

SCIENCE AND HUMAN VALUES

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Should scientists be concerned with the ethical issues and the social impact of their work? Should they accept responsibility for the human and environmental consequences of scientific research?

Those questions did not arise in the distant past, because there hardly were such consequences. In those days science had no role in the day-to-day life of people, or - with a few exceptions, such as Archimedes and Leonardo da Vinci - in the security of states. Science was largely the pursuit of gentlemen of leisure. They would collect plants or fossils; they would gaze at the sky and note unusual events. There was no Internet then, and so they communicated their observations to other gentlemen with similar hobbies at gatherings of a social character, a sort of salon entertainment. The impulse for those pursuits was sheer curiosity - the same that drives scientists today - with no explicit practical aims.

In course of time, science began to be taken up as a full-time profession; learned societies and academies of science were established, with highly exclusive memberships, and this widened even further the detachment of scientists from society. When the Royal Society - which is now the national academy of sciences in the UK - was formed 343 years ago, one of its founders, the famous physicist Robert Hooke, stipulated that the Society “*should not meddle in Divinity, Metaphysics, Moralls, Politicks, Grammar, Rethorick or Logick*”.

The detachment of scientists from general human affairs led them to build an ivory tower, in which they sheltered, pretending that their work had nothing to do with human welfare. The aim of scientific research - they asserted - was to understand the laws of nature; since these are immutable and unaffected by human reactions and emotions, these reactions and emotions had no place in the study of nature.

Arising from this exclusivity, scientists evolved certain precepts about science to justify the separation from reality. These precepts included: “*science for its own sake*”; “*scientific inquiry can know no limits*”; “*science is rational and objective*”; “*science is neutral*”; “*science has nothing to do with politics*”; “*scientists are just technical workers*”; “*science cannot be blamed for its misapplication*”.

The ivory tower mentality was perhaps tenable in the past, when a scientific finding and its practical application were well separated in time and space - the time interval between an academic discovery and its technical application could be of the order of decades, and it would be

implemented by different groups of scientists and engineers. Pure research was carried out in academic institutions, mainly universities, and the scientists employed in these institutions usually had tenure; they were not expected to be concerned about making money from their work. Taking out of patents occurred very seldom and was generally frowned upon. This enabled academic scientists working in universities to absolve themselves from responsibility for the effects their findings might have on other groups in society

On the other hand, the scientists and technicians who worked on the applications of science were mainly employed by industrial companies whose chief interest was financial profit. Ethical questions about the consequences of the applied research were seldom raised by the employers, and the employees were discouraged from concerning themselves with these issues.

All this has changed. The picture that I have presented is so much different from current practices in science that we may as well speak of being in a different world.

The tremendous advances in pure science, particularly in physics, during the first part of the 20th century, and in biology, during the second half, have completely changed the relation between science and society. Science has become a dominant element in our lives. It has brought great improvements in the quality of life, but also grave perils: pollution of the environment, squandering of vital resources, increase in transmittable diseases, and above all, a threat to the very existence of the human species on this planet through the development of nuclear weapons.

An important outcome of the change of emphasis in scientific research is the narrowing of the gap between pure and applied science. In many areas this distinction has become very difficult to discern. What is pure research today may find an application tomorrow and become incorporated into the daily life of the citizen next week (or even earlier if it has military value). Scientists can no longer claim that their work has nothing to do with the welfare of the individual or with state politics.

I said that scientists cannot make such claims; alas, many of them do. Amazingly, many scientists still cling to the ivory tower mentality, they still advocate a *laissez faire* policy for science. Their logic rests mainly on the distinction between pure and applied science. It is the application of science that can be harmful, they claim. As far as pure science is concerned, the only obligation on the scientist is to make the results of research known to the public. What the public does with them is its business, not that of the scientist.

At the present time, when the distinction between pure and applied science is largely non-existent, such an *amoral* attitude is unacceptable. Indeed, it is - in my opinion - an *immoral* attitude, because it eschews personal responsibility for the likely consequences of one's actions.

We live in a world community with ever greater interdependence; an interdependence due largely to technical advancement arising from scientific research. An interdependent community offers great benefits to its members, but by the same token it imposes responsibility on them. Every citizen has to be accountable for his or her deeds; we all have a responsibility to society, and this

includes scientists who are first and foremost citizens. Indeed, this responsibility weighs particularly heavily on scientists precisely because of the dominant role played by science in modern society. Scientists understand the technical problems better than the average politician or citizen, and knowledge brings responsibility.

The fulfilment of the social responsibility of scientists calls for certain measures to be taken. I would like to suggest a few concrete measures, but let me first recapitulate the purpose of science.

