor Stephen P. R. Rose (Director Brain and Behaviour Research Group, The Open University)

### **Biosciences and the Broadcast Media**

To take the Jeremy Paxman line, 'Sir Hugh' is going to be a hard act to follow for a variety of reasons. One, of course, is because he has told you a story of which he was very much a part; if not at the centre, very close to its centre. Many of us will have experience of being at the centre of perhaps less dramatic stories in the course of our interactions with the press and the media.

Although I was not really asked to talk about that today, I want to make one observation on the barrage of comments and phone-calls that one might receive from the press. That is (I'm sure Hugh Pennington would agree with this- he had a particular interest in responding) that you don 't have to! If the press calls and you don't want to speak to them - don't speak to them! Secondly, if a junior media researcher calls and says, 'I just want to find out what your attitude is on 'x'', take a leaf out of the book of many of the academic staff of the Manchester Business School and certainly many of our medical colleagues and say, 'Right, my consultancy fee according to my union is a minimum of £100 per hour or part thereof and I'm starting my clock now'. If that works you can ask for a cheque to be made out your institution to foster your research or to go for your graduate students and it will choke off anything except the most serious inquiry. These are strongly recommended techniques and can be quite profitable.

I want to start with some disclaimers! I've always been very uneasy about colleagues who parachute into meetings and conferences at the very last minute (and feel rather guilty therefore about missing the earlier sessions). If what I say now, repeats what colleagues have earlier I shall apologise now. I also want to make it clear that Kevin Gartland asked me to specifically talk about the broadcast media and science. The reason for this is three-fold. The Open University has an ongoing relationship with the broadcast media in terms of its being part of our teaching programmes. A few years ago, I was asked by the BBC and the Museum of the Moving Image to give an annual lecture. I gave it with the title 'From Frankenstein to Einstein - Changing Images of Science in the Media'. I had the joy of being able to trawl through a lot of the BBC archives of visual presentations of scientists when preparing for it. If I had a lot of time I would have brought you up some of the images I managed to gather from the archives running right the way back through the whole of the last century. This was Sir Kevin's starting point! Somewhat to my surprise, I was phoned in the autumn of 1999 and asked if I would like to give a key-note address to the BBC governors at one of their 'think sessions' (this was the time of the transition from Sir John Birt to Greg Dyke) about the way in which the BBC handles science. I asked them why? They explained that it was very simple in that they knew my name but as far as they could tell, I was one of the few scientists that did television or radio stuff who hadn't got a contract with the BBC to make a big series about anything at all! I explained to them that this wasn't for the want of trying but, somehow, the ideas I had, hadn't been judged exciting enough by commissioning editors or other individuals. That gave me an opportunity to think about some of these questions. I reflected on the changing images of science in the visual media and ended up trying to tell the BBC governors what I thought ought be their targets for approaching and handling science over the course of the coming century. My commitment (and I hope it's all of our commitments) is that if that old view of Francis Bacon that 'knowledge is power' is true and we want to live in a democratic society, we need to democratize knowledge. This means we ought to provide people with specialist knowledge - as scientists we must have a commitment to public dissemination as well as public education of the media and the public in science.

There's a caveat, however, and that's also reflected in the work of COPUS (the committee on the public understanding of science) a not very effective body shared between the Royal Society, the Royal Institution and the British Association. That is, we must recognise that the activity of public understanding of science is a two way process. The other half of the process is the scientists must increase their understanding of the public.

Just as a way of raising some of the current issues, I will reflect a little on the way in which the media images of science have changed over the past century. It seems a long time span, so I will compress it very quickly indeed. If you go back before the 1939-1945 war, you see essentially two types of scientist presented in popular images. One is, of course, the mad scientist inventing something by putting drops into a retort and bubbling it away until the thing explodes and he invents some kind of toxic agent, which can destroy the world. The scientist has these mad plans that he's going to become some kind of international dictator. The second image is a slight variant. In it, the scientist is a completely abstracted and absent-minded individual who may be handling extremely dangerous things. He doesn't, however, know what he is doing and he (and I do mean he, in this sense) generally has a

nubile, rather beautiful daughter. She is then captured by baddies and held to ransom until the absent-minded scientist reveals the 'secret of the universe' to them. Those are the two dominant characterizations; the scientist as absent-minded and abstracted and as the mad inventor producing dangerous things. It was implied that neither should be taken very seriously.

