

Health and the environment in a globalized world – some challenges for science

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Thank you very much for the invitation to be here today. I am sorry that I could not be here for more of the very interesting discussions that I am sure you have been having, but SBS has so few staff that it is very difficult for me to be away for long periods. However, given that I am here to speak about health and the environment, it is nice to get out of London into the countryside, to remind me of what the environment actually looks like.

I am going to give a very personal view of some of the challenges that the scientific community is facing in dealing with health and environmental issues in an increasingly globalized economy. It is personal for two reasons. One is that, before I did my current job, I was an ecologist, studying insects, birds and other organisms in Africa, South America and elsewhere, so I have some claim to know something about environmental research. The second reason is that at SBS, I spend all of my time understanding the intricacies of science policy in the UK, so most of what I have to say will be about what is happening in UK science.

I want to start by giving a quote from Lord May, who is now President of the Royal Society. Before he got that job, he was known as Sir Robert May, and was Chief Scientific Adviser to the UK Government. At a press conference about the international mobility of scientists, he said "Science was globalized before 'globalized' was even a word".

It sounded like a glib phrase, but like so many of Bob May's seemingly glib soundbites, it actually meant something serious. Science has always been a very international activity, and some of the challenges of that follow the globalization of the entire economy are issues that have already been addressed in one way or another by the scientific community. We have something of a head start on everyone else.

What I am going to do now is to try to answer two questions:
Σ What are some of the challenges for science in the field of health and the environment?
Σ How are we measuring up to those challenges?

The challenges

I must emphasise that the list of challenges I will talk about is entirely a personal list, and I make no claim that it is exhaustive (which it clearly is not) or even that the challenges I have picked are the most important ones. They are simply a few challenges that I perceive as being interesting.

In the field of health research, I see the following two interesting problems:

- ***How are we going to fund research on diseases of the poor?***

Given the much research is done by pharmaceutical companies, which exist to make money (that is, after all, what private companies

are actually for), we could expect most research to be carried out into diseases where someone is going to pay a decent price for whatever drug or treatment emerges. The world's poorest people cannot pay for expensive drugs, so there is a reduced incentive for drug companies to want to carry out appropriate research and development. Public funding bodies in the rich countries are also, quite understandably, under great pressure to work on the diseases that affect the taxpayers who fund them, and those diseases are things like cancer, coronary heart failure, and Alzheimer's disease, not malaria, diphtheria and dengue fever.

• ***How are we going to balance private profit against the public good?***

This is a slightly different question. The Human Genome Project is an example of where, potentially, great medical breakthroughs could follow the years of detailed (and no doubt sometimes tedious) research that has gone into the project. But will those advances come because of the private patenting of information, or from the sharing of information in the public domain.

In the field of the environment, I am interested by the following two issues:

• ***How are we going to fund routine description and monitoring?***

All sorts of science rely on what can be seen as rather dull research. Take global warming, where we now know that the Earth's temperature is warmer by about 0.6°C now than it was 100 years ago. The only reason we know that is because, for the past century, people have been going out every morning and noting down the information on their thermometers. It happens that they have done that for a variety of reasons (like the need for farmers and ship's captains to know what the weather is like), but it was routine, and has turned out to be useful.

In the field of biodiversity research, the routine description and naming of new species is going to be equally important. Since Linnaeus invented the system by which we give organisms scientific names in 1758, between 1.5 million and 1.8 million species have been described. We do not know exactly how many because nobody thought to keep a central list. Depending on which method you use, estimates of how many species remain so far undiscovered vary from about 2 million to about 100 million, with the best guess is probably somewhere about 10 million (but don't stake much money on it because we really don't know). Describing these species is important, because it is hard to conserve what you do not even know exists, and you cannot prioritise environments if you have no idea what is in them. But it is not obvious how such work should be funded.

Σ How will we deal with the international dimension in environmental science?

