

pages in which the biology of the frog and the elementary principles of zoological classification are followed by a 'Cook's tour' of the invertebrate phyla.

The backbone of the book is provided by the section on the development of genetic concepts which starts, rather surprisingly, with a detailed analysis of Darwin's theory of pangenesis—emphasizing that this was in fact perfectly consistent with the evidence then available. A largely historical treatment of classical cytogenetics follows and the student is led step by step through the evidence for linear arrangement of the genetic factors on the chromosome.

A third section introduced by a synopsis of the development of the frog leads the way to an analysis of embryological concepts—from the earlier antithesis of preformation and epigenesis, through mosaic and regulative development to the concept of the organizer.

The section on evolution starts with Darwin and Wallace on the origin of species and provides the opportunity at this point for a survey of the chordates. As a natural consequence of the earlier genetical and embryological emphasis, the way is well prepared for a careful presentation of the mechanism of evolution. Such topics as the change of gene frequency in a population, patterns of speciation and isolation, changes of ploidy are all treated convincingly at quite an advanced level.

The book is completed by a section on human physiology which is almost an appendix, only distantly related to the pattern of the earlier parts. With this exception, the work impresses the reader particularly with the very carefully designed order in which its material is arranged, by its careful documentation and illustration of the evidence presented and by the stimulating feeling it gives to the reader of an active and growing science. A first-year course based on this plan would be a fascinating subject for experiment in a British university.

JOHN E. HARRIS

ENZYMOLOGISTS' 'DO-IT-YOURSELF' MANUAL

Methods in Enzymology

Edited by Sidney P. Colowick and Nathan O. Kaplan. Vol. 3. Pp. xxiv+1154. 26 dollars. Vol. 4. Pp. xii+979. 24 dollars.

(New York: Academic Press, Inc.; London: Academic Books, Ltd., 1957.)

THESE two volumes complete the set of four which make up this treatise on laboratory techniques for enzyme studies. The first two, dealing with the preparation of enzymes, have already been reviewed in this journal (*Nature*, 177, 810; 1956; and 178, 509; 1956). Volume 3 is on the preparation and assay of substrates and Volume 4 on special techniques for the enzymologist. Like the earlier volumes they consist of articles by many different authors, with consequent variations of style and content, but between them they cover an immense and useful field.

Volume 3 is divided up into seven sections on the basis of the chemical nature of the substrates discussed: proteins, carbohydrates, lipids, citric acid cycle components, nucleic acids and derivatives, and coenzymes and related phosphate compounds, the final section being about the determination of inorganic compounds. In each section both preparation and estimation of the main substrates are

described, and in a great many cases both chemical and biological methods are given.

One result of this layout is that some general topics are dealt with in many parts of the book. The most striking case is chromatography, which is now perhaps the 'special technique' most universally used by biochemists. It is not discussed as a special technique in Volume 4, although the somewhat analogous process of paper electrophoresis is to be found there. However, there is plenty of space devoted to chromatography in Volume 3: the chromatographic separations of sugars, acids of the citric cycle, amino-acids, and nucleotides are described in some detail, and the chromatography of organic acids is dealt with in two sections, on pp. 377 and 397. In each case some space is devoted to a description of the apparatus required and the basic manipulations; a particularly useful account of paper chromatography is given in connexion with amino-acid analysis on p. 504. It seems to the reviewer that the space devoted to chromatography might usefully have been collected into one section; to a lesser degree this is true of other techniques, for example, microbiological estimations.

Volume 3 contains many useful features which are not easily found in the original literature without a great deal of research. To mention a few at random: the empirical colour reactions for identification and determination of sugars are collected together in a concise account; the methods given for preparation of sugar phosphates include the older, classical methods, sometimes with more recent modifications, side by side with newer, chemical methods; and a very useful table of hydrolysis constants of phosphates of sugars and related compounds is given on pp. 847-48. On the other hand, some of the methods given can only be described as exotic, and are scarcely likely to become routine procedures in many laboratories; for example, the estimation of adenosine triphosphate by measuring light production with a crude firefly luciferase preparation. Nor is the preparation of compounds such as γ -carboxymethyl- Δ^2 -butenolide likely to interest more than a small group of enzymologists.

In some sections the long time needed to collect the articles for volumes of this size is very obvious. A detailed description is given of a biological method for the estimation of carnitine, using *Tenebrio molitor*. Although the volume bears the publication date 1957, this article carries a footnote dated September 1956, saying that the method described has not been working satisfactorily in the authors' laboratory since 1953!

The final volume describes a very arbitrary selection of special techniques. More than half is devoted to techniques used in isotope studies; a short account of the measurement of radioisotopes and stable isotopes is followed by an exhaustive account of methods for preparing and degrading labelled intermediates. Other techniques dealt with are those used for the characterization of proteins, the difference spectra methods for metabolic studies developed by Chance, and electron microscopy of intracellular structures. The last mentioned is illustrated by some excellent photomicrographs of cell sections.

The whole set of four volumes forms a practical manual to which every biochemist will wish to have access. It is well documented, and even if it does not contain exactly the details one requires, it will usually serve as a lead into the appropriate original literature.

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