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.) 50s.

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. T. C. WADDINGTON

Critique of Pure Science

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

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

explanation. He attempts an *a priori* rejection of the atomic theory of matter in favour of a field theory and he says that his metaphysical views are closest to those of Faraday.

How successful is this ambitious attempt? There is no doubt that the notion of the inner constitution of things is asked to bear more than it can. It cannot help us to understand causal necessity or to establish, against Hume's arguments, that there is any such thing. Harré's attempt to answer Hume's criticism of the notion is very unconvincing indeed (pages 105–111). Nor, without some change of view about the nature of justification or of knowledge, is the fact that things have an inner constitution much help with the problem of induction. First, it does no more than replace the problem of the justifiability of inductive argument with that of the justifiability of argument by analogy. Second, for basic hypotheses such as some of those of mechanics, no acceptable explanation in terms of inner structure has been proposed to help us choose between the alternative hypotheses left open by induction from experimental instances. Harré is forced to relegate such principles as the law of impact, which stand as firm as any in science, to the status of protolaws. Further, although many scientific explanations do rest upon the inner constitution of things, and Harré is right to feel dissatisfaction with the positivist account of such explanation, it is not clear that all do. The principle of the lever is the basis of many explanations but has no concern with inner mechanisms.

There is one feature of the deductivist philosophy which is regrettably absent from Harré's own. The paradoxes in Hempel's rules of confirmation became apparent because those rules were formulated precisely. Harré not only eschews precise formulation of the principles of analogy which he thinks must replace the principles of induction (page 35), but is prepared to embrace principles, such as affirmation of the consequent, which lead to paradoxes just as serious as those of Goodman and Hempel and much more obvious.

The proof reading has been done very carelessly but, in recompense, there is an extremely useful bibliography.

JOHN WATLING

Tropical Medicine

Tropical Doctor: a Journal of Modern Medical Practice. Volume 1, Number 1. Edited by Dr Hugh Clegg. Quarterly. (Royal Society of Medicine: London, January 1971.) 60s annually; 15s each copy.

THE provision of adequate health services for developing countries is a task of

paramount importance and great difficulty in the face of the continued shortage of professional and auxiliary medical staff. There can be no permanent improvement in the present conditions unless the highest possible priority is given to the training of large numbers of health workers of every description.

Many newly independent nations embarked on the development of full scale medical schools while fully realizing that during the next decade or so, the number of graduates cannot be more than a trickle. But mere numbers of graduates is not enough. There is also the need to maintain the quality of medical practitioners—especially those who work in distant rural areas without an easy access to the medical books and journals that characterizes the present "information explosion". *Tropical Doctor*, fathered, carried to term and skilfully delivered by its editor Dr Hugh Clegg, under the auspices of the Royal Society of Medicine and with the assistance of the Commonwealth Foundation, aims at filling this gap in communication. It is being produced primarily for the benefit of the isolated medical worker who is responsible for a large number of people; he cannot decline this mandate without depriving them of their only source of medical help. Much of the medical practice in the tropics is subject to stagnation because of the remoteness of the under-doctored areas. And yet the man in the field must not only retain his original skill, but must acquire new knowledge of the advancing science and technology applied to medicine and public health.

The first issue of *Tropical Doctor* fulfils brilliantly its promise. The contributors to it come from many parts of the world. Chaudhuri from the School of Tropical Medicine in Calcutta provides an informative paper on the treatment of cholera; Khoo Oon Teik of Singapore deals with lobar pneumonia as seen in the tropics; Burkitt of London outlines the diagnosis and treatment of the tumour that bears his name; Norman from the United Arab Republic writes about hookworm, Wosorun from Accra and Adeloje from Ibadan discuss the management of burns and head injuries respectively; Cook talks about tropical ulcer and Farman about general anaesthesia.

In the series of special reports there are excellent papers on maternity care in the tropics; on control and eradication of smallpox, on "under fives clinics" and on surgical improvisation in the Pacific. "Newsletters" and replies to "Any Questions" are signed by many distinguished names. There are also two shorter sections on drugs and equipment and finally "News and Notes".

The attractive cover of the journal, its excellent layout, its clear print and

illustrations are bound to enlist many faithful subscribers and readers.

L. J. BRUCE-CHWATT

African Birds

Birds of West Central and Western Africa. By C. W. Mackworth-Praed and C. H. B. Grant. (African Handbook of Birds, Series III, Volume 1.) Pp. xxvii + 671 + 46 plates. (Longman: London, 1970.) 120s.

THE surviving author is to be congratulated on having so nearly completed the ambitious task undertaken 48 years ago; this is the penultimate volume of the six that were planned, and the final one is understood to be well on the way. Captain Grant died in 1958 but had already done much preliminary work even for this last stage. The aim was to provide a work covering all the birds of Africa south of about 20° N latitude. There were to be three series of two volumes apiece, each series constituting an independent regional account. The first dealt with eastern and north-eastern Africa and the second with the southern third of Africa; this one covers west central and western Africa, from southern Mauritania down to the Congo-Zambesi divide in Angola. This area is much more extensive than that covered by either Bannerman's *Birds of Tropical West Africa* (1930–51) or Chapin's *Birds of the Belgian Congo* (1932–54).

The plan inevitably involves substantial overlap between the different series, many species being common to two or all three of the regions. It has thus been necessary, for the sake of consistency, to deal conservatively with changes in nomenclature and new views on taxonomy that have arisen since the earlier volumes were published. The information about individual species and subspecies is on the same lines as before; the stress is on identification and distribution, with brief treatment of chief points of life history and behaviour. There are the same marginal drawings of birds, as well as the colour plates by a number of experienced bird artists; and the same useful distribution maps. Dr W. Serle, with personal experience of this side of the continent, contributes an introductory section on topography and climate.

A. LANDSBOROUGH THOMSON

Antarctic Ecosystems

Antarctic Ecology. Vols. 1 and 2. Edited by M. W. Holdgate. Pp. xx + 604 and x + 607–998. (Academic: London and New York, 1970. Published for the Scientific Committee on Antarctic Research.) 120s and 100s.

THESE are model symposium volumes, well edited and with a strong and coherent theme. They include 81 papers