

Science policy in practice

**Transcript of a panel discussion held before an invited audience
at the Science Museum on 28 January 2013**

**Organised jointly by the Mile End Group of Queen Mary University of London,
the Royal Society and the Science Museum**

Chair: Lord Peter Hennessy (QMUL)

Host : Dr Ian Blatchford (SM)

Panellists: Lord David Sainsbury of Turville (Science Minister, 1998 – 2006)

Lord William Waldegrave of North Hill (Science Minister [Chancellor of the Duchy of Lancaster]
1992 – 94]

David Willetts (Science Minister, 2010 –)

Blatchford

Good evening ladies and gentlemen I'm Ian Blatchford, Director of the Science Museum. I'm delighted to welcome you all here this evening, for several reasons. First of all that it's a coming together of three great power houses, the Science Museum, the Royal Society, and Queen Mary University of London Mile End Group – a great combination – we should do more and more of this. The other reason increasingly is that I hope you will have spotted that in recent years the Science Museum is getting serious again about academic research. We're actually increasing the number of opportunities, we're having more PhD students and more Research Fellows, so that might be bucking the trend but it's something I very firmly believe in. And the other reason why I'm pleased is that it is an opportunity to interrogate David Willetts about something. You might recall the major speech that the Chancellor of the Exchequer gave on 9 November outlining the government's commitment to research and also outlining research priorities. Well I was in the audience that day and I was very struck by the fact that almost everything that he mentioned matched the Science Museum's 10 year priority list which had been published one month before. Now, it might be of course a pure coincidence, but my own theory, and maybe we could clear this up tonight, is that, as we sent our document to the Prime Minister and the Chancellor and the Science Minister, the only logical explanation is that they sat over a coffee and thought 'my goodness me, we should follow The Science Museum's lead', and I'm hoping to have confirmation of that this evening.

But anyway, we'll have a fantastic night tonight and it's now my great pleasure to introduce Peter Hennessy and thank you very much for being here.

Hennessy

Thank you Ian very much for that welcome and for hosting us. I think it's a benignly and wonderful fissile combination – the Science Museum, the Royal Society and the Mile End Group – let's hope there's many more of these events. It's a great theme, Government and science. It's a slightly vexing one for we historians because it's a very patchy story. I think myself as a historian of the postwar years, that we've been agonising over it ever since Hitler ceased concentrating our minds in 1945, because there was a fascinating document, that very few people read now, called the Barlow Report in 1946 on the Scientific Civil Service, which was determined to make use of the model that totalitarianism had forced us to provide, for the purposes of

beating the Axis, and we've been trying to sort it out ever since. Allied to that is the problem which David Willets was so eloquent about the other day, about the 'valley of death' between having a wonderful R&D capacity and actually making it pay, in terms of output and production. Throughout my conscious lifetime, in varying forms, there has been this problem which we're here to talk about this evening. I also think there's a dell of death as well as a valley of death, I may be wrong about this, when Science Ministers have to present to largely innumerate Cabinet colleagues, very, very complicated presentations that involve very expensive procurements. I always remember, I forget where it was, I think it was the story Solly Zuckerman used to tell of when the TSR2 was cancelled in 1965, that somebody in the Wilson Cabinet said, well what are we worried about, breaking up the teams at Farnborough, why don't they work on something for which there's a market like this new birth pill. Ever since then I've had my doubts, although I'm a firm believer in Cabinet Government, about are these just the ideal instrument for scientific procurements.

It's a very special and elusive relationship, Government and science. It seems to me, to quote a phrase that William, and William's great friend Victor Rothschild, liked to quote from Aldous Huxley, it's a question of 'routine punctuated by orgies'. Getting the routine right, the sloggy bit, is the really hard bit and the orgies we were all terribly excited about, and it's the orgies that get people on the planes to Scandinavia to get the Nobel prizes, but the sloggy bits are always a problem. These three colleagues this evening, in their own way, have made great efforts to tackle that, but the one cheerful bit throughout the story is that the Science Ministers I've known, over the years, beginning with Quintin Hailsham, all of them without exception have relished their time as Science Minister. To use a 1950s phrase, it's a sort of 'salad days' appointment, which is encouraging and it's certainly true of all three who are here this evening. William Waldegrave is going first, David Sainsbury and then David Willets; I'm going to be a ruthless Chairman and keep you all to 10 minutes each and then we'll have a wide-ranging and jolly discussion. But you're all very welcome and my three colleagues are very especially welcome. William, tell us all.

Waldegrave

I wish I could! It was very nice, as an ex Chair of this place, to be back in the Science Museum again and I take full credit for Ian Blatchford's point about commitment to academic research, because appointing him was the last thing I did before leaving the Chair, and it's been an extremely successful appointment. It's particularly pleasing to hear that some of the taking to pieces of the scholarly side of the Science Museum, which I'm afraid had gone on in the previous period, is now being reversed. That's not to say that, in my time, there weren't some extremely good books written, including one by Robert Bud, who has co-organised this conference, on Penicillin, and I was going to refer later to Andrew Nahum's extremely good book on Frank Whittle. Nahum points out one of the dangers in science policy of the interaction between scientists and engineers and politicians. He talks about Whittle, who was a genius at getting the politicians down to see his machine and they would come down and see this spectacular machine with a great blue flame coming out of the end of it. And the civil servants, the wicked old civil servants, knew perfectly well that this machine was going to be just about ready for action in about 1951, well I'm exaggerating a bit but they jolly well knew it wasn't going to be ready in 1942, and 1943, and they knew equally well that what they needed to do was to make the existing technology work better. Arguably it was putting the Rolls Royce engine into the long-range Mustang fighter which was decisive in the end, and Whittle had actually got the thing wrong about the number of spindles in the machine, and so on and so forth. So beware of the scientist who is terrifically close to the politicians and shows them lovely gadgets.

