

and it is sad that he has obscured his amusing travel notes with absurd scholarly claims. As a work of scholarship or a contribution towards the Atlantis problem, *Voyage to Atlantis* is entirely without value. As an "Ugly American" narrative, a textbook tour of the pitfalls into which a specialist in one scientific field may fall when he invades another, without either acknowledging or respecting what has already been achieved, it certainly deserves its place among Atlantis curiosa.

COLIN RENFREW

WITH EYES ATWINKLE

Science Year

The World Book Science Annual 1969. Pp. 440. (Field Enterprises Educational Corporation: Chicago and London, 1969.) n.p.

"WITH eyes atwinkle and a firm step, Linus Pauling moves out to meet the continuing challenge of scientific fulfilment." Not all of *Science Year* is written in this vein—indeed, much of it is excellent—but the occasional lapses into fatuity are the stranger by contrast. It is curious, too, that the editors have chosen to emphasize the book's weakest points at the expense of its best feature, a series of review notes covering the year's major developments in a range of scientific fields.

The first chapter, for instance, consists of spacecraft pictures interlarded with the high school rhetoric of astronaut John H. Glenn. Space, he believes, "is the biggest exploration and research project ever conducted by man", yet the main value of the space programme is "the serendipity as you go along". So much for those who believe research has to be planned. To the impudent critics who choose to see more of the spirit of exploration in a single sentence of Doughty, Burchardt or Burton than in all the banal babblings of the astronauts, Mr Glenn gives short shrift. "Some people," he accuses, "have criticized the astronauts for not describing the beauty that had to be there, the beauty the camera could not reveal. Well, try describing the undescribable. It's a new group of sensations—a new world. How do you put it into words?" If that old group of sensations, the Sun, reminded Blake of nothing so much as a cloud of angels singing "Hosanna, hosanna, hosanna", their lofty visions might have evoked at least an alleluia from the astronauts; but that, as Glenn makes clear, was not to be.

The sixteen articles that follow include an excellent essay on dolphins by John Barbour (Associated Press), and an intriguing account of excavations on Thera, putative site of Atlantis, by Emily Vermeule (Wellesley College). Frank Drake (Cornell University) discusses pulsars and Preston E. Cloud (University of California, Santa Barbara) warns that by the year 2042 twelve of the world's twenty recoverable mineral resources may be exhausted. The forecasts, based on the two false but mutually compensating assumptions that the present rate of consumption will continue unchanged and that no new deposits will be found, spell the end for crude oil, natural gas, copper, tin, lead, tungsten, uranium, zinc, helium, gold, silver and platinum.

The best part of *Science Year* is a collection of well written and highly professional notes covering the year's excitements in everything from agriculture to zoology. These are excellent value and afford as good a picture as could reasonably be wished of where the action was. Apart from the irritations of its opening article and a pull-out cardboard absurdity billed as "the highlight of this year's edition", *Science Year* has much to commend it; brisk, informative, thorough, well illustrated and well put together, it bids fair to be what its editors can only describe as "a viable communications link between scientists and the public". And—who can tell?—it may even inspire its readers, with eyes atwinkle and a firm step, to move out to meet the continuing challenge of scientific fulfilment.

NICHOLAS WADE

PHILOSOPHY FOR THE SCIENTIST

Fact and Theory

An Aspect of the Philosophy of Science. By W. M. O'Neil. Pp. xiv+193. (Sydney University Press: Sydney; Methuen: London, July 1969.) A\$7; 66s.

An Aspect of the Philosophy of Science. By W. M. O'Neil. Pp. xiv+193. (Sydney University Press: Sydney; Methuen: London, July 1969.) A\$7; 66s. He may feel that he is being told how to do his job by somebody who has never been near a laboratory; or he may think it simply laughable to spend his time discussing such questions as whether electrons really exist. Unfortunately, some philosophers have got what they deserved after, for example, analysing the structure of physics and then assuming that they knew all about biology; and it is a fact that hardly anybody has aimed worth-while philosophizing about science at the scientists themselves.

Fact and Theory will help to change a few minds. It is based on a course of lectures which Professor O'Neil has given to science undergraduates at the University of Sydney, and what it does is to elicit from real scientific situations—drawn from the past for ease of understanding—a number of points which lend themselves to analysis. The book is intentionally introductory. Professor O'Neil compares himself to "the man with the megaphone at the front of the tent on the fairground", providing a link from science to philosophy in the hope that readers will want to see what the show is all about.

The "aspect" of the title is the relationship between what is observed and what is supposed in order to explain the observations. It is introduced gently by a discussion of theories about the motion of the blood up to the time of Harvey, to illustrate one simple kind of supposition. Harvey assumed the existence of capillaries joining arteries to veins so that he could explain where all the blood went to if the heart acted as a pump.

Subsequent historical sections deal with accounts of the solar system, attempts to explain the periodic classification of chemical elements, and theories of inheritance up to Crick, Watson and beyond. The methodological ideas develop naturally, and with gradually increasing complexity, out of the various scientists' work. In this way the discussion broadens to include issues that are peripheral to the main subject, and among these fruitful sidetracks are the nature of explanation, the distinction between realist and instrumentalist attitudes to theories, and the peculiar problems of trying to reduce biology to physics.

O'Neil has a happy knack of hitting on the kind of standpoint that many scientists naturally favour: the empiricist, the realist and the reductionist all emerge favourably. He is not, however, trying to be philosophically original or controversial, and this could account for the lack of tension implicit in his writing, which a more aggressive stance might tighten up. The book is interesting throughout, but unexciting.

The historical chapters are not as good as the philosophy. Presumably they are not meant to be read as pure history, but on the other hand they contain much more detail than the philosophical points need. Discussions also tend to jump uncomfortably back and forth from past to present—the sequel to the discovery of Kepler's third law, for example, is an illustrative calculation based on modern values—and the cumulative effect is of history-with-hindsight, which is not the best way to bring out the connexion between science in its context and philosophical analysis.

It is as a clear introduction to some of the philosophical problems of science, however, that *Fact and Theory* is valuable. Scientists who want to be convinced that philosophizing can have its points will perhaps find that T. S. Kuhn's *The Structure of Scientific Revolutions* offers a greater sense of enthusiasm, and although his viewpoint