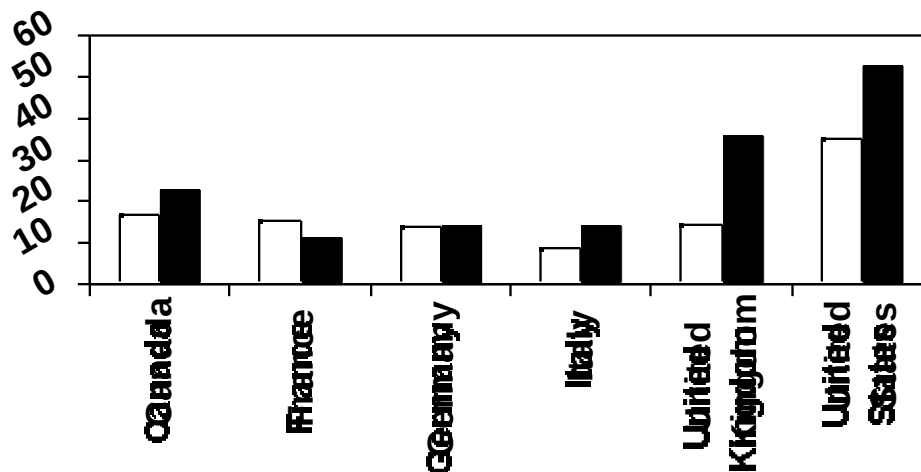
Animals and plants, currents of air, and weather systems are no respecters of man-made political borders. One of the last places I studied before I started this job was in Northern Tanzania, right on the border with Kenya. The birds I was studying quite happily flew across the border without a passport. At a larger scale, the negotiations over the Kyoto treaty on limiting the emissions of greenhouse gasses have shown the need for a serious international dimension in environmental issues.

But scientists are just people, each of whom has a nationality and home institution, and who cannot just cross international borders without a passport. Dealing with the international dimension of environmental research remains something of a challenge for science.

How are we doing?

Before I look at how we are doing on each of my four challenges, I want to look briefly at how we are doing in terms of funding science in the areas of health and the environment. If these problems are becoming more important (and the fact that we are having this conference seems to suggest that we think they are), then we need to pay for the research that will help us solve them.

The OECD requires its members to report what proportion of their civil science budgets are spent on health and environmental programmes.¹ The chart below shows these figures for six of the G7 countries, for 1981 and for the present day. Japan is excluded because no figures are reported for 1981.

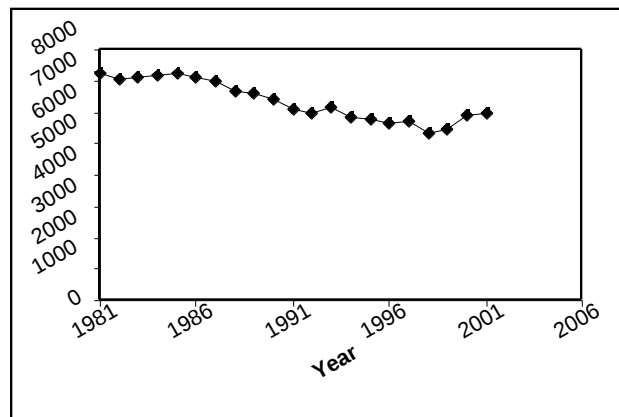


Percentage of civil science expenditure that was invested in health and environment programmes in 1981 (white bars) and today (black bars)

There was not a great deal of change in Canada, France, Germany and Italy, but the UK and the USA claim to have increased dramatically

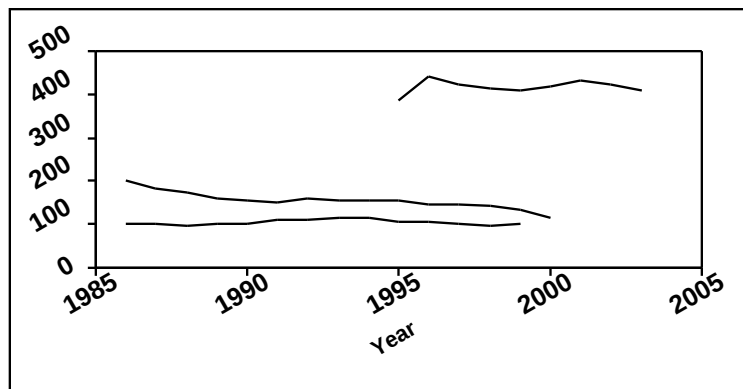
the proportion of their science budgets that are now being spent on research into health- and environment-related issues.

The problem, at least in the case of the UK, is that the proportion is of a declining total. The graph below shows the overall government investment in scientific research and development in the UK.



Overall UK government investment in research and development in £ million (real terms at current prices)

These figures include defence research, so they are not directly comparable with the previous chart, but the overall message is fairly clear. It may be true that we have increased the proportion of money we invest in health and environment research, but since the overall pot of money has been shrinking, that not only means that other areas of research must have been very badly hit, it also means that health and environment have not actually been given much of a boost. To be fair, the increase in research investment that has now begun, shown in the final few points on the right hand side of the graph, means that we may now see some real increases in research programmes in various fields.



UK government investment in research via the National Health Service (top line), Ministry of Agriculture (middle line) and Environment Department (lowest line) in £ million (real terms at current prices).²

However, the real picture to date is shown in the chart above, which plots how much money has been invested in research via the National Health Service, the Ministry of Agriculture, and the Department of the Environment over the past few years.