When I was working for Arnold Weinstock in the old General Electric Company, the people who were wisest and who did best in Arnold's ruthless annual budget analyses were the people who came along with a gadget, which did something frightfully clever and Arnold would then poke around and take it to pieces and show that it didn't work properly and they got through the whole thing without being cross-examined about

their numbers. So beware slightly, and I make a serious point here, of the populist: you can get a huge distortion. Don't always think that the best thing to do is to put the scientist and the politicians too close together. It's a little bit like intelligence, another thing where putting the politicians close to the raw data nearly always ends up in catastrophe. It's far better to have some wicked bureaucrats interpreting and saying, these things are not always quite like that Minister

I wanted to start by saying, before we come to issues of expenditure and so on, that I wanted to disagree with one of the very useful set of stimulating notes that you produced, Robert [Bud], to make us think straight. I was a Minister from 1981 until 1997, and I don't remember in that time big issues of science policy, that is things that had to be done with a science content, often being the problem. Let's run through some of the really biggest ones.

AIDS, for example. Now the national response to the impact of AIDS, HIV AIDS, was actually rather fine. We were quick, perhaps the quickest of the big countries to get in place the proper public education. And the research, you can't switch the research base quickly, you jolly well can't, but there was very good epidemiology done and we had very good epidemiologists in this country and still do, and there was very good work done, and in the end, actually, I think Britain can be fairly proud of its response to that unprecedented attack. It wasn't what you read in the letters to the newspapers at the time, and it did seem slightly eccentric to have a committee chaired by Lord Whitelaw in charge of the whole matter, but it worked pretty well as a matter of fact.

Going on to the next one, the CJD debacle: I'm not even quite sure that the CJD thing was a debacle. Now I don't want to get into all the detailed arguments, but the SEAC committee probably went on saying that it was going to be like the sheep disease, scrapie, for too long, but, again, very good epidemiology was done and then the risk factors were found and then the blocks were put in place and it is a beautiful bell curve. There are still mysterious things about that – I still don't understand why Britain had it so much worse than other countries, and so on – but there was a strong response from the science community, leading and pushing and shoving and answering to Ministers and dealing above all with the thing which is most difficult for politicians, which is the intelligent outliers, the passionate, intelligent, dissident outliers. Oh I remember the hours I had to listen to that man who said it was all to do with organo-phosphates, and other people who said that it was all nonsense, or indeed when I was sitting on my lawn trying to keep out of trouble in Somerset, to the old farmer who came round the corner of the house uninvited and said yeah I got the solution to that BSE. So I said well what's that Mr Hopkins, and he said, well you pay compensation you see for the cattle that get it, now you don't pay no compensation, you don't get no BSE do ye, which was a radical approach! That was relatively easy to resist, but it's quite easy now to remember how, rather like the disaster of the South African response to AIDS, we had dissident scientists here and so I don't quite see that as a debacle. There probably are others one can think of, but where there were issues with scientists saying this is the right response to a science-based issue, I don't think the British system works too badly, partly because politicians are quite keen to hide behind experts actually, and if you can say, well our scientific experts say this, you're in a much stronger position than if you're saying, well I personally think this is the answer. Of course you then have to stand by it. So I think that the interface between politicians and science-based policy isn't as bad as it's often said to be. Now that doesn't mean that it's always perfect, I can give you a wonderful example of some catastrophes which will lead me onto my next subject.

My favourite catastrophe is by one of my predecessors, Quintin Hailsham, who loved his job as Science Minister. There was no Cabinet level representation for science between him in 1963 and me. He intervened in all sorts of things. Incidentally, this is an anecdote but after Chernobyl, I found myself attending a subcommittee of the Cabinet, leading for the Department of the Environment, and I'd been properly briefed

with all the information. Whitelaw was supposed to be in the chair, and Whitelaw was late, Quintin therefore took the chair. I know all about this, he said, because I negotiated the Test Ban Treaty (which he had), and so gave us all a great lecture about radioactive deposits and that didn't take us very much further forward! One of his disasters – and a little bit like my Frank Whittle story – in the period when we had a huge, brilliant, national engineering and science effort on civil nuclear power, we took a series of catastrophic decisions about reactor choice, the most ridiculous of which was to go for something called the SGHWR over the pressurised water technology, which was a disastrous mistake. Quintin Hailsham made a speech in the House of Lords saying that anybody who went for this foreign technology – because it had been largely developed by the Canadians, not very foreign! – it was near to treason, he said. When people start to talk about science and technology decisions in the language of populist politics you are lost.

So the real problem is something deeper. Now David warned me not to talk about deep culture, because then we're all lost, but here we are talking about the same subjects that we were talking about 30, 40 years ago, the exact same list, and still only one British company in the top 20 of research. GSK is the only one still and looking at the NSF figures last night, there can be no other serious science country where that would be true, that in the last 30 years we've had no big new thing. Something has gone wrong with the way we develop and stick to our companies here and that is where it goes wrong. I don't think you increase the business spend on R&D by increasing Government spend. I wish it worked like that because then it would be a causal thing, but both are dependent on having an industrial structure which demands, on the one hand from the democracy and on the other hand from companies, that they go on backing the science-based industries that we have. Somehow we've lost this.

Let me just give you a couple of little stories. It can work. If you look at the Dyson story, that comes out of a cluster of technologists around Bath. Jeremy Fry & Rotork, then Alex Moulton, then Dyson, they all worked for each other and out of that came three bloody good businesses and Rotork and Dyson still exist. We should have dozens of those and why don't we? What we have is Pilkington Glass for example, bought by Japan-based the NSG Group which was much smaller, and we sell it. We have Rover versus BMW. When BMW went bust in 1959, the Quandt family put every last penny they had into saving it, they refused to sell it to Volkswagen who wanted to buy it, and they saved the company, whereas Rover was sold out to somebody. Now there's something wrong with the holdings of companies in this country that the little new start-ups get sold off pretty early on and the founder takes his money, and the big ones, the Stock Exchange looks for growth all the time and when they get into trouble, they get sold. I don't have any solution, but I do know it's not just to do with Government spend. In the 1950s we had these huge great civil Government-backed programmes, in aircraft, in civil nuclear, in telecoms, we built the first unified high voltage grid in the world and so on, and yet, with perhaps the one exception of GEC, we never got any world-beating companies out of it. Even Rolls Royce had to be rescued, went bust and had to be rescued. So what is it in our industrial structure? I think it's something to do with the radicalness of our shareholding structure and the short-term nature of investment. I now don't believe the old story, that the assets will all allocate themselves into the right place in this free market. I remember when I was working on the defence team of NatWest in 2000, we were beaten in the end by RBS because they put more cash in because all the asset managers wanted the cash to put into the dot.com boom. All the cash that RBS put in was lost, it all went into the pension funds and was lost, and it just doesn't work, somehow others have got longer-term investment in the industries, therefore that feeds back into the demand for the technology for the industries and that feeds back into the wonderful science base which Government can maintain and does maintain quite well here, quite well.

