

of physical fact, the i^{th} to k^{th} *actuating input function product-reference input function product performance function ratio function* reduces to the ratio of the reference input function product to the i^{th} to k^{th} input function product" (Vol. 1, p. 134). Even the corresponding mathematical statement is little shorter, because of the use of "self-defining symbols" in the statement of general relations. A simple example is sufficient to indicate their form and use: the standard deviation of x is given by $(SD)x \equiv (RMS) [(D)x]$, in which $(D)x \equiv x - (Av)x$ (Vol. 1, p. 148). The authors, of course, accept the use of "working variable symbols" in deriving results, but consider that all results other than those derived for purely educational purposes should be formulated finally in terms of "self-defining symbols" (Vol. 1, p. 109), and they conform rigidly to this practice.

When the reader has overcome the initial difficulties of interpretation—the difficulties of translation even from American to English terminology (for example, fitting constant $(FC) \equiv$ constant of integration) give one especial sympathy for the non-English-speaking reader—there are available in these volumes a most thorough exposition of a rigorously systematized way of analysing physical systems mathematically (Vol. 1), and analytical, graphical and numerical methods for deriving the solutions of the resulting differential equations, with—perhaps the most valuable feature of the work to the British engineer—nearly two hundred clearly reproduced large-scale graphs presenting data concerning every aspect of these solutions (Vol. 2). There are, also, in Vol. 1 useful introductions to dimensional analysis and statistical methods, and in Vol. 2 a chapter on the analysis of second-order discontinuous systems, having "non-linear terms of the rate-determined step type", due, for example, to the effect of Coulomb friction or of relay-operated controlling devices.

To sum up, these volumes are most welcome publications, in making generally available the very thorough exposition and useful graphs which have previously only been available locally. Because of the language and notation it seems unlikely that they will be considered suitable for teaching purposes on the eastern side of the Atlantic, but as reference books they are likely to prove of lasting value and should be available in every library of books on instrumentation and control engineering.

G. L. S. MACLELLAN

MAMMALIAN BIOCHEMISTRY

Principles of Biochemistry

By Prof. Abraham White, Prof. Philip Handler, Prof. Emil L. Smith and Dr. DeWitt Stetten. Pp. xiii + 1117. (London: McGraw-Hill Publishing Company, Ltd., 1954.) 112s. 6d.

THIS book is described on the dust-cover as "an integrated presentation of fundamentals". It might at first sight be doubted whether, with four authors at work, much integration could be achieved; but in fact they have succeeded so well that it is worth mentioning how they went about writing the book. The first draft of each chapter was assigned to one of the four authors and, when completed, was criticized by the other three. They met regularly for such discussions for several days at a time, and in some instances a chapter written by one of them was rewritten by another. In the end, each author had contributed to each chapter. As a result, this

book shows none of the overlapping or lack of continuity of style or matter which is so often found in a book by several authors.

The subject is treated in seven sections which deal in turn with the chemical composition of the cells, the enzymes, intermediary metabolism, the body fluids, specialized tissues, the hormones and nutrition. Intermediary metabolism is introduced by a valuable chapter on the general methods used in investigating metabolism—experiments on whole animals, on isolated organs and on tissue preparations, the study of patients with inborn errors of metabolism, the use of isotopes as tracers, and so on. The last section, nutrition, is at first sight surprisingly brief for a book of this size; but clearly so many topics bearing on nutrition have already been covered earlier in the book—vitamin A under the lipids and under the biochemistry of the eye, various members of the vitamin B complex under individual coenzymes, and so on—that there is correspondingly less remaining to be dealt with in the nutrition section. All the same, a chapter of one and a half pages on chemical elements in nutrition does seem almost ludicrously short. This tendency towards the curtailing of topics considered under nutrition will presumably continue as more and more becomes known of the precise biochemical function of the vitamins. In books on theoretical biochemistry, the vitamins will tend to be dealt with separately in connexion with the metabolic reactions which they influence rather than as a heterogeneous group of organic compounds which the body needs but cannot make. But the vitamins are closely linked by the early history of their discovery and investigation, and it will be a great pity if in the text-books this history gets lost sight of in a mass of details of chemical reactions and specific catalysts.

The style of writing throughout the book is scholarly and clear, and it is evident that the authors are writing from a wide experience of teaching. The book is well produced, with the structural formulae and chemical equations admirably set out. There are occasional slips or misprints (for example, in the structural formulae of the nucleosides and nucleotides on pp. 186–188, where the groups attached to the sugar rings should all be inverted), but these are few and far between. The book relies largely for its figures on reproductions from published work, and on the whole these have not been adequately assimilated into the text. For explanation of the figures the reader is almost entirely dependent on the smaller-print legends; these are sometimes of almost telegraphic brevity, and it would have made for easier reading if there had been a little more comment on the figures in the main part of the text.

While the book is mainly on mammalian biochemistry, it deals to some extent with comparative biochemistry, and there are frequent references to the biochemistry of micro-organisms and plants. For example, the chapter on carbohydrate metabolism begins, very reasonably, with an outline of the processes of photosynthesis. The references at the ends of the chapters, many of them to books and review articles, are well chosen, up to date and by no means confined to American publications. For undergraduate medical students, in any event in Britain, this book will probably be considered too large and too costly. For science students and for those engaged in teaching and research, it will be welcomed as a stimulating and a well-written text-book.

D. C. HARRISON