What changed perception was particularly the role of science in the 1939-1945 war. Above all, the nuclear explosion and famous statement by people like Robert Oppenheimer that, 'Scientists had known sin, as the bombs exploded'. After that, in the 1950's and 1960's (which reflects, I suspect, the childhood exposure to television of some of us in this room) you get different images. You get the image of scientists now battling to save the world against problems that actually might emerge. Battling against invasions from outer space, toxic bugs that were going to take over the world, bumbling bureaucracy in Whitehall or whatever else might conspire against the heroic scientist, shown in television programmes such as 'Quatermass'. A whole group of scientists appeared committed to solving doomsday problems weekly. Then, of course, you have the infamous 'Dr Who' with his endless collection of elegant, young assistants. These were always male scientists. It's very rare in that period to find a female scientist. The classical presentation of women scientists is inevitably patronizing. 'Don't trouble your pretty little head about it dear - we will solve this particular problem'. At the same time programmes like 'Tomorrow's World' had a very didactic approach to science. Here they presented some new technology/gizmo invented and that is about to transform the way in which we think about 'x, y, and z' and will change our quality of life and so on. So there was a gulf between the science producing these bits of technology and the romantic figure of the scientist in the media images.

Over the last ten years the image of the scientist has become totally transformed in a variety of ways. One of the transformations particularly involved biology. In the past, biology was part of 'little science' and not seen as particularly impacting on technology or the media. The advent of the Human Genome Programme, Biotechnology and, above all, the whole series of food scares (graphically illustrated by Hugh Pennington's talk) have actually transformed the relationship between science and the media in a very important way. It's important to remember that it's been transformed in two directions. The media has changed the way it represents provided information and the issues concerned. But don't forget that (particularly in the last ten or fifteen years) we scientists have been courting the media as never before. Most of our universities have press officers who are only too anxious to issue press releases about papers that we may have coming out in 'Nature' or 'Science'. If we don't have press officers in our own institutions, then the journals actually have a regular service producing press releases which trumpet and exaggerate (in ways we would find embarrassing when talking to our colleagues) our findings. Whatever we are actually reporting in a particular paper transmutes to 'smart mice' and 'genes for homosexuality'. Only last week, a report from Dr Breed's lab (nicely named) in California presented the extraordinary argument that you could tell whether someone was going to be a lesbian or gay by measuring the ratio between two fingers. It found its way onto the 'Today' programme. This was not accidental. There are a large number of science journalists in the country and they live by issuing press releases. We also live or die by those press releases. If we want to accuse the journalists or the media of exaggerating what we were actually saying or claiming, then we must

read the press releases that are put out. It is quite salutary to see the way that these are handled. So the scientists and the media have very much a two-way relationship. I've had science journalists say to me, 'Why don't your university put out more dramatic press releases about what you do because we get all these dramatic press releases from the United States and therefore it's US science that we cover rather than UK science?' That is a very serious problem because it's an example of Gresham's law- the bad driving out the good. You may feel after seeing those headlines that you can't live with the press but I don't think that in an open society one can live without the media. We do have to come to grips with its complexity.

That's the background to the way scientists are now understood by the media. In the past (apart from dramas), you were figures of respect. You were university professors and a scientist and deference was paid to you. Professors were relatively few on the ground, now (as we know) they are two for a penny (female professors being paid less are probably four for a penny). The situation is now very different. The deference has gone and furthermore, instead of automatically assuming we speak the truth (as we are based in universities and are university professors) quite frequently the current attitude is 'Why should we trust you?' We know (and the press know) that many university professors may have shares in biotech companies or be directors of biotech companies. In whose interest are we speaking? If someone with interests in a particular company makes a statement about a new drug or new agent (this is particularly true in the States), the share values shift. The whole issue of the relationship between who we are and what we are has very radically changed over the course of the last few years as a result of a change in the way we do science. We can't get away from that. Where does that leave us when we try and think about how science could or should be treated by broadcast (or any other) media? The first thing we must do is to try and think about what the broadcast media are trying to do. They see themselves as a profession. This is particularly the case at the BBC, which is a public service broadcast medium with three tasks. It's got to entertain and educate and that means it's got to be critical. Entertainment programmes involve quite a lot of science. Pure didactic programmes are transmitted on the BBC, which now has a remit of having to include a significant 'science' component in its daily output. There's a regular science slot on the radio. You may not recognise it as 'science' but they think it is! Between 9 and 9.30 am, the 'Today' programme includes science. 'Intellectual' chat shows on radio like those of Jeremy Paxman or the Melvin Bragg quite regularly include scientists. There's been a conspicuous effort (particularly on the part of the BBC) to actually increase its investment in and exposure of science. Some of those programmes are genuinely didactic. If you get Peter Evans talking about a breakthrough in continental drift or in cosmology, you will have quite a serious discussion with the scientist concerned and often they are of high quality. It's harder on television. The problem on television is with visual representation and you tend automatically to go to a 'gee whiz' type of presentation. In it, you have the expert scientist in his office (if he's American, often with his feet up on the table in front of him) extolling the new theory he's got. Then you cut to a bit of visual 'wallpaper', a white-coated technician pipetting into an Eppendorf tube or putting things into a scintillation counter. The journalists have no idea what this bit of equipment is but it's got a lot of flashing lights associated with and it's look good and is less boring than a 'talking head'. I'm really very unhappy about the presentation of science like that on television. I strongly believe that if you are going to show a bit of equipment you ought to show what it does and how it works and not just use it as

