THE RELATIONSHIP BETWEEN SCIENTISTS AND GOVERNMENT

George Kalmus

The premise of this article is that the relationship between scientists and government is important for economic, ethical and, not least, cultural reasons. The difference between research and development is discussed. Suggestions are made as to how advice to governments on scientific and technical matters might be improved and crucially how this advice might be seen to be impartial by the general public.

La premessa di questo articolo è che la comunicazione tra scienziati e governi è importante per ragioni economiche, etiche e, non ultime, culturali. Viene discussa la differenza tra ricerca e sviluppo. Vengono avanzate proposte su come gli scienziati possano esprimere pareri su questioni scientifiche e tecniche in maniera più efficace e su come questa espressione possa essere percepita come imparziale ed indipendente dal grande pubblico.

We are I believe, all convinced by the need for scientists to communicate our work and ideas to the public who after all finance our work. This is perhaps particularly true for those of us working in the more esoteric areas of science. But, communicating with our paymasters should not be our sole reason for this outreach, I believe that we have a duty to share our excitement and discoveries with the public at large for cultural reasons. Doing this effectively is not easy, especially in my subject of Particle Physics, which has neither the beautiful, if often false, images of the astronomers nor the immediate and very personal appeal of the medical researcher.

There have been and continue to be many initiatives to make the public more aware of the work of scientists. These are more or less successful and their success depends crucially on both individuals and institutions.

An area that is much less developed is the need to heighten the awareness and indeed educate, politicians and senior government officials on the scientific method and the power and limitations of science. This process does not come without serious consequences for scientists.

For centuries, indeed millennia, "scientists" have advised governments. Their advice has been sought on war machines by the ancient Greeks, and later on marine navigation, the efficient design of lighthouses and more recently on epidemiology, GM crops and radio active waste storage and very many other topics. It has to be said that our advice has not always been without blemish; indeed sometimes it was just wrong, sometimes misleading but most often wrongly interpreted by politicians. Even in this last category, scientists must bear some of the blame.

During the last decade and a half I have spent increasing amounts of time on various international committees that have had direct interaction with Government officials in the UK, Continental Europe, Canada and the USA and it was this interaction that triggered my interest in improving the communication and understanding between scientists and politicians and high government officials.

It was the result of this interaction that left me frustrated at times and led me to spend some time thinking about this topic. I cannot pretend to be an expert, but nevertheless, I have some views that might be of interest.

Some of these views may very well not apply to all or even the majority of countries, as there is a wide divergence in the way Politicians and Governments view Science and Scientists.

Perhaps I could start with a couple of quotes illustrating the problem from the two sides, the scientist's and the politician's.

The first is from Michael Faraday, the discoverer of electromagnetic induction and therefore the godfather of the electric power industry, who when asked by Gladstone who was the British Chancellor of the Exchequer (Finance Minister) at the time, about the practical worth of electricity said "one day you might tax it"

The second is from Georges Pompidou, the French President, who in 1968 said: "There are three roads to ruin; women, gambling and technicians. The most pleasant is with women, the quickest is with gambling, but the surest is with technicians."

The first and obvious question is, why do we care if politicians and governments are scientifically literate?

There are many answers to this; I will give just the ones I consider to be most important.

1) The scientific method is an important part of our cultural heritage and all citizens should be exposed to it. Politicians should be no exception; indeed we might hope that our leaders would be wiser and more rounded than the average citizen. In the UK, science is not considered by the vast majority of people to be a cultural activity. It tends to be considered to be a useful "qualification" and professional scientists tend to be viewed as rather strange and indeed unworldly. Culturally, it is far behind Literature, Music, Art and generally the humanities. I know this is not universally the situation in some other European countries. It seems to be a fact, that very few politicians have a scientific background, in the USA for example, the overwhelming majority are lawyers, in the UK the percentage of lawyers is lower. Even those that are not lawyers however are rarely scientifically trained.

2) The world we live in is becoming increasingly technologically advanced, both in the physical and biological areas. Politicians are having increasingly to become involved in technical and moral decisions which have enormous impact on the world without understanding either the underlying science or the often the advice they are given.

3) Last, but not least Governments fund us. If they really understand so little, why do they do this?