While the main purpose is simply to push forward the frontiers of knowledge, this pursuit should contain an element of utility, namely, benefit to the human community. In this respect I find a statement made nearly 400 years ago by Francis Bacon, fully applicable to the present time.

“I would address one general admonition to all: that they consider what are the true ends of knowledge, and that they seek it not either for pleasure of the mind, or for contention, ... but for the benefit and use of life ... that there may spring helps to man, and a line and race of inventions that may in some degree subdue and overcome the necessities and miseries of humanity”.

If Bacon was speaking today, he would probably add: “... and to avert the dangers to humanity created by science and technology.”

These desiderata should be expressed in an ethical code of conduct for scientists, and formulated in some sort of a Hippocratic Oath. An ethical code of conduct for medical practitioners has been in existence for nearly two and a half millennia. In those days - and still today - the life of a patient was literally in the hands of the doctor, and it was essential to ensure that the doctor would wield his power responsibly, with the care of the patient being his foremost duty. Hence the Hippocratic Oath taken by doctors when they qualify.

Nowadays, scientists can be said to have acquired a somewhat similar position in relation to humanity. The time has thus come for some kind of oath, or pledge, to be taken by scientists, particularly when receiving a degree in science. At the least, it would have an important symbolic value, but it might also generate awareness and stimulate thinking on the wider issues among young scientists.

Various formulations of oaths, to suit specific conditions, have been suggested and introduced by some professions. Some are long and detailed, some short and general. An example of the latter is the oath adopted by the European Physical Society:

“In all my scientific work I will be honest and I will not do anything which in my view is to the obvious detriment of the human race.

If, later, I find that my work is being used – in my view – to the detriment of the human race, I will endeavour to stop these developments.”

In this formulation, the scientist undertakes not only to refuse to work on projects harmful to society,

but to take action to stop such research going on.

A somewhat different approach is taken in the oath for Scientists, Engineers and Technologists, suggested by the Institute for Social Inventions:

*“I vow to practise my profession with conscience and dignity;
I will strive to apply my skills only with the utmost respect for the well-being of
humanity, the earth and all its species;
I will not permit considerations of nationality, politics, prejudice or material
advancement to intervene between my work and this duty to present and future generations;
I make this Oath solemnly, freely and upon my honour.*

A formulation suitable for young scientists to be taken at graduation has been adopted by the Student Pugwash Group in the United States. This Pledge, already taken by thousands of young scientists in several countries, reads:

“I promise to work for a better world, where science and technology are used in socially responsible ways. I will not use my education for any purpose intended to harm human beings or the environment. Throughout my career, I will consider the ethical implications of my work before I take action. While the demands placed upon me may be great, I sign this declaration because I recognize that individual responsibility is the first step on the path to peace”.

It should be noted that the Pledge refers to harm to the environment, as well as to human beings, that may result from science and technology.

There is the need for action to persuade universities to introduce a Pledge at science degree ceremonies. As a step towards this, the university curriculum should include courses of lectures on the ethical aspects of science.

While it is very important that new entrants into a scientific career become aware of their social responsibilities, it is also important that senior scientists acknowledge their own awareness of such responsibilities. For this purpose, I suggest that national academies of sciences (or corresponding bodies in countries where there are no academies), should explicitly include ethical issues in their terms of reference. The charters of some academies already contain clauses that allow them to be concerned with the social impact of scientific research. But I would like to see these clauses made mandatory; there should be explicit statements that ethical issues are an integral part of the work of scientists.

As a follow up to this general commitment, I suggest a specific task for the academies: the setting up of ethical committees - another practice borrowed from medicine.

In many countries, a research project that involves patients has to be approved by the ethical committee of the hospital, to ensure that the investigation will not put the patient's health and welfare at a significant risk. This practice should be extended to research work in general, but

perhaps, in the first instance, to genetic engineering, an area of research which has a direct impact on the health of the population.

I suggest that ethical committees, composed of eminent scientists from different disciplines, should be set up for the task of examining potentially harmful long-term effects of proposed research projects. Such projects have normally to be reviewed for other reasons - for scientific merit, for budget justification, for compatibility with other projects, etc. To these I would add ethical considerations and possible harmful applications. The assessment for this could be carried out in parallel with the other assessments, and therefore would not cause a significant delay. The ethical committees should work under the auspices of the national academies of sciences in the country, but it would be essential for the criteria used in the assessment of projects to be agreed internationally, so that the same standards are applied everywhere. The International Council for Science (ICSU) seems to be the appropriate organization to co-ordinate the task. In some countries ethical vetting is already carried out by formal or informal bodies, but there is the need for general acceptance and for an implementation mechanism, and this is where ICSU should come in.

