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Is Science Dangerous?

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The idea that scientific knowledge is dangerous is deeply embedded in Western culture. Adam and Eve were forbidden to eat from the Tree of Knowledge, and in "Milton's Paradise Lost" the serpent addresses the Tree as the 'Mother of Science'. Indeed the whole of Western literature has not been kind to scientists and is filled with images of scientists meddling with nature with disastrous results. Just consider Shelley's Frankenstein, Goethe's Faust, and Huxley's Brave New World. One will search with very little success for a novel in which scientists come out well - the persistent image is that of scientists as a soulless group, unconcerned with ethical issues. And where is there a movie sympathetic to science? Scientists are perceived as middle-aged, emotionally impaired, and dangerous males.

Technology is not science

Yet, reliable scientific knowledge is value-free and has no moral or ethical value. Science tells us how the world is. That we are not at the centre of the universe is neither good nor bad, nor is the possibility that genes can influence our intelligence or our behaviour. Dangers and ethical issues only arise when science is applied as technology. However ethical issues can arise in actually doing the scientific research, such as doing experiments on humans or animals, as well as issues related to safety

The problem is the conflation of science and technology. The distinction between science and technology, between knowledge and understanding on the one hand, and the application of that knowledge to making something, or using it in some practical way, is fundamental. Science produces ideas about how the world works, whereas the ideas in technology result in usable objects. Technology is much older than anything one could regard as science and unaided by any science,

technology gave rise to the crafts of early humans, like agriculture and metalworking. Science made virtually no contribution to technology until the 19th century. And even the great triumphs of engineering like the steam engine and Renaissance cathedrals were built without virtually any impact of science. It was imaginative trial and error. It is technology that carries with it ethical issues, from motorcars to polluting the environment, and the weapons of war.

But are scientists for the applications of science? In a recent issue of the journal *Science* the 1995 Nobel Peace Prize laureate, Sir Joseph Rotblat, proposes a Hippocratic oath for scientists. He is strongly opposed to the idea that science is neutral and that scientists are not to be blamed for its misapplication. Therefore he proposes an oath, or pledge, initiated by the Pugwash Group in the United States. "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 might be great, I sign this declaration because I recognise that individual responsibility is the first step on the path to peace."

These are indeed noble aims to which all citizens should wish to subscribe, but it does present some severe difficulties in relation to science. Rotblat does not want to distinguish between scientific knowledge and its applications, but the very nature of science is that it is not possible to predict what will be discovered or how these discoveries could be applied. Cloning provides a nice example. The original studies related to cloning were largely the work of biologists in the 1960s. They were studying how frog embryos develop and wanted to find out if genes, which are located in the cell nucleus, were lost or permanently turned off as the embryo developed. It was incidental to the experiment that the frog that developed was a clone of the animal from which the nucleus was obtained. The history of science is filled with such examples.

The poet Paul Valery's remark that 'We enter the future backwards' is very apposite in relation to the possible applications of science. Scientists cannot easily predict the social and technological implications of their current research. It was originally argued that radio waves would have no practical applications and Lord Rutherford said that applications of atomic energy was moonshine. There was again, no way that those investigating the ability of certain bacteria to resist infection by viruses would lead to the discovery of restriction enzymes, an indispensable tool

for cutting up DNA, the genetic material which is fundamental to genetic engineering.

Social obligation of scientists

The social obligations that scientists have as distinct from those responsibilities they share with all citizens, such as supporting a democratic society and taking due care of the rights of others, comes from them having access to specialised knowledge of how the world works not being easily accessible to others. Their obligation is to both make public any social implications of their work and its technological applications, and to give some assessment of its reliability. In most areas of science, it matters little to the public whether a particular theory is right or wrong, but in some areas such as human and plant genetics, it matters a great deal. Whatever new technology is introduced, it is not for the scientists to make the moral or ethical decisions. They have neither special rights nor skills in areas involving moral or ethical issues. There is in fact, a grave danger in asking scientists to be more socially responsible if that means that they have the right and power to make such decisions on their own. Moreover, scientists rarely have power in relation to applications of science; this rests on those with the money - industry and government. The way scientific knowledge is used raises ethical issues for everyone involved, not just scientists.