'wallpaper' in that sort of way (I suppose that's speaking with my Open University hat on). It's clearly entertainment as well as being didactic. There is actually an awful lot of such science on the media in one-way or another. You can't turn on BBC Radio 4 without hearing the whispered voice of a science or natural history correspondent saying, 'I'm now standing up my knees in marsh in Little Didcot under the Water' This is a sort of auditory wallpaper. You can find 'science' in a lot of the current entertainment programmes on television. You very rarely have a police show without a bit of forensic science going on in it. You have pathologists (the new heroes of the medium). You even get science and scientific method on 'The X Files'. You may not like it but, in a sense, there is an effort to discuss issues such as how one can understand something 'scientifically'.

We live overwhelmingly in a culture where science and technology permeate every aspect of our daily life. One mustn't automatically assume there is a little box called 'science' when it is actually spread around all over the place. COPUS and PAWS (the Public Awareness of Science Program) asked why there aren't any scientific soap operas on television (just like there are medical or police soap operas) and have offered prizes to people who can come up with story lines, I'm not sure if I find them very convincing. The whole point about a soap opera is that it concentrates at some point on personal interactions. Even the hospital or police settings simply become a backdrop for love affairs and betrayals. There's nothing we do in the lab that can be quite as dramatic as a police chase or someone being rushed into hospital on a trolley with a drip and a bit of medico-scientific jargon (that you not supposed to understand) being muttered. There's one famous programme, which the BBC did regard as didactic but I would regard as entirely entertainment (and probably a bad way of doing it). This was 'Walking with Dinosaurs'. They are enormously proud of 'Walking with Dinosaurs'. It cost a higher proportion of the BBC budget than any similar programme made before, the animations were superb and Kenneth Branagh's voiceover gave you the Flintstone view of the delightful domestic life of little dino and his or her parents as they escaped the surrounding predators. It was quite fascinating but I suspect that 'Jurassic Park' probably did it better. What distressed me (and I suspect would distress many biologists watching the programme) was that no attempt was made to explain how you could attempt to draw conclusions about the domestic life of the dinosaurs from the available fossil remains. They also did not distinguish between fact and fiction. So what you got is a seamless web of the dinosaurs morphed into the Brazilian rain forest or the cold rain forests of New Zealand. Scientifically, it was a very deceptive thing to have done. But they are proud of it and they got huge viewing figures. The latter, of course, is one of the issues that concerns the BBC enormously as well as every television channel and every newspaper. There is a competitive element. I guess most of us are least uneasy with didactic or entertainment programmes where, somehow, at least in the didactic ones, we feel that we (or our colleague who is taking part) has some control in what's going on. We feel less happy with news media treatment, where there are problems on both sides. There are problems in the way that the media handles the news and there are great problems in the way that we feel we should approach the news. Firstly, we have to recognise that, when we are involved in a news story or issue, we are not in control. We are one voice or asset. The suggestion that, somehow, we have access to the truth and therefore we should be given a major voice whereas Greenpeace or the Animal rights people should be given no voice or a lesser voice is something that the media, quite rightly, feels hesitant about. There

