

complete commitment to a description based on functional groups would have avoided the separation of topics which can best be appreciated or taught together (for example, Norrish type II reactions and photoreduction of ketones).

The chapter on experimental methods is particularly welcome, highlighting the ways in which the practice of photochemistry differs from that of 'ordinary' chemistry. The other introductory chapters are weaker, which is a pity when they are meant to give a helpful background for the later chapters. Throughout the book there is an accumulation of loose phrasing and of errors (of the type: (pp5, 6 and 9) the impression is given that the oxygen atom of formaldehyde has only one lone pair; (p155) it is incorrectly stated that there are eight

π orbitals in a benzyl-type anion; (p193) the reaction (21)→(22) is not, as stated, a vinylogous Norrish type I reaction) which could confuse the reader. Another distracting feature is the use of four different ways of indicating chemical reactions—by structural formula number, by figure number, by equation number, and by no reference at all (on occasion where the equation and the relevant text are a page apart).

For the organic photochemist the book could be a useful complement to others on his shelf (though it lacks references to primary literature), but I would hesitate to recommend it for teaching purposes.

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Biological rhythms

An Introduction to Biological Rhythms. (Tertiary Level Biology series.) By D. S. Saunders. Pp. viii+170. (Blackie: Glasgow and London, 1977.) £5.50.

THIS book introduces the reader to a wide variety of aspects of circadian rhythms: to their endogeneity, their entrainment by a variety of complex patterns of light or temperature, their implication in the control of reproductive and other rhythms by day-length—photoperiodism—and their function in navigation. It also considers rhythms with other periods—tidal, lunar or annual. All these are well described.

The author's particular interest in insects is rather too prominent: those aspects of rhythms manifested by insects are very fully discussed, with at times considerably more detail than one might expect of the advanced undergraduate student; data from other animals and from plants are included when they manifest essentially the same phenomena as can be seen in insects, but not often otherwise. Thus the fascinating problem of the hierarchical or other organisation between the presumed multiple oscillators in vertebrates receives the briefest mention, although the organisation in insects, with an apparent transmission from a clock in the central nervous system by way of either action potentials or neuro-humours, receives considerable attention. Population rhythms, rhythms in events which each individual encounters only once, are discussed in great detail with regard to the eclosion of insects; the similar mammalian examples, such as circadian rhythm in the time of birth or death, escape mention, although admittedly they are less amenable to study.

The choice and production of the figures is not always happy. A single figure frequently extends over two or more pages, and by omitting essential data they often confuse rather than enlighten. The section on further reading would be improved by more reference to symposia and reviews; it is unfortunate that the very valuable symposium in the October 1976 issue of *Fedn Proc.* appeared too late for mention. Perhaps the worst feature of the book, especially for a student text, consists of two frankly erroneous and hardly credible statements about the length of the solar day which appear on the first page; these first 9 pages are in any case largely superfluous.

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Research on chloroplast metabolism

The Intact Chloroplast. Edited by J. Barber. Pp. xi+476. (Elsevier: Amsterdam, New York and Oxford, 1976.) Dfl.140.

THIS book is intended to be the first of a series presenting reviews by specialists in different areas of photosynthesis research. The reviews are designed to provide an up-to-date account of research on their subject, while at the same time providing sufficient background material, and information about the methods used, to allow readers working on other aspects of photosynthesis, plant physiology, or bioenergetics to understand the results and apply them to their own research or teaching.

This volume deals, in most of the chapters, with the interactions between the different chloroplast compartments, or between the chloroplast and the remainder of the cell. This work has only become possible since the development of techniques for the isolation of intact chloroplasts, and represents a reversal of the classical biochemical trend towards the use of simpler systems. The effects which the use of this organelle-based approach is having on many aspects of photosynthesis research are well documented.

An introductory chapter on chloroplast structure by Coombs and Greenwood is followed by chapters on ion transport and energy conservation, (Vredenberg, Barber), ATP synthesis (Hall), the energetics of carbon metabolism and its relationship to transport of materials

between chloroplast and cytoplasm (Krause and Heber, Walker, Heldt, Coombs), sulphate metabolism (Schwenn and Trebst) and protein and amino acid biosynthesis (Ellis, Leech and Murphy). In the final chapter Raven attempts an overall view of the energetics of photosynthetic growth.

On the whole the authors have succeeded in presenting the material clearly and intelligibly, although one or two present an excess of undigested data. There is also some overlapping of subject matter between a number of the chapters on metabolite transport systems, both within the book, and with recent reviews published elsewhere. The book succeeds, however, in demonstrating the rapid changes taking place in our understanding and attitude to the relationship between chloroplasts and the remainder of the organism. It also illustrates one of the failures of photosynthesis research, the relationship between ATP synthesis and electron transport. Twenty-five years after the discovery of photophosphorylation it is not known how much ATP is synthesised per electron transported, or how it is made. It is also unclear whether "cyclic photophosphorylation" exists; from this book it seems that physiologists think it does occur, and biochemists think it does not.

The book can be recommended for any library dealing with photosynthesis research or advanced teaching as an authoritative source of information on the present state of research on chloroplast metabolism.

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