Don't, and my last word, talk about the Treasury as the enemy of science, because the one thing the Treasury well understands, is that there's market failure in basic science. It was never a problem to get them to spend on good programmes in basic science. They didn't like pouring it into British Leyland or whatever it is, because

it usually was lost. I therefore think that the real problem with this country is the industrial structure, and I don't have a solution to it, but it's not just a matter of push from Government.

Sainsbury

We were given these exam questions and I thought the way I would look at them is the way that I found I always ended up looking at things when I was in Government, which was under three headings. The three headings were: the funding of science; knowledge transfer; and the public engagement with science. These were the three areas one had to consider.

If you take the first one, the funding of science: we were given a rather brutal question: how do you get money out of the Treasury? That seems to be a very good question because that's the main job that Science Ministers actually have to do, and it seemed to me the answer to that was really very simple. It's the same as getting money out of anyone: you have to relate it to their agenda. It was no good going to the Treasury and saying this is a great feature of British culture, because there were hundreds of people making that pitch; you had to say that this was related to the economic growth of the country. Now that is always an argument I was very happy to make because I believed it very strongly and as a whole my sense was that the Treasury responded to that agenda.

I was confirmed in this view when I went to Finland to find out what their science policies were like, because they seemed to be very successful. You probably don't remember, but in fact in the early 1990s, Finland was in a terrible state. That was because the Russian markets which were very important to them were totally collapsing, they'd liberalised their banking system and there had been a terrible bust up there, as happens with almost all capital liberalisation of banks. Unemployment in Finland was 20%, and at that point they put more money into the science budget. I met the guy who was then Technical Director of Nokia but who had been Secretary to the group who had managed to persuade the Finnish Government to put this extra money into science, which in the end turned out to be hugely successful in the period of growth that followed this. Always wanting to learn how you get money out of Governments, I asked him how he did it, and he said, we didn't go along to Government and say we need money for science, because that would put us in the same category as every other interest group. We went along to Government and we said, you have a problem and we can help you solve it. And that was the argument that clinched it and I've always proceeded on that basis since.

The problem with that argument, in my experience, is that if you persuade politicians to put more money into science funding, the next step they almost always take is to say, well what we should do is take the money from basic research and put it into applied research, because that's obviously what leads to economic growth. You then have to show them that, in fact, that is not the way it works. If you look at all the radical innovations, they come out of basic world class research. That may seem rather strange but I had some work done, to look at whether this was actually true in practice, and we looked at the amount of venture capital that goes into spin off companies or into companies which select to be near a world class research university. You will find that there's almost exact correlation between the amount of money that goes into venture capital for spin offs from a university and the scores which it used to get under the RAE, and there's a very strong correlation from that. You can see those figures in the report I produced on the *Race to the Top*. In fact that should not come as a surprise to anyone, because if you look at American universities and you ask which are the American universities that have had most impact on their local economies, everyone would probably give you the same list – MIT, Stanford, Berkeley, Austen, Duke University. Now all those are in fact world class research universities, they're not universities which do applied research, but the Treasury always thinks, MIT is an applied research university, but of course it's a world class research university. So that is I think how you have to tackle the funding of science.

The second question is knowledge transfer. We were given a sort of quote on this, which William has actually picked up on, which is that Britain is famously good at getting Nobel prizes but failing to reap industrial benefits from science. The first point is, that it is not at all clear that that is true any longer. It certainly was true in the past, but if you look at our universities again, and you look at the amount of knowledge transfer from our universities, and you compare that with the top American universities, in fact you have a very similar pattern these days. Each year now we have about 250 spin off companies from our top universities and, as a whole, they do pretty well. We haven't got many of the Apples and the other companies in that category, but they're pretty good, Cambridge alone has 12 companies which have got to a billion and two have got to be £10 billion companies, so we've got to be very careful about just perpetuating this myth. How do you change this? I suppose the first thing is, you culturally stop talking about this being a God-given truth and you put in place the mechanisms and the institutions which improve our knowledge transfer. That's what we did with putting in place the Higher Education Innovation Fund, the Technology Strategy Board and its competitions bringing together industry and Government finance, the knowledge transfer partnership linking universities with small businesses, and indeed the present Government has put in place the Catapult Centres, which is another way of getting this commercialisation. So I don't think this is necessarily a cultural issue at all, it's an issue about whether you have the right incentives and you have the right mechanism for commercialising science.

I agree with William that actually if you look at the scientific input into policy making, on all the major issues, by and large it's pretty good and I think it has been taken forward very well. I still think there is an issue, on some of the very basic stuff, about making certain that the policy making by Government is better informed. Really there are two issues there. One is actually just improving policy making. It's one of the great myths I believe of British public life that we are fantastically good in the Civil Service and Ministers at policy making, the problem is a lack of good skills of implementation. The second is undoubtedly true, the first I'm not so certain about, it's incredibly amateur in my experience, you do not have a situation where there are well established links between policy makers in Government and areas in universities where they're doing relevant research. So I think there is a problem there, and there's also a problem of getting scientists to really understand what the issues are which are important to the policy makers so that they feed in the information at the right time.

While I was in Government, we had two White Papers on energy policy. I remember in the second one, seeing the guy who was running it and asking how he was getting on and he said we're having terrible trouble getting the cost figures of different sources of energy, what they are today, let alone what they will be in the future. What was extraordinary about that to me was, you would have thought that with any well informed policy making process on energy you would always have those figures, and it was exactly the case where you should go to a university which was interested in this area and say we will give you a contract to supply us constantly with good up to date information on what's happening on energy costs of nuclear against wind turbines and so on. That just didn't exist, and not only did it not exist, but no one saw that that kind of continuous policy making and information was necessary. So I think there is an issue there about improving that policy making.

