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Why Bother About Science?

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Your Excellency, Mr. President, Ladies and Gentlemen.

First of all let me thank you for inviting me here tonight. After-dinner speeches are usually given to a captive audience who are partially anaesthetised by food and drink and so are less critical than when fully awake. But, as anyone who has talked to a scientific society knows, you can't take full advantage of that fact because your address may be printed in the Proceedings and read in the cold light of day by people who have not just had their dinner. That is why, of course, these speeches are apt to be "essays standing on their hind legs".

It was while rummaging about among the essays in the back numbers of your Proceedings, that I came across an address of awe-inspiring erudition and length by Professor Elkin on the occasion of your centenary in 1966. He made the point that science had now become so specialised that it was no longer practical to present original scientific work at the general meetings of your society. I feel sure that must have been true for quite a long time; in fact if we go back to the first meeting in 1867, the first paper presented to this society was entitled "Non-linear Coresolvents" and was delivered by none other than the Chief Justice of Queensland. What "non-linear Coresolvents" are I have no idea; what interests me is that a scientific paper should have been delivered by a member of the legal profession and, moreover, by one from Queensland!

Professor Elkin urged this Society to pay more attention to the History and Philosophy of Science and so – taking my cue from him – I have chosen as the text of my sermon, "Why should we bother about Science?" Let's ask this question first of the general public, then of the community of scientists and, if there is time, of me.

As a start – why do the man and woman in the street think that we should bother about science ?

The New Scientist recently conducted a poll in the U.K. in which they asked a lot of people questions about science. They found, I am glad to say, that 45% of those people thought that science does more good than harm and that only 11% thought it does more harm than good; to be fair I should disclose that 38% of people thought that the good and the harm are about equal.

I am sorry to say that the New Scientist did not ask these people why we should bother about science, and so we must guess the answer, and for that reason I shall be very brief. I guess that in the minds of most people there would be no distinction between Science and Technology and that, with the exception of things which make very good TV such as the exploration of the Moon or the profile of Carl Sagan. they would see the principal value of modern science to be the good things which it has brought – better health, faster and easier travel and a wide variety of goods, services and entertainment such as ordinary people have never had before in history.

We may laugh at so-called primitive societies who build symbolic landing grounds in the hope that they will attract aircraft to appear out of the sky and bring goodies as they did in the last war; but we have our own Cargo Cult, Science, and the average member of the public knows about as much about the ideas behind science as the primitive, or should I say the “developing”, people know about the ideas behind the aircraft which brought them goodies in the war. Like Francis Bacon in the early 17th century, most people equate the value of science with its practical benefits; they value it for new things not for new ideas.

Now let's ask our question “Why bother about Science?” of the scientific community and see if we get a better answer. We do need a better answer and it must depend on a better understanding of what science is all about. Let us hope that we shall find that better understanding among scientists. although I can't forget what Gerald Holton, Professor of the History of Science at Harvard, wrote in his article on the “Mainsprings of Scientific Discovery”. He wrote: *“what seems to me to be most sensitive, the most fragile part of the total intellectual ecology of science is the understanding, on the part of scientists themselves, of the nature of the scientific enterprise”*

The scientific enterprise depends on three things; “the desire to know”, “the initiative to find out” and “the awareness to apply”. Your last speaker. the Hon. Barry Jones told us why we should encourage “the awareness to apply” and I am not going to say anything more about the importance of applied science; Mr. Jones has said it all. Lyndon Johnson once said of someone, “It's far better to have him inside the tent and pissing out, than outside the tent and pissing in”. We can, I feel sure, extend those generous sentiments to the Hon. Barry Jones.

On second thoughts I might remark that, according to that sacred oracle the OECD, the amount spent on R and D by Australian industry fell from 0.48% of the Gross National Product in 1968 to 0.21% in 1981. This is low by international standards and is going down. I do hope that Mr. Jones. although now bereft of Technology, can, unlike King Canute, turn the tide.

It is only too obvious that we need to encourage the “awareness to apply”, but why should we bother to encourage “the desire to know” and “the initiative to find out”? These qualities are, of course, as vital to applied science as they are to basic science but, not wishing to compete with Mr. Jones, I am going to talk about them, together, only in so far as they are the driving force behind basic science, or if you prefer that ridiculous phrase, “pure” scientific research.

