

means of examples. Dynamic programming is a subject too often obscured by difficult mathematics, and it is to be regretted that the example given here has been needlessly complicated for non-mathematicians by the use of a cost function itself involving an integral. Each chapter is concluded by a good review of the relevant literature, as it existed in 1959. The final chapter contains a brief survey of applications of operational research in Poland, where, it would appear, little work had been carried out by the date of the Polish edition.

Although this book may well have fulfilled a need when it was originally published in Polish, it does not contribute to the literature in English. Its merits have been lost by poor translation and frequent misprints, both factors which needlessly confuse the reader, and could have been rectified by an editor with a knowledge of the subject.

ANTHONY WREN

PROGRESS IN GERONTOLOGY

Advances in Gerontological Research

Edited by B. L. Strehler. Vol. 1. Pp. xi+410. (New York and London: Academic Press, 1964.) 96s. 6d.

THIS first volume of *Advances in Gerontological Research* contains a mixed collection of ten papers, mainly by American authors, which vary in length and the amount of detail thought to be appropriate. The chosen topics are wide-ranging, but concentrate more on the general biological than on the purely medical aspects of ageing. The psychological and sociological sides of the subject are omitted altogether, but can be expected to appear in subsequent volumes.

The opening paper by Bondareff is primarily concerned with the microscopic pathology and cytology of neurones of different ages. Only a short paragraph is devoted to the neurophysiological aspects of ageing processes in the central nervous system, and indicates how much less is known about functional changes in the nervous system with age than about morphological changes. Generally, Bondareff finds little undisputed evidence that important and causal changes with age can be identified in the central nervous system.

The two contributions from Europe come from Rumania (Oeriu) and the U.S.S.R. (Medvedev) and deal with the roles of proteins and nucleic acids in ageing processes. Both take a very broad view of the scope of ageing studies and extend their surveys to the early stages of embryonic development. Medvedev, in particular, shows how much we now depend on advances in molecular biology to provide hypotheses and ways of looking at the ageing process, either in terms of the accumulation of transcription errors or of the 'noise' engendered by the unmasking of genes at predetermined and later ages.

Oeriu ranges even more widely in a catalogue-type of review providing information about changes with age in the tissue contents of protein, enzymes and vitamin co-enzymes and in amino-acid patterns. He believes that the accumulation of disulphide bonds inhibiting enzyme activity is important and illustrates in detail his experimental findings that cysteamine and folic acid can restore the biochemical balance towards the situation characteristic of younger ages.

The three other general reviews are by Casarett, Clark and Blumenthal and Berns. Casarett critically discusses the extent to which exposure to irradiation can mimic or accelerate natural ageing changes and, while finding differences between the two processes, believes that the similarities are sufficient for the irradiated animal to be a useful model system. He, too, puts forward a theory of ageing in which he sees both irradiation and natural ageing having their effects as a result of increasing connective tissue barriers between the circulation and the parenchymal cells.

Clark's contribution on genetics and ageing is, perhaps, the most readable of all. He emphasizes the importance of genetic factors, the opportunities for research which genetically controlled material provides and discusses the relevance of somatic mutation to ageing studies.

Blumenthal and Berns's topic is auto-immunity and they too are concerned with the importance of somatic mutations. Their discussion centres mainly around possible ways in which modifications in immunological reactivity may lead to the diseases of old age and attempts to bridge the gap between the concepts of natural and pathological old age.

The remaining articles are by Andrews on changes in nuclear morphology, a short informative note by Sinex on cross-linkages especially in collagen and elastin, and two by Björkerud and the editor, Strehler, on the isolation of lipofuscin granules from heart muscle and the chemical and enzymatic properties of the particles, and on the histochemistry and ultrastructure of age pigments. There is considerable new and detailed information here about techniques, biochemical findings and histochemical appearances together with speculations on the origins of the granules. One wonders, however, whether the likelihood that these granules are more than an epiphenomenon of ageing is sufficiently great to justify the allotment of about a fifth of the book's pages to this topic.

Most of the present-day views on the causes of ageing are aired somewhere in these reviews. The authors vary considerably in their approach to the problem of how to prepare an article for this type of book and some succeed better than others. Some degree of overlapping and a few trivial proof-reading failures occur. Not everyone will want to read straight through the volume, but anyone who delves into its pages is bound to come up with some fresh ideas and some new pieces of information.

In the past, reviewers of books on ageing have often begun by emphasizing the unpopularity and lack of scientific respectability of ageing studies. To be included in the *Advances* series can be taken as good evidence that the subject has at last arrived. But in addition to marking this event, an important thing about the book is that it makes one realize how amorphous and pervasive a subject ageing is and how dependent workers are on advances in other fields. More depressingly, it serves to show one how little real progress has been made in coming to grips with the main problems.

P. L. KROHN

BIOLOGY OF RESPIRATION

The Biology of Respiration

By Sir Victor Negus. Pp. xi+228. (Edinburgh and London: E. and S. Livingstone, Ltd., 1965.) 60s. net.

THE *Biology of Respiration* by Sir Victor Negus is a disappointing book on a number of counts. In the first place, the title promises considerably more than the contents offer. I anticipated that this would be August Krogh brought up to date, incorporating the mass of work on the comparative physiology of respiration carried out since the publication of his classic in 1941. In fact, the contents are very much restricted in scope. About three-quarters of the text is concerned with the external apparatus of respiration and is clearly centred around the unique contributions of this distinguished oto-rhinolaryngologist. When he is on home ground, Sir Victor is superb without qualification, and this remarkable account of fastidious dissection of the upper airway systems of innumerable species, admirably illustrated, carefully, thoughtfully and crisply presented would, by itself, justify the purchase of the book. This part of the book is marred only by compression; for example, it might be thought that the complex air sac system of birds deserves more than half a page of text and the mechanics of pulmonary ventilation in mammals more than a brief mention.