The third issue is the public engagement with science. When I became Minister, we had something that was a great cause which was called public understanding of science and I think we have a member of the audience who was actually very involved in this [Walter Bodmer], so I'd better be careful what I say! But I think it was based on a misconception. The misconception was, that if the general public understood science, then they would be actually welcoming of it, and in my experience, that was simply not the case. The issue for most people faced with a new technology is that they make a judgement about the risks versus the rewards. The

problem of GM, to take an example which blighted that whole section of my life, was that people couldn't really see any great advantage of this, so telling them that they would get tomato paste which is 5p cheaper was not a compelling argument if there was any risk involved. Now that isn't a totally fantasy argument – ask yourself about mobile phones – there is, if you look at the risks, no more risk on GM than on mobile phones, both cases are pretty well negligible. There was never any fuss about mobile phones. Why? Because people love their mobile phones, and if you mention risks to them they say well, it's not an issue, it's not an issue. The interesting question was of course masts to do with mobile phones, and there you found there was a big issue in people's minds. Why was that? The issue was nothing to do with the technology, it was 'I get the masts and the dangers, and someone else gets the benefits', and people didn't like that. So I think we need to talk about the public engagement in science and how you get people to see the risks and rewards that are there, but if they aren't there, then don't worry about it because you won't persuade people.

I remember Bob May saying to me, David you know, if you can produce a white powder made by GM and you can tell people that if they take a spoonful of this before breakfast, they will be witty and slim for the whole day, this whole problem of GM would go away. So what I'd say in summary about being Science Minister is, don't accept the event. These are very interesting and very difficult issues, but don't go along with necessarily the conventional wisdom of these things because this is one of the policy areas, like many others, where well informed policy analysis has a huge pay off. Thank you very much.

Willetts

Well of course what they got, David, was a white powder in which they think they're clever and slim, which solves the problem in a different way!

For me it is a great privilege to be on this panel with two Science Ministers whom I regard as being the kind of canonical Science Ministers. There are some who don't leave much behind, but both William and David have left a lot of substantial work behind them. In fact I've got two documents that they produced that I've brought with me because they're both absolutely about the same problems as I wrestle with day to day. William's *Realising our potential*, produced almost exactly 20 years ago and really setting up the structure of Research Councils which still functions today, very much on the lines that William set out then. And David's *Race to the top*, which came out after the creation of the Technology Strategy Board but in many ways had at its heart an enhanced role for the Technology Strategy Board. The institutional architecture that I work with on a day to day basis with the Research Councils and the TSB is therefore one which my two predecessors here on this panel very much shaped. In terms of how then we work within that architecture today, I would say that the challenge – and this is partly in answer to William's question, what is the problem in Britain, what is the difficulty we have in successfully commercialising things – is that when you look at what the Research Councils do, the Research Council funding stops further upstream than the funding available in the US for example, from Federal Agencies in the US. If you look at what the National Institutes for Health will do, if you look at what the National Science Foundation does, this was of course most famously DARPA, or the other week when I was at the San Francisco Californian Centre for Regenerative Medicine, they weren't just funding upstream research in labs in regenerative medicine, they were willing to fund prototype plants, investigation of manufacturing processes, demonstrator facilities. So we beat up on ourselves thinking somehow we are more reluctant to take risks than they are in the US, what they've actually got in the US is a far more successful risk reduction strategy delivered by Government, so that when you do come in, you are taking less risk, you are more likely to have a contract for the purchase of your goods and services from DARPA, you're more likely to have had the manufacturing techniques for the implementation of your technological idea funded by some Federal or State agency. And because William rightly talked about the importance of clusters, you are more likely to be functioning within a cluster which economically I think should be thought of as a low risk environment for high risk activities.

So my view is, what we can learn from the US is being smarter at not expecting the commercial sector to take on heroic levels of risk, and not beating up on ourselves when they don't, but instead saying it's a legitimate role of Government in these circumstances to take some risk and reduce risk. And that leads on to the TSB because the TSB was a distinctive British solution to this problem. So you have these Research Councils that don't go close enough to market, and what David does is add the TSB in there, and it's by and large a different institutional model than they have in the US, as I said. There are many arguments for the British structure of the TSB. We have some interesting exceptions. One of the features of the UK Space Agency that we've just created – in many ways the UK Space Agency is much more like a US type agency – is that it provides funds for upstream research and brings it closer to commercialisation, so you've carved out a sector where you have a different organisational structure. But one thing we have tried to do is then to strengthen the links between the Research Councils and the TSB. I thought the hinge between the Research Councils and the TSB was rather rusty, I don't think it was working as well as David had envisaged in *Race to the top*, so we've tried to create, for example, the Catalyst Fund. In this case the first example was £90 million of Medical Research Council money aligned with £90 million of TSB funding, so that you could have something much more like a coherent strand of funding for a medical idea and closer to what you would get from the NIH. I felt too often we were, say, like one of those Attenborough natural history films, we were pushing the fledglings out of the nest and far too many of them were ending up on the forest floor and being eaten by the foxes, so we have an obligation just to take them a bit further.

I think also, and this goes back to one of William's challenges, and one of the few things in his Report, re-reading it, which I disagree with and which I am wrestling with at the moment; I think especially for William and myself as Conservatives, what I worry about is that the institutional environment is quite thin. I think some of the public sector research establishments, which were privatised towards the end of my party's last period in office, some of them were repositories of experience and sometimes custodians of physical samples and data and understanding which has been weakened in the subsequent 15 or 20 years. When I look at the scientific reports on the performance of the National Physical Laboratory, the scientific community was worried that the NPL, very efficiently managed by SERCO, nevertheless was no longer delivering cutting edge science. That's why we are not renewing SERCO's contract, we are going to try a different model, a joint venture. When I look at the problems we've now got with the National Nuclear Laboratory, it's not a custodian of understanding of nuclear technology and physics, it currently does project work for which it receives a specific payment from Whitehall. There isn't a broad enough understanding that it's the nation's research lab that is the custodian of this data. The only safe haven for these research establishments has been to fall under the embrace of a university. I can't find anybody else who thinks this is anything we should be particularly worried about, but it is striking how when these rather vulnerable free-standing research establishments are trying to find a place to end up, they end up under a university. So we have a very peculiar institutional structure in Britain where the Roslin Institute ends up under Edinburgh, the Institute of Fiscal Studies ends up linked to UCL. And is there any point where we say there are any arrangements for these institutions other than falling under the ambit of a university? That's a problem we wrestle with at the moment.