I am old enough to remember the heady days of the 1950's and 60's when the funding of particle physics was increasing by 10% pa in real terms. This was the result of two factors; firstly, there was confusion by government between what we now call particle physics and nuclear physics. So worldwide, but particularly in the UK and USA, the atomic bomb and nuclear energy factors were important. On this occasion the scientific illiteracy of the politicians was beneficial to us, but not to other branches of science! Secondly, it was widely perceived by government that scientists had made an enormous contribution to victory, and that in the future wars would be more and more technical and therefore physical sciences needed to be supported for defence and security reasons. I should mention that although the atomic bomb was the most spectacular technical development of the war, there were many others that were extremely important, including RADAR, the development of new materials and even new methodology such as "operational research". The idea that the impact of, for example, the blanket bombing of German cities could and should be studied in an analytical and quantitative way, was the work of the young mathematician Freeman Dyson among others. He presented his results to the airforce, showing that bombing industry and communications was far more effective, but his advice was ignored by bomber command.

As I have said, the funding "bonanza" was a very local effect. "Nuclear Physics" benefited greatly but for example astronomy (pre sputnik) was in the doldrums and biological research was hardly supported at all, neither was mathematics. This was the start of a practice that goes on to this day, Governments love trying to pick winners and only fund those areas. This is yet again a misunderstanding by them between "Research" and "Development".

Most governments lump these two categories together as R&D. But they are very far from the same, and require quite different approaches. In the case of "D" some reasonable guesses or projections can often be made as to future potential. In the case of the "R" history has taught us that the greatest technological breakthroughs have come from serendipitous discoveries often in fields remote from that benefiting. There are many examples, from the discovery of X-rays to the quantum mechanical understanding of band structure in semiconductors leading to the microelectronics industry.

As a footnote, this great concentration on the funding of "Nuclear Physics" in the immediate post war period did in fact have a long term beneficial effect on all of science in the UK. Basically the funding of nuclear research established for the first time a substantial government science budget. As new areas of science became important, eg space science after sputnik, and governments started to understand that particle physics was not the same as nuclear physics, this science base was used to fund other areas. This leads me to one of my guiding principles when dealing with government funding of science:

It is good for the total science base (science budget) to increase, even if this is in areas different to our own, even if in the short term they appear to be in conflict with our area. My experience is that once government gets used to a science budget of a certain size, it is much more likely to accept this as the long term level norm and redistribution is often left to officials much closer to active scientists. So, I believe that it was a great

mistake for Philip Anderson and other scientists to oppose the SSC. I don't think that the cancellation of the SSC has resulted in any more resources going into material science and the total funding of physical sciences in the US has if anything decreased. It is for our collective good that we support each other, with the caveat that the projects to be supported are fully scientifically justified.

So I have identified two important interactions between science and government:

Firstly, the need to expose our leaders to the scientific method and thought so that they have a better understanding of important issues and perhaps even more importantly that they can better assess and question the advice they are given.

Secondly, the advice of scientists is more and more needed and being sought by government. This can take several forms, either from their own experts, from outside experts or from specially formed committees.

Advice is also sometimes given gratuitously by various bodies and individuals. Some of this advice is clearly self-serving but other is more impartial, such as from National Academies. It is important for scientists to consider carefully how best to interact with and influence politicians and in particular how to give clear advice which is impartial and is seen by the public as being so.

I will address both these issues.

Firstly, how do we try to educate our leaders?

My view is that it is very difficult to do this once they are already in positions of power, indeed perhaps it is too late once they have embarked on a political career. This shouldn't discourage us from trying!

The best way is by providing a better introduction to science to all students, in particular those studying the humanities, arts and law. I know that in some countries there are mandatory courses on science for all students, the so-called, Physics 10, Chemistry 10, Biology 10 etc. in the US, in Britain the provision of such course is to say the least patchy, it is much more prevalent that science students have to attend courses on arts and humanities to make them more rounded and cultured!

Even when such courses are provided, my experience is that they are deeply unpopular and have little effect. This is at least partly due to the way they are often taught. Apart from the courses being unpopular with the students, they tend to be unpopular with the lecturers. I remember they used to be called Physics for Sorority Girls in the non PC world of the 1960's. Nobody wanted to teach them. Very large classes, composed entirely of students who didn't want to be there!

But, in some ways these are the most important courses we teach. They are our only chance to influence the people who are going to rule us! We should deploy our best lecturers and devise courses that are interesting and deal with ideas and concepts rather than details. It is much more important to convey the ideas of symmetry and resonance than calculating the excess pressure in a soap bubble. So, my message is when you are asked to teach a low level course to non physicists please look upon this as a challenge, I believe these courses are more difficult to teach well and require more thought than the standard post graduate course.