The National Health Service is more-or-less holding steady, the environmental department has just about held its own, and the Ministry of Agriculture has continually been cut. For anyone who has lived in the UK for the past decade and a half, this seems rather bizarre. We have, after all, had BSE, concerns about genetic modification of foodstuffs, foot-and-mouth disease, a scare about **Salmonella** in eggs when a minister had to resign, **Listeria** in cheese, tuberculosis in cattle and badgers, and so on.

Personally, my imagination lacks the capacity to understand why successive governments have sought to **reduce** investment in trying to understand these problems.

Anyway, my point here is that the overall picture on research investment in the fields of health and the environment is somewhat mediocre, but is not so excessively awful that we ought not to have made some progress.

So now I can turn to my specific questions.

Progress on funding diseases of the poor

The Medical Research Council (MRC) helpfully provides a searchable database of the projects it funds. You can type in a key word, such as the name of a disease, and it will give you details of any MRC-funded projects whose titles contain the word.

So I looked up all of the 8 diseases that are currently on the World Health Organisation's list of "outbreaks" since 1st January 2002. There are eight such diseases, including meningococcal disease, yellow fever, dengue fever, leishmaniasis and **Ebola**. The MRC is funding six projects that name these diseases in their titles.

Then I looked up three diseases chosen by my colleague Alice Sharp Pierson as being diseases of rich countries that are not third-world epidemics, although she did not know why I asked her to name them. The three diseases were asthma, Alzheimer's and dementia, and I discovered that the MRC is currently funding 33 projects with these names in the titles.

This is a crude and simplistic analysis, and it would exceptionally foolhardy to treat it as a detailed piece of research, but it suggests that, currently, the academic funding agencies are not funding diseases of the developing world at the kind of level that is really needed.

But the MRC exists to fund world-class research, not to solve the world's problems, and much of what it does will in any case turn out to be useful because it is studying underlying principles.

In terms of the private sector, the Chancellor of the Exchequer brought in new incentives for research into third world diseases just two days ago in the Budget. He introduced a general tax credit for larger companies carrying out research and development, but he doubled the rate of credit for research on malaria, tuberculosis and some kinds of AIDS (specifically those that afflict the world's poorest people). So he is signalling that government policy is to tackle the research deficit in these areas.

I checked on the website of GlaxoSmithKline, the UK's largest pharmaceutical company, and it very helpfully lists all of the drugs that it has currently brought to the stage of clinical trials. 10% of them list malaria, diphtheria, hepatitis and leishmaniasis as indications, and many more name AIDS, although it is not possible to decide which ones would have qualified for the new tax credit.

In other words, drug companies are already doing a substantial amount of research into diseases of the developing world, and if the new tax break stimulates more work in this area, we may be able to point to an increasingly impressive record in years to come.

Progress on the balance between profit and social good

The story that everyone tells when they want to criticise those interested in profit rather than the public good is the tale of how 39 drug companies took the South African Government to court to enforce their patents on anti-AIDS drugs.

We have already heard something about this case in other talks today, but it is a tale that can easily be interpreted as suggesting that we are not very good at balancing profit and social well-being. But we must remember that the companies eventually withdrew their action, and that ***they were offering cheap drugs anyway.***

Moreover, as of last month "[n]ot a single South African [had] been put on a course of...drugs as a result of this historic climb down by the drug companies".³ Whatever we think about big business, and whatever we think about the rigorous enforcement of patents, we cannot blame the big drug companies entirely for the fact that the fruits of their research are not filtering through to the poorest people.

The other big example of the need to balance the public and private good comes from the Human Genome Project. A balance has been struck here because two quite different teams have set up rival projects. One is a private company that seeks to patent whatever

might make it money in the future. The other is a public-charity partnership, in which both the UK government and the UK charity the Wellcome Trust have been very heavily involved.

At the moment, this balance seems to be working, but one has to worry about whether future projects would be balanced in the same way. There is not really a formal mechanism for ensuring that the public good is balanced against private profit in the increasingly competitive and research-driven world in which we live.

Progress on funding routine environmental work

Taking the description of new species as a case study, the problem for the funding of routine environmental research is that it falls between a number of stools. The Research Councils, quite properly, say that their job is to fund cutting-edge science, and that routine description is rarely cutting-edge. The government departments, with some justification, argue that any individual set of taxonomic studies is unlikely to be directly relevant to a policy-making decision, so it is not their job to fund taxonomy and systematics.