In terms of other topics which have not so far been touched on, I think the open access movement and access to data, and also for me again, as a Conservative, understanding the value of historic data, where you have the large, long historic data sets which are an incredibly precious resource – these are all really important. If I can refer, Ian [Blatchford], to the Natural History Museum next door, when they were repairing the Hubble Telescope and they brought one of the solar panels from Hubble back to earth, and they wanted to analyse all these tiny indentations they'd got in the panel from specs of dust and small meteorites, they brought it to the Natural History Museum because the Natural History Museum has got the world's largest collection of

meteorites, assembled over centuries by Victorian explorers and others, and if you're trying to work out what you've got and what the Hubble Telescope has been encountering, that kind of historic data matters. So access to both historic data sets and current publicly funded research I think is a hot topic.

We haven't yet talked about the international angle. Something that is increasingly striking, and it's one of the issues that gets the Prime Minister's attention, is if you are sitting in Russia or China or Brazil and thinking about what is special about Britain – what you wish to engage with in Britain, why should your rapidly growing self-confident country care about Britain – one of the things that comes very high up your list is the quality of our universities and our science and research. You find, therefore, that when there is a bilateral, a long phone call or a trade mission, science and research cooperation is very high on the agenda nowadays, and the Foreign Office completely understand this. Of course then we encounter a problem which is touched on briefly I think in William's Paper, there's a chapter on international issues, you then have the problem that they have an expectation of our ability to steer research that is completely in conflict with the Haldane Principle which will of course be etched on the heart of every Science Minister here in this room. The Haldane Principle matters a lot, but when you have the Chinese Industry or Science Minister saying to you, we really want to cooperate with you, we're worried about ocean acidification, how about a joint programme of research on ocean acidification, you put in £25 million and we put in £25 million, you then have slightly awkwardly to explain how that isn't quite how science funding works in the UK. The gap between the international appetite for cooperation and any kind of acceptable arrangements in which we make that happen with any of steer I think is another dilemma that I wrestle with on an almost daily basis.

Hennessy

Could you explain briefly what the Haldane Principle is?

Willetts

The Haldane Principle is that Ministers do not engage in decisions about the individual allocation of funds to particular science projects or research projects. I think it is an excellent Principle and the level of ministerial disengagement, the fact that the Ministers don't control it, is one of the reasons our science is so good and our universities are so successful. I should add that with almost every difficult decision, there is a set of letters that then come in from the scientists or the universities arguing that of course in general the Haldane Principle applies but nevertheless in this case the Minister should intervene to prevent the closure of this institution, the closure of this programme, what they're proposing to do with my university department is so shocking, that this Principle needs to be set aside in these unique circumstances. Those letters come in regularly as well.

Just finally, and I would be interested to know from David and William whether they think this is an improvement or not, but one of the things that was striking from William's document is, there was a structure of coordination between different Whitehall bodies that had an interest chaired by William as, I think, Chancellor of the Duchy of Lancaster at the time. What we've ended up with, probably ultimately through the imperialist instincts of Peter Mandelson, is that most of the different functions that were attributed to different departments then, now come within BIS. We have responsibility for science, we have responsibility for universities, we have responsibility for the TSB and camping there though although not directly under the responsibilities of BIS Ministers is the office of the Chief Scientist John Beddington. That does mean that instead of Cabinet committee structures, every six weeks or so I convene a group of the Chief Executives of the Research Councils, the head of HEFCE, the Chief Executive of the TSB, the heads of the other major science agencies like the UK Space Agency, the Atomic Energy Authority and I don't give them instructions, but we just talk about what is going on and what we're up to and I find personally that the ability within one Ministerial portfolio to bring all that together in a coherent, single set of responsibilities is an enormous advantage. But it does mean that a lot of the science policy discussions happen within a department rather than across different departments in Whitehall with a coordinating role from the Cabinet Office.

So there are some rather random observations, and I look forward to your questions in due course, thank you.

Hennessy

Thank you David, thank you to all three of you. Now who's going to start us?

Sir Walter Bodmer

One of the points I would make at the start which is a bit related to what you were saying: I think it's extremely important not to contaminate scientific advice with policy. Whenever that happens, you get a real mistake, so it's extremely important to have advice that is objective as far as it can be from the science point of view. There are many mistakes one could quote, the most extreme might be Lysenko in the Soviet Union. You referred to an interesting committee that was very similar to something I once sat on called the Advisory Board for the Research Councils which was actually non-Government and I think had some value.

The other thing I think is very important, and William you emphasized it: don't listen to only one scientist in particular, listen to several different ones who have different views. I think that one of the mistakes that can happen is if you get one or a small number of people who are too influential who don't necessarily represent the spectrum of things that you go on.

In relation to the interface with industry, I think it's changed hugely in the 30 or more years I've been involved with Oxford University. I remember George Porter saying well you've got a bridge between academia at its extreme and industry, and when you cross that you expect to find someone on the other side, and that doesn't always happen. I don't think there's any inhibition whatever in academic institutions about trying to get something of value out of what they're doing. Having worked for many years in cancer research, the most basic of our scientists would always be delighted if something could actually be applied. I don't think that's where the problem lies. I thought the analysis of the problem, of the nature of funding, is interesting because certainly in the experience of the contacts I have, including my son, if you try and get venture capital for start up companies in this country, it's much more difficult and they all go to the States because they're much less risk adverse there and there's more money available for that.

Finally a brief comment on public understanding of science and David, with due respect, I have to say I think you have completely misunderstood what we were trying to say. I'll send you a paper that Peter Collins, who has been involved in this, asked me to write on the 25th anniversary of our Report. The point was that of course you want engagement, but you can't have engagement between different groups unless they have a common platform of understanding and the understanding of the science has to come from the scientists who are the experts. So whatever you want to do about engagement, whatever you want to do about that communication, you must have scientists able to speak to those who are not experts in ways that they can understand and that was not happening at the time I was asked to be Chairman of the Royal Society Report. I think that's quite fundamental. If you read what was said, there was no intention of the thought that just because you tell people that this is good science that they're going to believe what you say or like it.

