BOOK REVIEWS

Duality of Science

Beyond the Ivory Tower : The Frontier of Public and Private Science. By Sir Solly Zuckerman. Pp. ix + 243. (Weidenfeld and Nicolson: London, November 1970.) 50*s*.

SIR SOLLY ZUCKERMAN has produced out of his experience both as a mammalian anatomist and as Chief Scientific Adviser to the British Government an intriguing account of the two faces of science. The first face is that of "private science", the way in which a scientist makes a discovery, demolishes a hypothesis, attempts to convince his colleagues; the second face is that of "public science", the role of a scientist as an adviser, the application of science to social needs, the way in which decisions about the use of applied science for national defence or economic growth have to be taken. Sir Solly is a distinguished practitioner in both fields and he believes that the two activities have different criteria of truth. Pure science is only concerned with objective truth; with the hypothesis whose predictions can be either verified or shown to be false. On the other hand, applied science, technology, science in the area of political judgments, requires decisions which involve subjective values (should we devote money and manpower to building a supersonic transport or should we devote the same effort to improving communications between properly sited airports and the capital? Should we spend money on geriatric research or on heart transplants?).

Sir Solly is of course quite right to stress the objective nature of "pure science" and the fact that scientists are weak, fallible creatures with appallingly subjective responses should not obscure this. The separation of "public" and "private" science is, however, perhaps not quite so clear to many of us as Sir Solly suggests. Some branches of basic science are now so expensive in national terms that scientists cannot be solely responsible for decisions about them. They can only be responsible within an overall budgetary framework. For a country of limited financial resources, such as Great Britain, decisions about spending on "Big Science" and "Little Science", pure science though both may be, will be political decisions. Questions such as "Can a nation like Great Britain afford to support basic research in high energy nuclear physics ?" have a subjective value judgment built into them.

Both parts of the book are controversial, the section on "Private Science" perhaps more so than Sir Solly realizes. This part consists of three stories, which illustrate what science is about and how it progresses, drawn from Sir Solly's own specialism. The first shows how an accepted scientific hypothesis was proved to be incorrect, and how Sir Solly demonstrated that the mammalian ovary at birth has a finite stock of egg cells which decline in numbers. The account illustrates pretty clearly how difficult it is to dislodge a mistake which has become sufficiently firmly embedded in the minds of scientists and in the scientific literature.

The second story relates Sir Solly's failure to dislodge a set of hypotheses on the mechanism by which the brain controls the pituitary gland. I found this example, for a non-biologist, pretty difficult to follow and too technical to judge the relative merits of the two sets of views. The third concerns the determination of the status of *Australopithecus* from a comparison of the fossil skulls and other remains that we have with those of man and of the great apes. It confirms a view I had held, that comparative anatomy is more of an art than a science; related more closely perhaps to an art expert's identification of a picture as a Vermeer than to the biochemist's process of classifying an enzyme as lysozyme. Sir Solly's account is particularly interesting because it catches the subject at the point where it is being converted from an art into a science, and quantification by means of multivariate analysis is replacing the intuitive assessment of experience.

The second half of the book is based on the thesis that decisions about the application of science to social needs must be made politically; here scientists have no more votes than any other group of citizens. Most scientists would, I feel sure, agree with this wholeheartedly and so I imagine would most thinking people. But scientists do have a very definite pedagogical duty. This is to make sure that the political decisions are made in the fullest and clearest knowledge of the scientific background involved and of its limitations. Scientific and technological forecasting is a chancy game because we cannot predict the changes likely in basic science. But even when we choose goals that can be achieved with currently available technology we lack, in a democratic society, the means of obtaining a public consensus if these goals are at all sophisticated. The population explosion is technologically controllable, but is, at least at present, politically unlikely. The health of the community could be improved and the incidence of lung cancer drastically reduced if we abandoned the cigarette, but we are incapable of even fully controlling cigarette advertising. It is not perhaps surprising that Sir Solly thinks that the quality of life may very well decline rather than improve in the years ahead.

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Critique of Pure Science

The Principles of Scientific Thinking. By R. Harré. Pp. viii + 324. (Macmillan : London, September 1970.) 90*s*.

HARRÉ points to those obstinate problems in the philosophy of science which surround induction and explanation and argues that they arise from fundamental mistakes—he calls them myths—shared by apparently diverse present day philosophies of science. The myths are most characteristic of logical positivism : those which do not derive from Hume derive from mathematical logic. Among them are Humean atomism : perception gives us knowledge of events occurring at one time and place from which no conclusions about events at other times and places can be deduced; positivism, that to be legitimate a concept must be verifiable in experience; deductivism, which is, in Harré's meaning, the view that there are no necessary connexions except those of deductive logic; and finally, a myth which he might have called verbalism : that scientific thought can be adequately expressed in language, without the aid of pictures and diagrams. Together these principles exclude from science all concern with the hidden constitution of things, yet to explain phenomena is, essentially, to show how they arise from the inner constitution of things, and the acceptability of a theory rests not only upon its conformity with experiment but upon whether it ascribes to things a plausible inner structure. "Those which command serious attention are just the theories which describe models which might be hypostatized to be the actual mechanisms of the nature and the real structure of things." Furthermore, Harré believes that a distinction between causal and accidental regularities can be made by reference to the inner structure of things : causal laws "describe the modes of generation or mechanisms of production of phenomena". In its claim to identify myths lying behind a received doctrine, the introduction to Harré's book bears a striking resemblance to that of Gilbert Ryle's book, *The Concept of Mind.* Perhaps the resemblance is not fortuitous, for the fault Ryle found with Descartes's theory was explanations in terms of occult mechanisms, whereas the fault Harré finds with today's philosophy of science is just the opposite. It forbids the possibility of genuine explanation by restricting science to what is not occult.

The defence of his views leads Harré into discussions of many fundamental problems of the philosophy of science. He is led to the view that nature must have a fundamental structure whose persistence without change demands no