touched on, although the authors note that it is treated in detail elsewhere. Both these reaction classes have enormous technological importance (and most students end up in chemical technology), and the study of them provided many of our present unifying concepts. The roles of energetics, steric hindrance, and polar effects were identified by polymer chemists in the 1940's, as were many of the principles governing radical redox processes. The subsequent development of unifying concepts has been largely the demonstration that many of these principles apply to other systems as well.

In summary, this book fills a need, and I've mentioned what seem to me omissions simply to call readers' attention to matters they may want to look into elsewhere. I hope it will have wide distribution.

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Rhythmicity

Biological Clocks in Marine Organisms. The Control of Physiological and Behavioral Tidal Rhythms. JOHN D. PALMER. Wiley-Interscience, New York, 1974. xii, 174 pp., illus. $12.95.

This attractive little book is a summary of a large quantity of experimental data, together with a certain amount of interpretation, pertaining to biological timing phenomena shown primarily by marine organisms. As the subtitle indicates, the emphasis is on tidal rhythms: cyclic physiological processes which under natural conditions are entrained by tidal factors and which persist, in some cases for many weeks, with a circatidal period under nontidal conditions in the laboratory. The book is generously illustrated, with a clearly drawn figure on nearly every page, and at the end of each of the ten chapters there is a point-by-point summary. This format suggests that the book is intended for use as an accessory text in an undergraduate course, and the author's writing style is also well suited for such an audience: clear, informal, and at times entertaining. Whether the subject matter and its treatment are equally suitable is a moot point.

The book is the outgrowth of a recent lengthy review article by Palmer on tidal rhythms, and that article itself (*Biol. Rev.* [*Camb.*] **48**, 377 [1973]) will probably be the preferred source of information and references for those who are engaged in research on biological clocks. For those who may be teaching a course on the subject, I would emphatically recommend a trip to the library to consult the original literature and decide which of the many phenomena described in Palmer's book are sufficiently well documented to deserve detailed attention in a lecture. Therein lies a central problem in the attempt to understand tidal rhythms.

Some few intertidal species reproducibly show clearly defined, persistent biological rhythms, but the majority of the published literature on so-called lunar-tidal rhythms deals with data in which a rhythm, if present at all, is difficult to discern owing to noise. Elaborate, and often unjustifiable, methods of data analysis have been used to "extract" a presumed periodicity from the data. Such a body of literature should be approached with skepticism. In my opinion, Palmer has done an inadequate job of separating the wheat from the chaff. As just one example, a 1954 study based on data from oysters is given major coverage. That article purports to show that oysters, when transported from the East Coast to a laboratory in Illinois, rephased their tidal rhythms to correspond with times of lunar zenith in Illinois. It was taken by its author, then, as evidence that some factor related to lunar gravity was perceived in the laboratory by the animals. This claim, if substantiated, would represent one of the most exciting sensory phenomena ever to be documented. In discussing these experiments, Palmer voices modest reservations about possible unexplained changes in period of the rhythm. In fact, this 20-year-old study has apparently never been repeated, and there is good reason, based on reanalysis of the data (*J. Theor. Biol.* **8**, 426 [1965]), to suspect that the animals may not have demonstrated a persistent rhythm of any sort, much less a tidally synchronized rhythm that stays in phase with times of local lunar zenith. Many studies of tidal rhythms about which a properly critical reader will have fewer reservations are also described in excellent detail, but the moon-sensitive oysters are by no means the only instance of a questionable report's being given "equal time," often with no critique at all. The coverage of recent English-language publications is little short of exhaustive, and extends, for example, to claims of lunar cycles in human reproduction, another controversial topic that is not treated as such in this book. The one major bibliographic oversight that caught my attention is the omission of Neumann's beautiful and definitive studies on the fortnightly reproduction of the intertidal midge, *Clunio* (see, for example, *Z. Vgl. Physiol.* **53**, 1 [1966]). Neumann is the leading European worker on tidal rhythms, and *Clunio* is one of the few organisms in which a tidally synchronized biological rhythm has been analyzed in sufficient detail to permit strong and fascinating conclusions about the physiological and genetic processes involved.

A book that is as attractively produced as this will have a strong initial appeal. It seems particularly unfortunate to me that the selection of material to be covered was not more judicious. For an illustrated tour through as confusing, controversial, and contradictory a literature as is here involved, the novice needs a more discriminating guidebook.

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