It is not easy to find examples of scientists as a group behaving immorally or in a dangerous manner - BSE is not an example - but the classic was the eugenics movement. The scientific assumptions behind this proposal are crucial; the assumption is that most desirable and undesirable human attributes are inherited. Not only was talent perceived as being inherited, but so too were pauperism, insanity and any kind of so-called feeblemindedness. They completely failed to give an assessment of the reliability of their ideas. Quite to the contrary, and even more blameworthy, their conclusions seem to have been driven by what they saw as the desirable social implications. By contrast in relation to the building of the atomic bomb, the Allied scientists behaved morally and fulfilled their social obligations by informing their governments about the implications of atomic theory. The decision to build the bomb was taken by politicians, not scientists, and it was an enormous engineering enterprise. Had they decided not to participate in building an atomic weapon that could have led to losing the war. Should scientists on their own ever be entitled to make such decisions?

Genetics and cloning

Mary Shelley would be both proud and shocked. Her creation of a scientist creating and meddling with human life has become the most potent symbol of modern science. But shocked because her brilliant fantasy has become so distorted that even those who are normally quite sensible lose all sense when the idea of cloning humans appears before them. The image of Frankenstein has been turned by the media into genetic pornography, whose real aim is to titillate, excite, and frighten. The bio-moralists are triumphant with the aid of genetic pornography to titillate and frighten, purveyed by the media.

Ironically, the real clone of sheep has seen the media blindly and unthinkingly following each other - how embarrassed Dolly ought to be. The moral masturbators have been out in force telling us of the horrors of cloning. Jeremy Rifkin in the USA demanded a world wide ban and suggests that it should carry a penalty "on a par with rape, child abuse and murder." Many others, national leaders included, have joined in that chorus of horror. But what horrors? What ethical issues? In all the righteous indignation, I have not found a single relevant new ethical issue spelled out.

It seems distasteful, but the 'yuck' factor is however not a reliable basis for making judgments. There may be no genetic relation between a mother and a cloned child, but that is true of adoption and cases of IVF. Identical twins, who are a clone are not uncommon, and this upsets no one except the hard stressed parents. What fantasy is it that so upsets people? Say that one could clone Richard Dawkins, who seems to quite like the idea, how terrible would that be? While genes are very important, so is the environment, and since his whole upbringing would be completely different and he might even have a religious disposition - clones might make very rebellious children. Indeed the feelings that a cloned child might have about its individuality must be taken into account. However, this is an issue common to several other types of assisted reproduction such as surrogate mothers and anonymous sperm donors. I am against cloning as it carries a high risk of abnormalities. Those who propose to clone a human are medical technologists not scientists.

The really important issue is how the child will be cared for. Given the terrible things that humans are reported to do each other and even to children, cloning should take a very low priority in our list of anxieties. Or perhaps it is a way of displacing our real problems with unreal ones. Having a child raises real ethical problems as it is parents who play God,

not scientists. Here lies a bitter irony. A parent's relation to a child is infinitely more God-like than anything that scientists may discover. Parents hold tremendous power over young children. They do not always exercise it to the child's benefit.

In regard to therapeutic cloning for stem cells, for example, I find the ethical discussions hard to follow. They are based on the false view that the fertilised egg is a human being. Would one not rather accept a thousand abortions and the destruction of all unwanted frozen embryos than a single unwanted child who will be neglected or abused? I take the same view in regard to severely crippling and painful genetic diseases. On what ground should parents be allowed to have a severely disabled child when it could be relatively easily prevented by prenatal diagnosis? It is nothing to do with consumerism but the interests and rights of the child.

It is not, as the bio-moralists claim, that scientific innovation has outstripped our social and moral codes. Just the opposite is the case. Their obsession with the life of the embryo has deflected our attention away from the real issue, which is how the babies that are born are raised and nurtured. The ills in our society have nothing to do with assisting or preventing reproduction but are profoundly affected by how children are treated. Children that are abused grow up to abuse others.

So what dangers does genetics and embryo research pose? Bioethics is a growth industry but one should regard the field with caution as the bioethicists have a vested interest in finding difficulties. Moreover, it is hard to see what contribution they have made. Some of these common fears are little more than science fiction at present, like cloning enormous numbers of genetically identical individuals. Who would the mothers be, and where would they go to school? In fact it is quite amusing to observe the swing from moralists who deny that genes have an important effect on behaviour to saying that a cloned individual's behaviour will be entirely determined by the individual's genetic make-up. Gene therapy, introducing genes to cure a genetic disease like cystic fibrosis carries risks as does all new medical treatments. There may well be problems with insurance and testing, but are these any different from those related to someone suspected of having AIDS? Anxieties about designer babies are at present premature as it is far too risky, and we may have, in the first instance, to accept what Ronald Dworkin has called procreative autonomy, a couple's right 'to control their own role in procreation unless the state has a compelling reason for denying them that control'.