Two other aspects of ethics in science, seemingly contradictory, need to be examined: whistle-blowing and irresponsible publication.

The first follows directly from the social responsibility of scientists. If in the course of work in a governmental or private situation, a scientist becomes aware of an undisclosed application that is being developed which could result in harm to society, it should be their duty to disclose it to relevant authorities, or, if need be, to the general public, so that steps can be taken to prevent the damage. Indeed, whistle-blowing should become part of the scientist's ethos.

At present, this practice is rather dangerous: the whistle-blower is subject to reprisals, dismissal from their job, or even more severe punishment. The most extreme case is that of Mordechai Vanunu, the Israeli technologist. When he found out that the Dimona plant where he worked was actually engaged in a clandestine project to produce plutonium for nuclear weapons, he resigned from his post, and brought to the notice of the world the true situation. For this he was sentenced to 18 years imprisonment, most of it in solitary confinement. There is an urgent need for some sort of legislation to provide immunity to whistle-blowers.

Seemingly opposite is the practice whereby some scientists publish results of research, that are based on insufficient data or erroneous interpretation but which may have an impact on society. Sometimes such publication is not through a scientific journal, where it would have had to pass peer review, but directly in a release to the media. The public generally tends to believe in sensational findings, and it may lead to a great deal of suffering. The worst case is when the scientist concerned persists with his findings, even when they are shown to be false, in further, more thorough, investigations.

The way to deal with this is perhaps by borrowing another practice from medicine. The medical profession usually has a body – for example, the General Medical Council in England – which has the power to stop a doctor found guilty of professional misconduct, to withdraw the

license to practice. Something similar should perhaps be instituted in scientific practice.

Among the negative aspects of scientific research is the extent to which it has become motivated by financial gain. Frequently, this works against one of the main postulates of scientific research: that results of research are available to everybody. The financial promoters of research projects, particularly in the pharmaceutical industry, tend to impede the publication of findings, either prohibiting publication altogether or adding considerable delay. The whole practice of patenting scientific findings goes against a basic tenet of science; it also affects the pursuit of science by exacting payment for the use of essential materials, or the technology covered by patent rights. To overcome these inequities, action should be initiated, such as banning the granting of patents for certain results of scientific research, particularly on basic materials, such as genes. A radical solution would be to buy out the patents on findings that directly or indirectly affect human health.

Secrecy in scientific research for the financial profit of a commercial company is only one aspect of a multi-faceted problem. Another is secrecy imposed by scientists themselves, in the pursuit of a Nobel Prize, for example, to safeguard against other scientists stealing their ideas or techniques. This too may cause a delay in the publication of results and thus be an impediment to scientific progress. It is an ethical issue which scientists have to tackle.

However, the worst aspect of secrecy is that imposed by governments in national research laboratories, such as Los Alamos or Livermore in the USA, Chelyabinsk or Arzamas in Russia, Aldermaston in the UK, etc. Many thousands of scientists are still employed in these establishments doing pure and applied research for specific purposes, purposes that I see as the negation of scientific pursuit: the development of new, or improvement of old weapons of mass destruction. Among these thousands there may be some scientists who are motivated by considerations of national security. The vast majority, however, have no such motivation; in the past they were lured into this work by the siren call of rapid advancement and unlimited opportunity. Theodore Taylor, one of the chief designers of the atom bomb in Los Alamos, said

“The most stimulating factor of all was simply the intense exhilaration that every scientist and engineer experiences when he or she has the freedom to explore completely new technical concepts and then bring them into reality”.

What is going on in these laboratories is not only a terrible waste of scientific endeavour but a perversion of the noble calling of science. It should not be tolerated.

The Nobel Laureate Hans Bethe, one of the most senior living physicists, and one-time leader of the Manhattan Project, said:

“Today we are rightly in an era of disarmament and dismantlement of nuclear weapons. But in some countries nuclear weapons development still continues. Whether and when the various Nations of the World can agree to stop this is uncertain. But individual scientists can still influence this process by withholding their skills.

Accordingly, I call on all scientists in all countries to cease and desist from work creating, developing, improving and manufacturing further nuclear weapons - and, for that

matter, other weapons of potential mass destruction such as chemical and biological weapons”.

I would like to see an endorsement of this call by the scientific community. I will go further and suggest that the scientific community should demand the elimination of nuclear weapons and, in the first instance, request that the nuclear powers honour their obligations under the Non-Proliferation Treaty.

Let me in conclusion, remind you that the theme of my speech was science and human values. The basic human value is life itself; the most important of human rights is the right to live. It is the duty of scientists to see to it that, through their work, life will not be put into peril, but will be made safe and its quality enhanced.