is a commitment to balance. But if 99% of us say one thing and 1% say the opposite, the media tendency will be to try to balance the 99% against the 1%. There are conflicting voices in areas of science and we have to recognise that in those debates on issues in the public domain ours will be only one such voice. My problem with the BBC (and it is slightly different from the rest of the media in this respect) is that it tends to assume there is one thing called 'science'. It does not recognise that what cosmologists and molecular biologists do, are really very different. So, in the cases that Hugh Pennington was talking about, you will find it claimed that a 'scientist' has advised the Ministry of Agriculture, without letting us know whether the scientist is an agronomist; ecologist; geneticist or a pathologist or whatever else he/she might be. Somehow it all gets homogenized. There is more than one science and this is something that the media has to learn. Hugh Pennington also raised this issue of not speaking out of our terrain just because we are scientists. This is a tendency, which affects all of us, as we get older. If you are fortunate/unfortunate enough to get a Nobel Prize you believe you are entitled to speak about absolutely anything from global warming to microbiology. Even so, there is great danger in being a media scientist because you are actually expected to pontificate outside your area. If you do and then you get shot down, it's your own fault. We also have to beware that tendency, of the media to only go to the scientists that they already know about, who are public figures. At a rough count, there are probably at anyone time about ten media scientists who will be used again and again on the chat shows and that journalists phone up. 8.5 are male and 1.5 female. One needs to spread the load. I think it important for all heads of departments and professors to encourage journalists or media persons is interested in something that is going on to talk to more junior colleagues in your group who perhaps know a little bit more than you do yourself about it. This brings them on and may help them become a voice on the television and the media as well.

One peculiarly British problem is the distinction between 'natural science' on the one hand and what, in continental Europe, is the much broader understanding of science. There are lots of sciences. There's social science, economics and psychology and so on. These other areas of science tend to be dismissed because, as mentioned earlier, 'natural science' is put in a box. The British tendency arises from C. P. Snow's claims. Snow made a great distinction between the 'two cultures' saying that, 'Scientists are the men with future in their bones'. As Snow put it, all of us will be able to tell you the plot of Hamlet but how many arts men know and can quote the second law of thermodynamics? This was the great gulf he saw between the two cultures. Of all the great problems we have at the moment and it would be interesting to try it here, how many people in this room of biologists know the second law of thermodynamics? I actually tried this on my colleagues in the department at one point and, I have to confess, only about a third of us could quote the second law. All that says is that science has become 'professionalised' and fragmented in a particular sort of way. We don't deal with two cultures. We have many cultures even within the sciences themselves.

One of the things of which I accuse the media is treating any scientific breakthrough with an automatic cultural cringe towards the USA. If they want to quote a scientific breakthrough from 'Nature' or 'Science', they tend to phone up a scientist at MIT or Harvard etc. This sort of response seems to me, quite harmful. It downplays the contribution of British scientists and it also downplays the fact that Britain is part of



Europe. It is just as easy to get a perfectly fluent German, Swedish or Swiss or a less fluent English, French or Italian to talk about what they've been doing than to go to the United States. That cultural cringe seems a serious problem, particularly in television programmes e.g. 'Horizon'. Television crews just love getting on a plane, jetting over and making an elaborate set of arrangement where they can flit from one lab to another in the States. Persuading them that there Europeans they can talk to as well is an uphill task but I think it is something worth trying.

In the last few minutes, I want to consider the way in which the television and the news media treat news stories. There is a very real problem, which concerns the lack of scientific literacy that you get amongst many journalists. Take a typical 'Today' programme. It has an obligation to have at least some slot on science on as many days as possible. So they find something in the newspapers or the press releases that have come and they get James Naughtie or John Humphries to interview the scientist concerned. What you get is a fairly inexperienced and illiterate interview. They really don't know what's going on at all. Yet the same journalists would not address music or arts questions with the same degree of illiteracy. That's a great shame because science needs to be handled in a different sort of way. A related issue is the failure to recognise that, in many areas, the issues are controversial within science itself. If someone is brought on as a 'scientist', they are expected to debate or dispute with an opponent who isn't a scientist (e.g. someone from the ALF, Greenpeace or Friends of the Earth). Yet many of the issues we are confronting at the moment (especially in Neuroscience and human genetics and cloning and so on) are controversial within science itself. It's become very important that we as scientists recognise that we rarely speak with a single voice. There are conflicts and differences of interpretation. Science overwhelmingly deals with doubt, risk, uncertainty and debate. It's still quite difficult to get this point over and to get the issues and debates within science (as well as between both 'scientist and those outside') out in the open and discussed. That's an issue that broadcast media will have to come to grips with and we may need to help them come to grips with.