One must wonder why the bio-moralists do not devote their attention to other technical advances like that convenient form of transport which claims over fifty thousand killed or seriously injured each year. Could it be that in this case they themselves would be inconvenienced? Embryology and genetics, in striking contrast, have not harmed anyone.

Should the so-called ethical issues relating to the applications of genetics, for example, lead to stopping research in this field? The individual scientist cannot decide for a science like genetics is a collective activity with no single individual controlling the process of discovery. I regard it as ethically unacceptable and impractical to censor any aspect of trying to understand the nature of our world.

Politicians and politics

John Carey, a professor of English in Oxford, in his introduction to the Faber Book of Science writes: "The real antithesis of science seems to be not theology but politics. Whereas science is a sphere of knowledge and understanding, politics is a sphere of opinion." He goes on to point out that politics depends on rhetoric, opinion, and conflict. It also aims to coerce people. Politics, I would add, is also about power and the ability to influence other people's lives. Science, ultimately is about consensus as to how the world works and if the history of science were rerun, its course would be very different but the conclusions would be the same – water, for example, would be two hydrogens combined with one oxygen and DNA the genetic material, though the names would not be similar.

There are surveys that show some distrust of scientists particularly those in government and industry. This probably relates to BSE and GM foods and so one must ask how this in fact affects people's behaviour. I need to be persuaded that many of those who have this claimed distrust would refuse, if ill, to take a drug that had been made from a genetically modified plant or would reject a tomato so modified that is was both cheap and would help prevent heart disease. Who refuses insulin or growth hormone because it is made in genetically modified bacteria? It is easy to be negative about science if it does not affect your actions.

Cloning of a human raises no new ethical issues, and should be opposed on the ground of the risk of the child developing abnormally. Therapeutic cloning to make stem cells that could provide tissues to replace damaged organs without the increased risk of immune rejection raises no such problems. No politician has publicly pointed out or even understood that the so-called ethical issues involved in therapeutic cloning are

indistinguishable from those that are involved in *in vitro* fertilisation, IVF. One could even argue that IVF is less ethical than therapeutic cloning. But no reasonable person could possibly want to ban IVF that has helped so many infertile couples. Where are the politicians who will stand up and say this?

Science and society

Genetically modified foods have raised extensive public concerns and there seems no alternative but to rely on regulatory bodies to assess their safety as they do with other foods, and similar considerations apply to the release of genetically modified organisms. Genetic engineering requires considerable scientific and technical knowledge and even more important money, which scientists in general do not have. Indeed, for the public sector, the applications of genetics and molecular biology can open up difficult choices because such applications are expensive

New medical treatments, requiring complex technology, cannot be given to all. There has to be some principle of rationing and this really does pose serious moral and ethical dilemmas much more worthy of consideration than the dangers posed by genetic engineering.

Are there areas of research that are so socially sensitive that research into them should be avoided, even proscribed? One possible area is that of the genetic basis of intelligence and particularly the possible link between race and intelligence. Are there then, as the literary critic George Steiner has argued, 'certain orders of truth which would infect the marrow of politics and would poison beyond all cure the already tense relations between social classes and these communities'? In short, are there doors immediately in front of current research, which should be marked 'Too dangerous to open'? I realise the dangers, but I cherish the openness of scientific investigation too much to put up such a notice. I stand by the distinction between knowledge of the world and how it is used. So I must say 'No' to Steiner's question. Provided of course that scientists fulfil their social obligations. The main reason is that the better understanding we have of the world, the better chance we have of making a just society, the better chance we have of improving living conditions. One should not abandon the possibility of doing good by applying some scientific idea because one can also use it to do bad. All techniques can be abused and there is no knowledge or information that is not susceptible to manipulation for evil purposes. I can do terrible damage to someone with my glasses used as a weapon. Once one begins to censor the acquisition of reliable scientific knowledge, one is on the most slippery of slippery slopes.

To those who doubt whether the public or politicians are capable of taking the correct decisions in relation to science and its applications, I strongly commend the advice of Thomas Jefferson. 'I know no safe depository of the ultimate powers of the society but the people themselves, and if we think them not enlightened enough to exercise that control with a wholesome discretion, the remedy is not to take it from them, but to inform their direction.' But how does one ensure that the public is involved in decision making? How can we ensure that scientists, doctors, engineers, bio-ethicists and other experts, who must be involved, do not appropriate decision making for themselves? How do we ensure that scientists take on the social obligation of making the implications of their work public? We have to rely on the many institutions of a democratic society: parliament, a free and vigorous press, affected groups, and the scientists themselves.