Hennessy

Thank you Walter. Quick comment on that, who'd like to go, David perhaps on public understanding?

Sainsbury

Well could I just comment on what David Willetts said because I think this is enormously important, and it's something that I have only realised recently, which is this issue of the 'valley of death'. Endlessly people quite rightly are saying, it's very difficult for new start up companies to get over this period into profitability. What David said is absolutely right, as I've recently found out, which is that in America where we say they're much more into risk, they will take greater risk, their funding system means that that gap is very much smaller. One of the things which you should be trying to do with our universities today is to stop them putting companies

out into the commercial world too early and use research funding to keep them within a university much longer, so that when the venture capital people are approached, then this thing is much, much closer to financial viability. I think that's a fundamental point. It's also true that if you look at American funding, of course this idea that it's all based on a completely market system is complete nonsense, there are huge funds coming out of Government departments to fund innovation and commercialisation of science. You only have to look at what the Department of Energy does to see how important this is, and the small business research initiative companies and so on, it's a huge operation. We should never be totally beguiled by the American story, which is, this is all the free market. Someone told me recently that, as you know, Jefferson was tremendously in favour of small Government and the State did nothing and of course Hamilton, who was I think the first Secretary of the Treasury, was actually very into industrial policy and Government supporting industry. Someone explained to me that the way the Americans had solved this problem is that you do what Hamilton suggested but you use the language of Jefferson, and that in my experience is totally true.

Hennessy

Exactly. Quick thoughts on Walter's contribution?

Sainsbury

Walter was the person who was right in the middle of all this, and I'm sure he's right historically. I think it did become, though, a belief that if people understood the science, then they would accept it, but I take the point.

Bodmer

That was put on me by others later.

Sainsbury

Yes, I would accept that this is almost certainly the truth of it.

Hennessy

Comments?

Willetts

I think we're all, the three Science Ministers here, I think we're all lay people, none of us would claim to be a scientist and I think the science community is very tolerant of having a Science Minister who doesn't have a science degree. But, actually, the challenge of understanding science as a layman and then being able to communicate it as a layman, and for a scientist therefore, being able to explain what they're doing to a layman, is a very important challenge for scientists. The Science Media Centre, which has just celebrated its tenth anniversary – a great party, I think it was here wasn't it – has I think really transformed the landscape in getting scientists to think about how they explain what they're doing. I think in turn, not least because of the shocking science scandals – the MMR vaccine scandal, for example, in which there are probably children now disabled or worse because their parents didn't accept the MMR vaccine because of the scares – the BBC now recognise that science reporting is not the same as political reporting. If a scientist is saying something which is the view of the vast majority of scientists on the basis of rigorous analysis, you're not obliged to balance it with an eccentric view taken by a very small minority of scientists outside peer review journals. So the kind of balance, and I think the quality, therefore of science reporting has improved as a result and I think that's a welcome trend.

I think a separate point I'd make on this issue of who are the industrial partners: absolutely, one of our challenges is where there aren't primes. For me the dialogue on science and technology takes two forms. There's one form, the dialogue, when there is an industrial prime or a group of large players with whom you can communicate, you can talk to. When you have the Space Leadership Council, EADS Astrium is at the table; when we're thinking about high tech investment in the automotive sector and which battery technologies are worth researching, you can talk to Jaguar, Land Rover and Nissan. But the problem with, say, robotics or synthetic biologies, you have not got obvious major primes there, you're pushing stuff out, partly because it's more speculative, partly because of the structure of British economy where we lost too many

primes in the 70's, 80's and 90's. You are pushing ideas out where there isn't an obvious prime and that is a completely different and far trickier set of challenges.

Waldegrave

Well maybe we're perhaps hearing too much from the panel! I just want to go back to my anxiety. I think there's an excellent new consensus, that we shouldn't be too pure about staying too far away from the market and the transition making us go further downstream. I tried to put my toe in the water with Bill Stewart with our Foresight panels. They were not supposed to be the Government predicting the future, but I thought I'd seen in Japan and the Netherlands, structures in which industrialists and researchers and customers and marketing people were all mixed up together and sometimes the Japanese companies told me that the marketing people would say to the scientists, what we really like is this and the scientists would say, well if you'd told us that's what you really liked we could have done that a long time ago. They weren't in the same culture very often. So that was the very beginning of trying to move down that frontier a bit. Now I was pessimistic with what I was saying and I think the optimistic thing for Britain is that all this is long term, nothing will happen unless we stick to roughly the same policy for say, 20, 30 years and then we'll begin to see. Max Perutz told me that the MRC gave him the money for the LMB and said we don't really want to hear from you for about 10 years, just get on with it. And he did. One of the costs of instability and economic weakness of course is that you tend to lose the long-termism because you're always struggling to meet some immediate budget problem. I wish I'd been Minister when he was there, anyway!

Willetts

So do I William, so do I!

Waldegrave

So to counter my pessimism about our mega industrial structure, about which I am still pessimistic – it's no good relying on a couple of relatively big pharmaceutical companies because I happen personally to think the very big pharmaceutical companies are dying themselves anyway. Where are the new ones coming from? I hope they're coming from things like ARM – but my goodness we've got to stick to it for a long time, because they're not there yet, any of them.

Victor Keegan

Following on from the last question, I was very interested about the references to clusters and to Cambridge. Around the London scene, silicon roundabout in Shoreditch gets a lot of the publicity, all of the publicity, but there aren't to me any signs of any large companies that are coming out of that, and particularly not any large companies linked to the universities in London. I hope I'm wrong about that, but the question I'm going to ask is, is there a London problem here and if so, is experience in Cambridge, where they seem amazingly successful and miles away from the capital, at having a number of very large companies that London could only dream about, are there any lessons that can be applied from there to London?