As a member of the Australian Grants Committee for several years, I well remember how some journalists enjoyed themselves poking fun at some of the projects which we supported. They took it to be self-evident that research which cannot be seen to be useful, by someone who knows nothing about science, is a waste of public money. How should we have answered them? Why should we encourage and support basic research much of which, to the layman, looks to be useless?

The answers to this old question can be found in innumerable reports. They can be divided conveniently into two categories, the arguments that science is ornamental and the arguments

that it is useful. The ornamental arguments picture the pursuit of pure science as a feature of a “high civilisation” like music and painting. To quote from the fairly recent Report of the Royal Commission on Australian Government Administration (1976):

“Like the arts Science is one of the graces of life, and its presence as an aspect of a particular society is seen as a mark of civilisation commanding respect from other societies. Since this activity can no longer be by the wealthy amateur, a civilised community will, it is argued, properly support it”.

This high-minded paragraph, I am glad to say, was not written by the scientists advising that Commission. It reminds me of the reasons which have sometimes been given for supporting a useless and decadent aristocracy. I can hardly imagine a worse argument for the support of science by a government which contains very few people who seem to be even interested in science.

It is one of the paradoxes of our time that we should be governed by a bunch of people most of whom seem to know very little about science – and yet modern science is, I would say, the major achievement of the present century and one of the principal forces shaping our world. In fact I know of only one legislative body in the world where you could hear a well-informed discussion of a scientific question and that is the House of Lords. By-the-way I am not complaining that our parliamentarians don’t know a lot of science; I am complaining that they know very little about science – which is quite a different thing.

This brings us to a much more robust reason for supporting basic research – that in the long term it is useful. In its classic form this argument tells us that the only difference between basic and applied research is one of time scale. All knowledge, however apparently useless, eventually results in a better mouse trap. This is an argument of which we astronomers make considerable use when we are looking for money. The study of the Sun, so we say, has led to an understanding of the process of nuclear fusion, and in the long run will give us a new source of unlimited power for our power stations.

On a more local level my own Department of Astronomy has proved its usefulness to Australia Post, an organisation which surely needs all the help it can get. Only the other day one of our lecturers was hailed by the postman who was changing the little notice on the post-box which tells us when the next collection will be, “Hi, mate!”, he called across the road, “can you tell me which is A.M. and which is P.M.? I can never remember”. I am proud to say that our lecturer knew the answer.

The classical and most solid argument for basic research is that it is the seed corn of the future practical benefits which will flow from applied science, and it is our responsibility as scientists to put this argument over to the public and to the Government as clearly as possible – much more clearly than we do at present. To do that we need to trace the connections between basic scientific research and the progress of applied science.

Painful and paradoxical as it may seem to the tidy-minded people who would like to plan basic research, the popular, often self-righteous demand that all research should be relevant to our social needs is one of the greatest dangers to the advance of science, and hence to the long term satisfaction of those social needs. Indeed it is a hard historical fact that the future needs of our society have been well served in the past by research which was not constrained by those very needs. To insist on relevance in research is like insisting on naturalism in art; you end up with something comfortably familiar but not new.

Appoint a committee of eminent and concerned persons who know all about what society needs – not difficult to find and very little about science – also not difficult to find – and give them the job of dispensing funds for basic research – and what will they do? The most likely thing – as happened quite recently in Australia – is that they will put the funds largely into medical research. What could be more important to the community than to seek a cure for cancer? In giving money to medical research – with the best possible intentions – they can be sure that they are “doing the right thing” as we are told to do by the slogan on our rubbish bins.

What is wrong with that? Quite simply that history of science suggests that if you want to make a significant advance in medical science you should give the money to someone who is not working on medical science. In actual fact many of the major advances in medical science in the last 100 years, such as the discovery of X-rays and our understanding of cellular and molecular biology, have come from people who were not concerned with medical problems at all. Advances in molecular biology, which have greatly advanced our understanding of cancer, were made by physicists who in turn depended on advances in computing and applied mathematics. An understanding of the cause and cure of cancer may well come from some study which is apparently remote from medicine.

