Education and the compleat scientist

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Teaching and Learning about Science and Society. By John Ziman. Pp.190. ISBN 0-5212-3221-X. (Cambridge University Press: 1980.) £9.50, $22.50.

MOST scientists are interested in scientific education, if only for the memory of their own debt to it. I imagine that a great many became scientists because they were lucky enough to have an inspiring teacher. My own at Marlborough College was A. G. Lowndes, a remarkable man who trained several Fellows of the Royal Society and a Nobel Prize Winner (Peter Medawar). He inspired us by his own somewhat amateur researches, he showed us endless living things and, by making us work even in our spare time, taught us that all science involves much hard work.

These are perhaps the main items that must be included in any scientific education: it must catch enthusiasm, it must cover a huge mass of facts and it must find out those who can enjoy learning a lot of detail. This is how scientists are made, but in the process they seldom learn much about the position of science in society, still less about its history or philosophy.

It is these defects that are the particular concern of Professor Ziman as indicated by the title of his book. I cannot remember ever hearing them discussed by my teachers either at school or university. Probably many scientists still take up their subject because they are interested and like it, though there is now more concern about its social implications. They are all too liable to fall into what Ziman calls "scientism and technocracy", the uninformed assumption that everything that is done in the name of science is good. How can this restriction of the development of young scientists be avoided? Ziman has tried to encapsulate the problem under the acronym STS — Science, Technology and Society. These themes permeate the political, economic and cultural issues of our times yet "there is no *rationale* of STS as an educational subject", although various courses of study of it have been tried. In trying to provide this rationale Ziman manages to stimulate thoughts about a great many fundamental questions, even beyond those dealing with the educational problem itself.

For instance, one feels that the discussion obviously needs a definition of science, and many times Ziman seems on the point of providing one, but wisely never comes down to calling it a definition. Sometimes it is a question of method: "Science derives its practical power and authority from the rigours of its arguments and the hardness of its facts". Moreover, he repeatedly stresses that the production of scientific knowledge is a social process. Then only a page later we are in a different world of discourse: "There is no single 'scientific' map of reality — or if there were, it would be much too complicated and unwieldy to be grasped or used by anyone". Is this true? I suspect that Ziman doubts it himself. He pursues the question into a discussion of the hierarchy of scientific enquiry and the questions of emergence and reductionism,

> the notion that the properties of complex systems such as organisms or molecules can be 'reduced' to the laws satisfied by simpler systems such as cells or atoms — is not only a very dubious philosophy, it is a dangerous folly in science education, where the map appropriate to each level must be taught wholeheartedly according to its own lights

Yet probably most scientists have a hankering for that "folly". And is it indeed so foolish? It is true that chemistry and biology have their own laws but no one can go all the way in either of those sciences unless they know something about physics. However much "autonomy" there may be for each part of science there is still, at least for many of us, a scientific map or model of the world to which we try to refer all events and all knowledge, including the knowledge of ourselves. It seems that the human brain is so constructed that it tries to build all its information and schemes of action around a unified model. Of course this grows gradually in each one of us, centred at first around a parental scheme. The scientific model, if properly learned, can provide the adult substitute, which many people feel they lack in the absence of religion. That is of course not to say that science should be dogmatic or be treated as religion, but that it can provide what Ziman calls "the possibility of discovering order in nature" and to do this is a requirement for human life. We all need some system of order. Incidentally this is a characteristic specific to human beings and not present in our nearest relatives. Ziman actually recognizes this later in his book when he says that "scientific world pictures" allow "deductions that help us along the way through life".

This is only one of the ends that he believes could be achieved by the proper attention to STS education. He holds that they can only be reached by specifically designed courses for all levels of scientific education. In the later part of his book he discusses how these should be planned for different stages. He is against "General Science that is too sloppy and technical science that is too arbitrary", and he advocates a "valid science". This is easy enough to say until you come to the job of deciding what to put in and what to leave out. Ziman discusses the many ways in which it could be done. For instance, it can be through the social relevance and applications of science, through its possibilities as a vocation for the individual, or its history, or its philosophy or its value in solving world problems. But he does not try to specify the content of particular courses. His aim is to show that the teaching of science at present is grossly defective because it does not properly develop the understanding of the individual either of himself or society, or indeed of the nature of the science he is learning. His plea is that teachers of science should take definite steps to fill this gap by designing what he calls STS courses. He knows that there will be much opposition and anyone who has tried to introduce such courses will have experienced this. But there are many people ready to agree with his plea that a better understanding of the relations of science and society is needed for the proper training of research scientists as well as doctors and other technologists, not to mention civil servants, politicians and the general public. A major value of this interesting book is that it makes you realize how difficult it is to reach agreement either about the nature of science or its proper place in society.

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IQ gladiators in separate combat

Stuart Sutherland

Intelligence: The Battle for the Mind. H.J. Eysenck versus Leon Kamin. Pp.192. ISBN hbk 0-333-31279-1/0-471-08884-6; ISBN pbk 0-330-36399-4. (Macmillan Press, London/Wiley, New York/Pan: 1981.) Hbk £12, $12.95; pbk £2.95.

NATIVISTS have battled with empiricists for many years, but never with such fury as over the inheritability of intelligence. It might be thought that the issue could be resolved by bringing together representatives of the opposing sides and letting them argue out, point by point, the evidence for the respective roles of inheritance and of environment. *Intelligence: The Battle for the Mind* could have provided just such an opportunity, but unfortunately it is constructed in such a way that the combatants only skirmish and never meet in a decisive battle.

The book contains four sections. In the first, Professor Eysenck sets out his case for supposing that in Western society inheritance accounts for about 80% of the variation in intelligence. Although he does not enumerate them, he deploys 20 different lines of evidence from which he claims this inference can be drawn. In the second