Secondly, let us consider scientific and technical advice.

Most governments have very well developed scientific advisory systems. These are mostly in the form of scientists directly employed by or paid by the government to do research and give advice. This may be on anything from how to deal with an outbreak of foot and mouth disease to estimating the total probable death toll from variant CJD to the safety of burying radioactive waste. It is clearly necessary for governments to have expertise readily accessible and to direct work into areas of public concern. However, there is a down side to the expert being employed by the government, giving advice to the government. This I believe is largely but not totally illusionary, but even if it is illusionary, it is important, because if the public believes that it is being manipulated by the government, it reacts badly. In the UK, politicians are among the least trusted people, together with journalists and estate agents! Let me illustrate this by an example from the UK. There has been a long running controversy about the safety of the MMR vaccine (mumps, measles and rubella). A paper was published in a medical journal several years ago, suggesting there was a possible link between autism, irritable bowel disease and the MMR vaccine. This was picked up by the popular press and caused a huge reaction from anxious parents who wanted to have their children vaccinated with the three vaccines separately which apparently was considered safer. Now, this

had two drawbacks, firstly, it takes longer to have the three courses of vaccines and therefore more babies would die from the diseases in the meantime and secondly it would cost more. Clearly it was most important that the situation with regard to the claim that there was a measurable correlation between MMR and autism be clarified. Infact, as I understand it, the claimed correlation even at the time it was made was very questionable, there was other, and more substantial work, from round the world which did not show any effect. However, one cannot expect the press to be balanced!

This furore led to two actions, firstly a denial by the government that there was any danger from the MMR vaccine, based no doubt on advice from its medical experts and secondly, more research on this topic was undertaken. I may say that further research did not substantiate the claim. The government continued its policy of only providing the MMR vaccine free, it would not provide the three vaccines separately. However, many parents just didn't get their children vaccinated since they could not get what they wanted, and in fact the uptake is now at a dangerously low level for the whole population and there are predictions that there could be a measles epidemic in the near future. Now, why is this? I think it is because the public has a healthy scepticism of government motives, and hearing that the three separate vaccines are more expensive, it naturally ascribes this as the motive. It is not reassured by the government's own scientists. It has been told lies in the past by experts in the pay of the interested parties. There are many examples of this from research by the tobacco industry showing that there is no correlation between smoking and lung cancer etc. to the claims for star wars by the Reagan administration.

So, how do we combat this scepticism of expert advice? In my view the way forward is for the government to seek and get more advice from third parties, and importantly to make this advice available openly. Who might give this advice?

There are several possible sources, committees of academics and others could be set up for specific topics, or advice could be sought from academies or professional societies. Although the last of these also has dangers.

All these are used, although the one that is probably least used and in my view is possibly the most useful is using the National Academies where they exist. I believe that the use of all these sources of independent advice should be expanded and care should be taken on how these are constituted and how the results are communicated to both government and the public. We must find a way in which the public has more faith in the scientific and technical information it receives.

We must renew our efforts to educate the public and therefore politicians on the essentials of the scientific method. To increase the understanding of probability rather than certainty, to understand that although it is possible to disprove a theory or hypothesis it is not possible to prove it.

We must try to make sure that the advice we give is dispassionate carefully considered and most importantly well explained so that misunderstanding cannot arise. This means that we must be willing to give of our time.

Finally, to the more senior members of the audience, there is an important role for you to play together with fellow scientists in other fields, if your country has a National Academy make sure that it is active in proffering advice to your government, if your country does not have a national academy, you and your colleagues should think about forming one. This has happened recently in the UK, although the Royal Society is more than 350 years old, the Royal Academy of Engineering is only about 15 years old. Eventually, the *Academia Europeana* might fulfil this role, but I fear that it will take quite a long time for this to happen.

GEORGE KALMUS

He is a former Director of Particle Physics Research at the UK's Rutherford Appleton Laboratory.

Contacts:

CCLRC Rutherford Appleton Laboratory - Particle Physics Department
Chilton Didcot, Oxfordshire, UK - OX11 0QX
Phone: +44-1235-445443 *Email: G.E.Kalmus@rl.ac.uk*