plants as a complete system was originated by the Danish scientist C. G. J. Petersen around the turn of the century. Now, 70 years later, this approach has received a boost from the U.S. Office for the International Decade of Oceanic Exploration, which is supporting a long-term program of seagrass research utilizing the ecosystem concept.

An early step in the IDOE seagrass program was a workshop held in 1973. *Seagrass Ecosystems* stems from that workshop.

The book is both useful and disappointing. It contains nine papers, of which six are basic reviews covering the productivity and physiology, systematics, decomposition, consumer ecology, and chemistry and geochemistry of seagrasses and the wasting disease of eelgrass. These papers are uniformly clear, well organized, and comprehensive. They are weakened only by the almost total lack of references more recent than 1973. Why it took four years to publish an offset-printed book of nine papers that were largely completed in 1973 is not explained.

One might question the inclusion of the three final papers summarizing seagrass research in Mexico, Australia, and Israel. These papers were written after the workshop, and they hardly seem compatible with the six process-oriented papers.

Still, for anyone interested in seagrass ecosystems this book is a logical starting point for reviews of pre-1974 research.

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Paleophycology

Fossil Algae. Recent Results and Developments. Papers from a symposium, Erlangen, West Germany, Oct. 1975. ERIK FLÜGEL, Ed. Springer-Verlag, New York, 1977. xiv, 376 pp., illus. $36.10.

A few years ago, biogeologists with an interest in algae had only a few references—most notably monographs by Maslov, Pia, and Johnson for fossil algae and Fritsch, Geitler, and Bourrelly for recent algae—to turn to. Today the situation is much different; the literature explosion has hit algal studies. *Fossil Algae*, which contains 37 of the papers presented at an international symposium on the subject, is one of the latest entries into the paleophycological sweepstakes.

The book covers a wide spectrum of subjects having to do with ancient algae, from the interpretation of microbial fossils found in Precambrian cherts (Golubic and Barghoorn) to the paleogeographic significance of some Miocene rhodolites (Orszag-Sperber *et al.*). It is concerned primarily with algae, recent as well as fossil, as related to carbonates, but coccoliths are omitted.

The review by Claude Monty on the nature and ecological significance of stromatolites is a gem. I think I finally understand what Kalkowsky meant by "stromatolith." Aside from the report by Krumbein and Cohen of facultative anoxygenic cyanophytes forming algal mats and Riding's account of skeletal stromatolites, I found little new and exciting in the ten remaining stromatolite-oriented papers.

The strength of *Fossil Algae* lies in its coverage of Phanerozoic and Recent calcareous algae (23 papers). Though rather heavily weighted in favor of red algae, the papers offer up-to-date accounts of dasyclads, algal carbonates, algal paleoecology, problems of algal affinities, and algal phylogeny.

Paleoecologists—they need not be algal enthusiasts—should look at this volume and pay particular attention to the last 12 papers, which deal with algae and sedimentary environments. Too few paleoecologists are able to recognize and use calcareous algae in their syntheses. This last section contains papers (such as those by Abate *et al.*, Flügel, and Tsien and Dricot) that have photomicrographs and distribution data that should help in overcoming that deficiency.

Flügel did a fine job of selecting the papers, and the book has excellent generic and species name and subject indexes.

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Quantum Chemistry

Quantum Mechanics of Molecular Conformations. BERNARD PULLMAN, Ed. Wiley-Interscience, New York, 1976. x, 412 pp., illus. $32.50. Perspectives in Quantum Chemistry and Biochemistry.

This volume is an auspicious beginning for a series intended to provide an interdisciplinary survey of the major developments in the application of the concepts of quantum mechanics in various fields of chemistry, physics, biochemistry, biophysics, and pharmacology. Each book in the series is to be "devoted to a *specific subject* of major significance," and "the aim is to demonstrate the importance of the quantum mechanical approach in each of the selected fields for all types of molecules." This strategy is well conceived, and the resulting volumes, being self-contained and coherent, should be much more useful than those of the customary "advances" or "reviews" series.

The present volume is devoted to a description of quantum-mechanical computations used in the study of molecular conformations and to the extension of such computations to a wide range of molecular systems, from small inorganic compounds to biopolymers and their constituents.

In the first chapter, entitled "Small molecules and inorganic compounds," A. Veillard reviews the LCAO-MO-SCF method (linear combination of atomic orbitals to form molecular orbitals by a self-consistent field technique), the choice of expansion basis sets (Slater versus Gaussian functions), the bond orbital approach, correlated wave functions, the semiempirical SCF methods, among which he includes CNDO, INDO, and MINDO (complete neglect, intermediate neglect, and modified intermediate neglect of differential overlap), and the extended Hückel method. He does not mention the use of ab initio effective core model potentials, a theoretical method that has not yet been used extensively for conformational analyses. This method enables one to treat only the valence electrons explicitly, yet to obtain solutions comparable in accuracy to ab initio calculations retaining all the integrals. The development of this method will have a profound impact on the feasibility of conformational analyses, especially for molecules containing four or more even first-row atoms. It will cut the amount of computer time necessary for such calculations so significantly that it may well make them competitive with less rigorous methods. Veillard also omits the use of improved virtual orbitals or multi-configuration (MC) SCF, by itself or as a starting point for more rapidly converging CI (configuration interaction) expansions. The omission is no doubt due to the paucity of conformational analyses using these techniques.

Veillard's review is especially valuable in that he compares the reliability of conformational analyses done by the different computational methods. Particularly important are the instances he cites of the failure of the CNDO method,

which is now widely used by the nonspecialist. His assessment of the reliability of the various methods in predicting the correct inversion barriers for hydrides also applies to their reliability in other conformational problems. He points out that, with too small a basis set, even ab initio calculations can lead to incorrect results.

In the second chapter, entitled "Organic molecules. Studies by semi-empirical methods," J. K. Fernandez Alonso describes the semiempirical techniques more thoroughly. His examples of the smaller molecules overlap Veillard's somewhat, but most of the examples are of the larger molecules.

The third chapter, entitled "Molecules of pharmacological interest," by R. E. Christoffersen, has a somewhat different format. It deals with calculations on the pharmacological molecules themselves. The separation of molecules by their pharmacological effects is especially valuable in view of the dismal state of indexing of quantum-chemical calculations that have been performed on pharmacological molecules. There is at present no way to search for such calculations without knowing the precise molecule or general family of molecules on which the calculations were performed. The literature is covered in this chapter only through 1974. One hopes that every two or three years a chapter updating this one will appear as part of the series.

In the last chapter, entitled "Proteins, nucleic acids and their constituents," B. Pullman cogently describes the fundamentals of the PCILO (perturbative configuration interaction based on localized orbitals) method derived by his group as well as the more empirical, potential-function methods used by other investigators. The large majority of examples in this chapter have been calculated by Pullman using the PCILO method, and the comparisons of the computed conformational energy maps with the known experimental results are truly impressive.

All four of the authors have searched the literature thoroughly and have presented their subjects coherently. In several chapters, the introductory sections, which summarize theoretical and computational methods and give extensive references to the original articles, will be especially useful to the nonspecialist. One looks forward to the subsequent volumes in the series.

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