The final point I want to leave you with is that we must recognise (and the broadcasting media need to recognize) is that science must be taken out of its cultural box. We have to find ways of integrating scientific issues and cultural issues. For example if we are talking about current issues in genetics and the genome program, it ought to be linked organically with the debate over gene patenting between Celera and the Wellcome MRC unit, the nature of British biotech shares and so on. These things do link up. They are all part of the complexity of the world in which we live at the moment and, in a sense, that's the way they should be reflected on within the media. There is a challenge for the journalists to get it better and to do it right, especially if one remembers how few scientifically qualified journalists there are at the moment (despite all the programs in science communication existing in a number of institutions). It's also a challenge for scientists (as people likely to be called upon by the media) to reflect on how we respond. The issues are complicated but as I say, 'It's a two way street'.

Q. You've got this media (especially at the BBC) that has to have balance when there are opposing views. You mentioned, of course, that scientists are rarely certain of what they are doing leading to varied views within the scientific community which is perfectly healthy. Don't you think, however, that one of the problems is that

commonly when science is up against people who object to what the science is doing, the fact that the opponents seem certain to speak with one voice whereas it seems that the scientists are either shifting or overly concerned about what they are saying, to some degree, puts science at a disadvantage?

A. In sense that is true but one mustn't ignore that fact that many people are critical of some of the things that we do. I'm thinking of the Animal rights people and so on particularly because they are the people with whom I have been engaged 'outside' science. They have arguments, which do need addressing. But they do seem certain and can sometimes seem extremely arrogant. Often their arguments are, I would say, flatly fallacious and need responding to like that. Yes, it is a problem that science has changed a bit. We are much less certain and positive as a scientific community than we were in the past. It used to be the case that our spokesperson (someone from the Royal Society?) would speak with enormous certainty saying this is the way it is and dismiss opponents as having no validity. Scientific communities have had a few bashes over the last years so we are less certain but I don't think that lack of certainty is a bad thing. A little bit of humility is OK. One's got to concede that the other side has arguments that we need to address. It is no good saying, 'We are the experts, trust us!' when Animal rights people raise issues about ethics around experimentation or of extrapolating from rats to humans. I would rather try to take their argument seriously than try to dismiss them. A little bit of modesty actually seems to play quite well.

Q. I wonder if I could take issue with a couple of your comments, especially about the 'Walking with Dinosaurs'. I personally enjoyed that and (certainly in the first episode) it made a point of saying that it was quite a fanciful view. The book that accompanied the series did go to great lengths to distinguish fact and fiction. I do wonder that, if one purpose is enthusing young minds and getting people interested in science, saying at every step 'We have to distinguish fact from fiction' would detract from the entertainment value and that would be counterproductive.

A. I haven't seen the book but I do know the first episode in particular had a little bit of a background in terms of how these conclusions were going to be drawn. The overwhelming tendency in the other episodes, however, was to show you these dinosaurs and to make statements with apparent certainty about their family practices and when they would migrate from the forest into a savannah type area and back again and so on. I wouldn't have minded if they had said 'We're speculating here' and so on. Yes, they had enormous entertainment value- the viewing figures were huge. You might well say that I am being ungenerous to the people who did the computer graphics. I suppose I am, in some sense, but it wasn't presented as entertainment. It was presented as fact. If they had said this is entertainment and matched it against 'Jurassic Park', then you would know a bit better where you were. I do get very worried about the ability of the visual media to morph seamlessly between fact and fiction. It's acute when they put Woody Allen in the middle of a Nuremberg rally for example and you can't really tell where the world is coming to. It just offends a little sense of propriety I have about doing that. So, maybe, I am unfair about it.

Q. I think that one of the things it did that 'Jurassic Park' didn't do was to give you the feeling that Tyrannosaurus rex was actually only around for the last couple of million

years of the period. It actually brought you through that doing it in quite an entertaining way. There was another extraordinary feature that reminded me of that nearly every other natural history programme you see on the television. That was the extraordinary concentration on birth, population and death.....

Q. What else is there?

A. ....It was the close up views of predators masticating on large chunks of meat. Although that is a particular feature, they do lie around and sleep for a lot of the time and play and do other things.