What the scientists are telling us is that the progress of applied science depends upon the progress of basic science and that, although relevance may be a good guide to applied research, it is a poor guide to basic research. Science advances on a side frontier and we can only make very limited advances on a narrow part of that frontier. When we bother about the health of basic science we must bother about the health of all science.

As this is a gathering of scientists and not a grant-giving agency may I end my talk by giving very briefly some of the answers which I, personally, would give to the question – why bother about science? As far as I am concerned the answers which we have given so far are the practical answers which we must use to enlist support for science; I believe that they are only a part of the whole story.

May I first add to the reasons for not constraining basic research by its relevance to our immediate social needs. My argument is unlikely to impress anyone who is actually responsible for funding basic research, but it impresses me. Copernicus removed the Earth from the centre of our picture of the Universe, but he didn't remove us; we still see ourselves firmly in the centre of the stage and nature as being there to serve our needs. One of the dangers of taking that view is that in planning our attempts to understand the Universe we are apt to forget that it may not have been designed with our welfare in mind, and that it is advisable to investigate it on its own terms and not in terms of its relevance to our own very limited concern with the practical application of what we discover. We must be guided more by the internal logic of science than by the external logic of our own needs.

Modern physics has show us that nature is very, very queer, even alien, and modern astronomy has shown us that the Universe is so vast that it is difficult to believe that it can all have been made for our benefit. I saw Mr. Universe on the telly the other night, Mr. Universe mark you, not Mr. Solar System; let us hope that on some other planet God has done better. As J.B.S. Haldane once said:

“The Universe may not be only queerer than we suppose, it may be queerer than we can suppose”.

We cannot, I believe, limit our interest in nature, nor the questions which we ask of her, to things which we expect to be useful.

I should also like to enlarge the argument that science is useful, because I do not believe that what is arguably the dominant influence on modern culture should be valued mainly for its utility. As I see it, the principal function of science in our society is not to produce goodies, but to show us the world as it is and not as we would prefer or imagine it to be. Science is our essential link with reality and if we fail to maintain that link then there is no longer any “nature’s truth”, there is only “your truth” and “my truth”, and we are in danger of losing the distinction between fact and fiction, and between science and magic.

Francis Bacon said, “God forbid that we should give out a dream of our imagination for a pattern of the world”. History shows us how true that is. We have only to look at the ideas of the Aztecs about the need of the Sun to be sustained by human sacrifice, or, nearer our time at the racial theories of the Nazis, to see what can happen if our conjectures about the nature of the world lose touch with reality.

The point which I want to make is that it is the new understanding, the new perspectives, the new ideas and the distinctive values which science brings to our society which are really of much greater value to us than many of the practical applications for which most of us value science. Our modern understanding of the genetic code and the mechanism of inheritance is a profound advance in our understanding of living creatures; our modern vision of the world seen in the completely new perspective of time given us by the theory of evolution, and in the completely new perspective of space given us by the discovery of the realm of the galaxies, is of profound importance to our ideas about our place in the Universe and so to our ideas about the meaning and purpose of life. To be reminded, by the sheer scale of the Universe, that man is not the measure of all things is, I suggest, a good thing, especially in a largely irreligious society.

The ideas of modern physics, for example the new ideas about causality and about uncertainty brought to us by the quantum theory, are of the greatest interest to philosophy, a subject which could well do with some fresh ideas. The values of science, which are encouraged by the actual practice of scientific research, such as intellectual honesty and international collaboration, are also important to society. For instance, let me remind you that one of the major dangers to any civilisation is that it should become credulous, and that the antidote to credulity is scepticism. Organised scepticism, so Robert Merton tells us in his classic study of the sociology of science, is one of the major values of science. Indeed the first commandment of science is to value the “truth of fact”.

To sum up, a knowledge of what actually is in this mysterious world is central to the discussion and solution of all our major problems, and is essential to any wise vision of a better world. To seek that knowledge, and in so doing to cultivate the pursuit of the “truth of fact”, is in my view the most cogent reason for bothering about science.

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