Lord Bob May of Oxford

I made up my mind I wasn't going to say anything! I've lived 20 years of my academic life in the United States, 11 of them as Vice-President for Research at Princeton. There's lots of things that are better in Britain than they are in the States – I mean not only the gun laws but lots of things – but there are a lot of legislative things in the States that are much more encouraging of risk-taking. Just to start with one very simple thing that's been helpful in the recent financial troubles: in the States, if you have a mortgage and you can't pay it, you give the mortgage back to the bank and that's the end. That's a very big difference from what happens here, where, if properties have gone down you lose your house and you still owe money to the bank. Another really quite important thing, I think, is simply in the attitude to risk. David is familiar with the anecdotes that I repeatedly told him about my brother in law, who is a person who started out in physics, didn't make a go of it, went into silicon valley and went bankrupt three times, but the fourth time round, he made a hell of a lot of money. It was a kind of insecure life that I can't see any of my colleagues in Britain having embraced. I

don't know how you achieve it, but I don't think you achieve it with well intentioned committees. Another difference between here and the States, an odd one: when I say I was Vice-President for Research at Princeton, that was a day and a half a week job, whereas our more sclerotic ways of handling these things in Britain, the people who hold that kind of job in a British university are essentially out of research because they're spending all day, every day on committees. So there are some really cultural things, attitudes to risk that one has to get at and it's not easy to see how you change a culture.

Hennessy

Thank you Bob. Quick comments on those questions; clusters first. You're Mr Cluster...

Willetts

Well clusters can have benefits in different ways. The one thing that clusters can do is attract in overseas investment and remember, partly because of the loss of our big primes, Britain has ended up that as part of our national strategy, part of our comparative advantage, and it's no bad thing, is essentially trying to be the world's preferred centre for R&D, and that is not a bad strategy to have. So I find all round the world there are companies that are saying, we want to locate an R&D lab in Britain because we want to understand what's going on in your universities and indeed you have in Tech City, the arrival of CISCO with a big investment, the arrival of Google with a big investment, because they want to know what's going on and spot the ideas. Now, of course, down the track, you want to see home-grown businesses, but the path to that is as uncertain and unpredictable as in a rom com, these things are not straight forward, that's the thing, the lesson we all learnt. Someone has referred to ARM Holdings, a great company, it probably wouldn't be there but for some early EU grants, the BBC Acorn computer, a fortunate deal with Apple which Apple then wanted to disengage from: the early history of ARM is a classic messy history and that I suspect is how, if we can get there, British companies will emerge. I know there's all this stuff about culture, and several people have mentioned culture and Bob May has just mentioned it: I just don't find culture an explanation of anything. Saying it's in the culture is just re-describing the issue, I don't find attributing it to the culture has any kind of explanatory power. That's why I think it's much more useful to ask what are the economic incentives, are there different structures, are there different ways in which things are financed. I mean the clustering in California undoubtedly was partly to do with the fact that the Californian Supreme Court struck down the non-compete clauses in labour contracts in California, so you could leave a firm on Friday, with all the intellectual property and set up a new firm or go to a different firm on Monday. The companies tried to stop that happening, the Supreme Court permitted it, so I, perhaps because of my background, a bit of economics, I tend to try to find the structural and economic incentives behind these things rather than settling for a cultural explanation.

Hennessy

William, 20 years ago I think for Radio 4 we had a discussion about Martin Wiener's book about the decline of the industrial spirit – do you remember? – the thesis being the little Brunels went to Harrow, became solicitors and politicians and didn't do anything, but I mean that's a sort of encapsulated version of things!

Waldegrave

Well I've come to the conclusion that it went on much longer than that, although I was a child of the 60's like you were, and it was such fun, the 60's! But what were the expanding industries? They were media industries. So where, in the 30's, all the smart people would have gone into automotive companies or oil companies, in the 60's they went into the media. Archetypically, Britain won all the prizes and still does at satire and acting and it was wonderful fun; but the heroes of that industrial revolution were not the technologists who built the new methods of communication and the television, they were the stars on the screen and The Beatles and so on, and that was wonderful, wonderful fun. The 50's were a completely different culture which is why I agree with David, culture is an unchanging thing. If you think back to my childhood, when Sir Hubert was holding off the Mekon in the *Eagle*, the *Eagle* was propaganda for engineering and science; and all the big 50's heroes, we knew their names, they were Peter Twist, they were

John Cobb, with his land speed records, it was a lot of it to do with engineering and science. That culture could come again I think.

Hennessy

I think we need to revive the *Eagle*, that's the conclusion. Quick thought David?

Sainsbury

I agree with David about this. I think when people say culture, what they actually mean is we don't really know. It's very easy to say well it's culture and that sort of seems to solve it, but I don't think it does. Just a quick comment about mortgages, Bob: the biggest problem of the sub-prime mortgage issue was this very fact that you could have your house mortgaged, you get a year's free loan with no payments and then if you can't pay at the end of it, you send the key back. Not surprisingly, a lot of people who were quite happy to keep moving, were prepared to take mortgages on that basis and of course, the bankers were very happy to fund mortgages like that, because you could then securitize them and hand them on to someone else, so that when the problems started, huge sums of money were left in other people's pockets. So I think you want to be a bit careful about that mortgage argument. The other point I'd just like to comment on is, I think it's called silicon roundabout: I think one ought to be very clear, most of the high tech clusters in that high tech area, are not surprisingly round universities and the fact that you have here a cluster, which is praised beyond belief as one of the great clusters, is not round a university, and I very much doubt if long term this will be a significant cluster. What one wants to look for in London is what I think is now happening, which is that Imperial and UCL are thinking of setting up campuses, I think Imperial now has already announced it is going ahead with this and UCL also and to look at how those will be successful in future, and also of course the Francis Crick new centre for research, which again should be the centre of a cluster because those are the clusters which long term will be very important.

Hennessy

Take two more? Yes please. It's the boss so I had to give him the floor!

Professor Simon Gaskell

Simon Gaskell from Queen Mary; I do have an issue to raise, but I can't help first of all contesting what Bob May said about Vice-Presidents for Research, having been a Vice-President for Research in Manchester and maintaining a very large research group and having just appointed a new Vice-Principal for Research at Queen Mary, specifically on the understanding that he will maintain a very strong research presence, I just wanted to correct you! The point I wanted to make though related, Peter, to your comments at the beginning about, what was it, "routine punctuated by orgies". One of those orgies is when a particular national crisis arises and the science base has to be called upon at short notice to deliver. William referred to a couple of those instances, but one that I think is a good example of this happened in Canada in fact a few years ago with shellfish toxin poisoning, where basic scientists were called into action at very short notice and within a fortnight had solved the problem. So there is this need for, if you like, the rapid response from the science base and my question is: how is that best maintained? David Willetts referred to the complex issue of whether the science base should be entirely within universities or outside, and I think that's debateable. What I don't think should be debateable is that the science base needs to be there to provide that rapid response.