Q. Then we get students saying why aren't the animals doing more interesting things?

Q. There was an opportunity missed with that programme because clearly it did have massive viewing audience. I suspect that they probably wouldn't want to do the things that you are asking because that would detract from the impact. But they could have had follow up programmes, having captured that audience. They did have follow up programmes on the technology used and how they achieved the images. But they didn't have a follow up programme to deal with the kinds of things we've been talking about.

A. You 're absolutely right! They were more obsessed with their own technological skills than anything else. If IT people were meeting here, perhaps we would have a different view of them?

Q. I think it presents a classic opportunity to be re-edited as a DVD that would be inherently valuable. You could expand on the speculation or theory behind the series.

A. The copyright fee would be absolutely enormous. When I was doing the Museum of the Moving Image lecture I wanted a little clip of Boris Karloff doing the Frankenstein thing. I was told that a ten second clip would eat up the entire budget that the BBC was prepared to allocate for the programme. So you do have to be careful about these things.

Q. I was interested in the advice you gave about sharing around our media experiences to other staff. It's an important part of staff development to do that. What are our key national scientists doing in respect to that?

A. What key bunch of national scientists?

Q. The scientists that speak for us all on the media presently. There are a number of them including Colin Blakemore, and yourself who we often hear. Do we actually have a strategy whereby those key people also encourage media participation?

A. PhD studentships and post-docs do. We know that several other places also try to do that. There are skill courses in media presentation that are now offered by a number of groups, sponsored by COPUS, so there's funding for people to go on them. One I know is run by a combination of Bernard Dickson (who used to edit 'New

Scientist') and Peter Evans who does a lot of BBC radio. It's worth helping one's more junior colleagues to take part in those courses simply to learn the presentation and media skills. They involve the mock telephone calls of the type that Hugh Pennington was talking about in which you are expected in the middle of something else to give a 30 second sound bite response to something. They also show how to deal with an interview on television and radio.

Q. Do we all need to be prepared for press involvement?

A. You need to be prepared for press involvement. Several organisations have scientists as figures on their lists about people can be phoned about such and such. The BMA run such a list and I know it is used because people who have queries about memory etc often phone me. I know they pick me out from the list, I don't know if the Biochemical Society or any other biological societies have got such lists. It is helpful because it does spread things around. You do have to be prepared to be media friendly when they speak to you. On the other hand you've also got to be prepared to say, 'P\*\*s off! I'm busy and, anyhow, it will cost you money'.

Q. One of the things that worries me sometimes and hasn't really been mentioned in the last two days is the shifting culture of political correctness. You could very easily find yourself in the situation where you make a comment today that is acceptable but it will be totally unacceptable tomorrow. Things seem to be shifting so fast.

A. You have to live with the fact that things that you have said will appear and be used hereafter. Whether it's politically or scientifically correct or whatever! You do have to be a little sensitive and recognise that we live in a society in which not everyone is a male and that there are many different cultures around. If one can be deliberately offensive to someone when conscious of what one is saying, I think it should be possible to be deliberately inoffensive.

Q. I had a colleague (Nancy Rothwell) who gave the Royal Society lectures a couple of years ago and the media could well have captured her. She had to balance her time in all sorts other areas. If she became a media personality how could she fulfill her scientific ambitions? This is a real problem about expanding the number of people the media can generally call on.

A. You make a deliberate decision to abandon the laboratory and become a professional person speaking about science. Richard Dawkins is a very good example of someone who has done just that. He no longer is a zoologist but he has a Chair in the Public Understanding of Science, it happens not to be my public understanding of science but it's perfectly different and legitimate position. If you want to try and balance that with being a 'normal scientist' (writing papers and so on), then it's a trade-off that you have to do. On the other hand, if you get yourself into biotech, then you have to puff yourself. Increasingly, you have to have some public profile in order to increase your chance of getting grants even from the MRC.

Q. It doesn't have to be time-consuming if you get involved in the news side of things. You may have to put yourself out in the evening and go to a studio and do something but it's not going to dominate your day except when there's a story running (and that's not going to happen all the time). Becoming 'the expert' takes

time, which then makes you attractive to the media. You're seen as a person that perhaps the public trusts. You get yourself into that role in that way but it doesn't have to dominate your life. I agree with what you say. You do have to worry that your colleagues may regard you being, somehow, not proper or kosher. They may see you as someone who is suspect because you appear on the television from time to time.