These problems have led the House of Lords Select Committee on Science & Technology to begin a second inquiry into the funding of taxonomic and systematic biology, because they perceive growing difficulties.⁴

However, there was a “systematics forum” for a few years, which came out of the first House of Lords inquiry into the subject, and a number of funders contributed.

And it is worth pointing out that the funders of cutting-edge research were happy to pay for the Human Genome to be sequenced, even though doing this was hardly hypothesis-driven. It just seemed that knowing the sequence of the genome would prove useful in various ways, just as knowing what species are out there might prove useful in various ways. So maybe there remains hope for this kind of research.

Progress on dealing with the international nature of environmental studies

In the UK, we have a superb example of a funding scheme that tries to handle the international intricacies of research relating to the natural environment. It is called the Darwin Initiative for the Survival of Species, and it was a result of the Rio Earth Summit in the early 1990s.⁵

Its aim is to match the scientific skills of people in the UK with the local knowledge and expertise of people in countries that are rich in biodiversity but poor in financial resources.

I want to give one example of the science that it is funding, which relates to vultures in India. A mystery illness has afflicted two species of vultures rather seriously, and their populations have suffered enormously, by as much as 90% in many areas.

We do not tend to like vultures very much, but in this case, their disappearance is a real problem, because they normally deal with any dead animals that might be lying around. In the Indian climate, and in the ecological situation that pertains, if the vultures do not pick the carcasses clean, the flesh of dead corpses rapidly goes rotten, threatening to harbour nasty infectious diseases, and the local dog population shoots up, as the dogs come to feast on the meat that the vultures are no longer devouring. Feral dogs in India spread rabies, and the incidence of rabies in some areas is now increasing alarmingly.

To stop this problem, we need at least to know what is killing the vultures, and it is here that UK scientific expertise is crucial. Whatever the cause, it seems to be spreading (it has reached Nepal and Pakistan) and if it carries on doing so, it could reach Europe and Africa. If the vultures of Africa start disappearing, and their ecological role remains unfulfilled, the world will have a real problem on its hands.

Stopping the spread of this disease might turn out to be one of the **major** problems for the world, and identifying its cause is the first essential step. The pattern of its spread suggests that it is caused by an infection, possibly a virus. An old colleague of mine from the Zoological Society, Dr Andrew Cunningham, is being funded by the Darwin Initiative to work with Indian counterparts to start this process (collaborators in the host country is an essential requirement for funding under this programme). He knows more about the viruses that infect wild animals than almost anyone, and I have every confidence that if the potential crisis is to be avoided, the solution involves his scientific input.

You can tell from the way I am going on about it, that I think the Darwin Initiative is something of which the UK can be justifiably proud. It is to the credit of a previous government that they invented it, and of the current administration that the scheme has survived the scrutiny of the "Iron Chancellor". The problem with the Initiative is that it is too small – a mere £2 or £3 million annually, despite the vast biological talent in this country, and the enormity of the scientific need in many of the poorest countries that also happen to harbour a disproportionately large fraction of the Earth's biodiversity.

Concluding remarks

So my final message is that there are some serious challenges for the scientific community, and for the political community that sets the

context and the funding regime in which scientists operate. Health and environmental issues are increasingly important, and globalization of the society in which they operate is bringing fresh challenges.

My survey of the UK's progress in dealing with a few of these challenges suggests that, in broad terms, we are fairly good at inventing methods for tackling them – the Chancellor's extra tax breaks for research into malaria and the Darwin Initiative are two such methods. Where there seems to remain some reason for concern is that we are not always very good at recognising either the urgency or the scale of the problems.

As in so many areas of science policy in the UK, our intentions are pointing in vaguely the right direction (and it would be dangerous to try to point them any more precisely, we would end up unable to see the bigger picture), but we need to understand that in globally competitive environment, and in a world that is changing ever more rapidly, we need to step up the level of our commitment, and to do so without delay.

¹ OECD Main Science & Technology Indicators, 2001 edition. Present day figures refer to the most recent year for which the country has reported this indicator (mostly 1999).

² ***The Forward Look 2001***, Stationery Office. Because of changing Departmental responsibilities, the early Environment Department figures refer to the old Department of the Environment, but later data are attempts to estimate the research money that would have been challenged through this Department if it had not been merged with the Department of Transport.

³ Radford, T (2002) ***Frontiers 01: Science and Technology, 2001-02***, p.44. Atlantic Books, London.

⁴ For SBS's evidence to this inquiry, see ***The importance of underpinning research***, SBS, 2002 [SBS 02/02].

⁵ ***Darwin Initiative for the Survival of Species: Fourth Report***. Department of the Environment, Food and Rural Affairs, London, (2001).