Sir John Ashworth

In a way I'd like to follow that up, but referring to something that Governments always do, which is regulate, which we haven't yet spoken about. Of course the origin of some of our national laboratories which David Willetts referred to, was in underpinning good regulation – the National Physical Laboratory, but there are others too – and I thought whilst I watched the development of the privatisation of these institutions during the late 70's, that the point that the politicians and the civil servants didn't quite understand was the nexus between Government use of regulation to give your own industry a bit of a chance and a bit of a competitive power – by God the French understood this and the Americans, who have never had to be told it – but that depends on a link between very good science, which is often boring and therefore best put in a national

laboratory; a technology transfer operation which involves commerce, the one I remember is the building industry with the Agreement Board; and the Government research establishment like the Building Research Centre. When we were trying to develop proper Government regulation for energy transfer across walls of buildings, it was extremely difficult because there was not in the UK, very good science, the building research establishment was terribly underfunded and the Agreement Board was a disaster.

Hennessy

Thank you. Who'd like to start on those two questions?

Waldegrave

Well can I just agree with something where David criticized me. I think we took the privatisation of Government research institutes too far as a matter of fact and I think that for exactly the reason that John gives. Now part of the reason was, that if they were no good we weren't necessarily brave enough at making them better. I'm saying they were no good, because we were never allowed to say that anything is no good, and we were also frightened of the model run by my French colleague on the European Council of Science Ministers who subsequently became Prime Minister, is still Prime Minister I think, and he had the whole of his science research in Civil Service structures where people stayed for life and it was a complete nightmare for him. So that we were frightened of having that, but we did take it too far, and the regulation drive. When I was Environment Minister, I was normally sent into Brussels on behalf of some out of date British company being protected by Norman Tebbit, like British Leyland usually, saying that it was absolutely essential that an enormous amount of smoke came out of the back of all their cars otherwise the whole population of Birmingham would be put out of work tomorrow. And it was hopeless, and eventually one gave up defending them and of course they bought a Japanese engine and got on perfectly well. But we weren't proactive, we weren't thinking, how can we take this new subject of clean engines and drive a new industry hereby using regulation. You needed some good Government scientists to help you; I totally agree with what you say.

Sainsbury

Can I just respond to the question of Government having to deal with crisis, and mention what I think is one of the things we do very well in this country which is our Chief Scientific Advisers, because what I always experienced in these situations was that probably it's inevitable that the scientists within Government departments do not have totally up to date contacts or knowledge about what is going on, usually if they've come through the system. We have a much better system now because we appoint people from the outside to be there, but this is a very important part of this, because when you have these crises, the important thing is to be able to bring in the best people on that science from outside the system and in my time I think that was done extraordinarily well. So David King or Bob May would bring in the very best experts and they would give advice on the system and that actually worked incredibly well and could be done very quickly.

Waldegrave

Can I just go back on John's point, because one other problem was that nice little companies were often the enemy. I remember when we were taking lead out of paint, there was a lobby from the Isle of Wight; there was a little bucket shop, literally, a paint company that couldn't do anything, had no research programme, if we took lead out they were going to go bust. I went to ICI and they said, well what do you want to do, we can do it in a couple of years, you just give us a couple of years, we'll have a new paint formulation that you like. This is a Lovelock view that he annoys his friends on the green side by saying, big companies are essential because big companies do research.

Hennessy

Can I give the Minister the last word and also be tactless, breaking the habits of a lifetime and ask you, don't you think, and it applies to David too, as William raised it, that the Science Minister should be in the Cabinet full stop, always?

Willetts

Yes, and I do attend Cabinet and speak at Cabinet on a wide range of issues. I think it does work and I think it's necessary to have someone responsible for science at the table. So we have delivered that.

I think on the other two issues that were raised: on the question of crises, the Science Minister is not the important voice, I mean it's good and important to be there but the crucial voice is the Chief Scientist and as David has said, at COBRA and elsewhere the Chief Scientist – I'm trying to think of the crises we've had, the Ash dieback at the moment, the Icelandic volcano with the unpronounceable name, Fukushima – I think on all those occasions we've had rigorous science advice. Going over on a trade mission with the PM to Japan, it was clear that in Japan the voice of the British Chief Scientist in saying this is not another Chernobyl, had really earned an enormous amount of respect and goodwill. This contrasted incidentally with I think a reference from one of the EU Commissioners talking about Fukushima as a potential apocalypse. They're now looking in Japan at creating a Chief Scientist post because they were so impressed that you could have a voice for empiricism and scientific rationality even in the middle of an incredibly fraught crisis.

On the regulation issue, I quite agree about the importance of getting the regulation right. This Government is absolutely committed to reversing the burden of regulation, but there are times when, equally, regulation is crucial for shaping a new market and new technology. One of the reasons for maintaining a lead and a presence in these areas is to ensure that we can help shape both the standards and the regulations. One of the things that we're working on at the moment is synthetic biology, which is likely to develop as a significant technology in the 21st century. At the moment there are three countries that basically do synthetic biology – China, the US and the UK – and if we can agree standards for engineering type conventions for synthetic biology, I think we still have the capability to shape things. We don't currently have a synthetic biology standard setting body in the UK. There is the Library of Biological Parts at Stanford and I would very much like the UK to be up there working alongside Stanford in helping shape that. William referred to carbon and de-carbonising the economy and all that, and again I am shocked by how primitive some of the data and standards are. When we are trying to work out how much carbon dioxide comes out of China, we measure the shipments of coal in, make some rough estimates of the production of Chinese coal mines and do some calculations. You could have a far more sophisticated scientific measurement of the carbon dioxide over China and do it properly and similarly apply it to our own domestic building techniques. That's where we can make progress, so I agree with you on that.

Hennessy

Well thank you. It remains for me to thank the three partner bodies that have made this evening possible and our three Scientific Ministers and above all, you for coming. It has been a terrific evening. Thank you all very much.