Q. I notice that yourself and Hugh have very different approaches to being in the media. In one case as controlled as you can make it, in the other almost freewheeling with little direction. One of the dangers is that if you do something that is pre-recorded then it can be edited. You don't have that disadvantage if you go out live but, of course, there is more chance of having an accident in that circumstance. How do people feel about the relative merits of those two types of interaction?

Q. Could I just comment on your remarks about Hugh and myself? I represent an organisation- there are 320 people and a small industry dependent on me not putting my foot in Hugh is representing himself. I don't think he's representing a university. It makes a lot of difference to how you perform and how you respond.

Q. I have to give the university by-line but I know the university is quite happy to have someone who is active in the media. I don't think they care two hoots about what you say. In a way, the more inflammatory and stupid you are, the better. They are keen to get the time and the exposure and the institution's name on the foot of the picture.

Q. I had an MP tell me that, under the last Tory government, Norman Tebbit refused to pre-record anything because it could be used at anytime.

A. Live is good because you know what you are saying and, if you make a fool of yourself, then it's your responsibility. It will be grossly over-simplified by the time it gets into the tabloids. I don't think you can control what reporters are going to say. If they want to use the word 'admit' rather than 'say' then tough. One just has to live with that. The worst in terms of potential misrepresentation is television. There isn't so much that the editor can do with pre-recorded radio. In pre-recording in television, you don't even know how something is being filmed because you are not looking down the eyepiece of the video when it's recording. A little bit of manipulation can make you look foolish, evil or saintly, irrespective of what it is you're saying. That's a trick over which one never has any control.

Q. You can even be reported accurately and your bit can be fully transmitted but the context can be damaging. A friend of mine was asked to comment on a Salmonella outbreak and give an overview. He said it was a pretty mild condition and that most people get better. When he got home, his daughter said, 'You didn't see the rest of the programme did you? There were coffins being brought out of the hospital'. This was the government expert being demolished again by his own words. There's nothing you can do about that.

Q. Kirstie Wark runs a magazine programme in Scotland. Her researcher arranged for her to come to my house and we went through my kitchen in an attempt to talk about safe cooking and food. It was a five-minute piece. She said, 'I'll just have look

in your fridge'. It turned out that she had come with that intention (but she didn't tell me about it). She was looking for the 'sell by' dates on all the food in the fridge. The only thing she found that was out of date was some plums. That was featured in the programme but not in any big way. It was, however, put out as a press release to the tabloids with photographs taken from the programme the day before transmission. I took it in good spirit because it wasn't a serious mistake. They had put it out to boost their viewing figures as much as anything else. When I asked them about it, they denied that they had done any such thing. That's the down side of a pre-record, in that they can make a story out of the story. This also happened to me about this poor lad who suffered brain damage after an E. coli infection. I went on 'Country File', which was pre-recorded about a week before saying that kids, under five, may catch it on busy farms. This was the issue that was highlighted by the child. That was put out as a press release so that became a story before the programme was actually shown. 'Country File' is good at doing that! It's an agriculture programme and you would think there's not that much contentious stuff there for the general public but they made it very hot. So that's something else you have to remember. The people who are putting it out on television can whip up a story so it becomes part of the print media as well.

Q. I took part in a radio confrontation with an Animal rights person in a debate. It was a pre-recorded exercise. I was actually given a cheque for doing this and I actually ran my opponent home at the end of the exercise and delivered her safely to the accommodation. I was then told that it wasn't going out because it didn't make very good radio because I had completely demolished her in argument. I often wonder that if she had demolished me, would it still have been bad radio?

Q. Can I make a comment partly directed towards Steven about his three different types of portrayal of scientists? The mad scientist, the absent-minded scientist and the noble scientist who saves the world. I wondered whether there might be another one? This is one the public seems to latch onto namely 'the anti-establishment scientist'. I wondered if this is because biology has become less favoured by the public because it's become much more associated with the establishment.

A. I think there is an element of truth in that. It stems from biology being connected with big business. Certainly, molecular biology and biotechnology come into that sort of category. The problem, therefore, of who you trust becomes very important indeed. I actually think that one ought to declare an interest. There is a very clear case for your anti-establishment scientist. Let's go back to the Pushtai case, which is an extremely interesting one both with the treatment of Pushtai as an anti-establishment scientist who stepped out of line and the trashing of his results. I haven't actually seen the data and I'm perfectly happy to believe (despite what the 'Lancet' says) that, by reputable scientific standards, it's invalid. But a letter signed by I don't know how many FRS's trashing the results was over-kill. None of those signatories declared an interest.