the diverse facets of coral reef problems, advances scattered in a multitude of papers." The success of this encapsulation will be judged better when the third and fourth volumes, containing the rest of the 46 chapters by nearly as many authors, are published, but the contents of these first two bode well.

The papers, as the introduction implies, are essentially reviews, though most of them contain previously unpublished material. Brief notices will give some idea of the scope and contents. Volume 1, Geology 1, opens with 50 pages on Caribbean reefs by J. D. Milliman, a concise analysis with references to nearly everything that has been written this century. D. R. Stoddart equally well covers the reefs of the Indian Ocean. A short article by H. S. Ladd neatly summarizes the results and implications of the extensive geological studies of Bikini and Eniwetok atolls (Marshall Islands). J. P. Chevalier surveys the work in the past few years on the reefs of French Polynesia and the recent studies in New Caledonia. The late F. W. Whitehouse has contributed, in his easy style, a description of the little-known reefs of the New Guinea–Torres Strait region.

The remaining five papers in volume 1 concentrate on the Great Barrier Reefs. All the authors seem to recognize that this vast province is not a single reef, but balk at using the label "Great Barrier Reefs" first given it 170 years ago by Matthew Flinders. D. E. Brandon sets the scene with many new data on the oceanography of the reef area, followed by a presentation of the geomorphic setting by W. G. H. Maxwell, including an important summary of the results of recent deep drilling. The account of the structure and tectonics of northeastern Queensland and their relation to the reefs by E. Heidecker is marred by five almost incomprehensible physiographic diagrams. The complex problem of sediment accumulation is considered by Maxwell, using distribution maps derived from his *Atlas of the Great Barrier Reef*, which here suffer from reduction and poor reproduction. A. R. Lloyd gives the results of his study of the Foraminifera from four bore holes, one, at the north end of the reefs, reaching nearly 12,000 feet into the Jurassic. A large foldout in the back of the volume is so arranged that one cannot look at any of the 12 maps and refer at the same time to the text.

Volume 2, Biology 1, proffers 12 papers on developments in old and new fields of coral reef biology. L. H. Di Salvo discusses microogranisms in reef waters and sediments and their involvement in reef carbonate dynamics, an aspect previously little studied. Following this a chapter by Yu. I. Sorokin considers the microbiological aspects of the productivity of reefs, demonstrating the metabolic and biosynthetic role of microorganisms in this ecosystem. L. Muscatine very ably summarizes the present status of the old problem of nutrition in corals. P. R. Burckholder contributes a highly interesting review, with new data, of the ecology of marine antibiotics and reefs, from bacteria to chordates. L. S. Cierеszko and T. K. B. Karns note in their article on the biochemistry of reef coelenterates that these organisms afford "a mine for novel compounds of potential value as drugs or as tools for pharmacological research." J. H. Connell surveys work on the population ecology of hermatypic corals, including his own extensive studies at Heron Island, and new data on variation in reef communities at Heron Island are described by J. F. Grassle. P. W. Glynn's account of aspects of reef ecology in the western Atlantic region packs into some 50 pages a surprising amount of information on work done and in progress. G. J. Bakus summarizes what is known of the biology and ecology of tropical holothurians and reveals how much is yet to be learned about these quaint and significant reef inhabitants. One of the parameters of the "*Acanthaster* problem," the early life history of these and other asteroids, is considered by M. Yamaguchi, mainly from his own recent research. The final paper, by R. Endean, long deeply involved in the same "problem," is a balanced review of present knowledge of the population explosions of *Acanthaster* and their destructive effects on Indo-Pacific reefs, although not everyone may agree with Endean's suggestion that these eruptions may have a human causation.

Both volumes are well printed, with few obvious typographical errors, although some authors still believe that "fauna" is plural and "data" is singular. The references for each article are exhaustive, and each volume has indexes of authors (about 350 in Geology 1) and subjects plus an index to localities in Geology 1 and a systematic index in Biology 1. Many halftone illustrations, especially where five or six reef views are crowded on one page, suffer from too much reduction and muddiness.

The editors have done well. Their efforts will be appreciated by all hermatologists, hermatophiles, and others concerned with the kaleidoscopic complex of coral reefs. These readers will be looking forward to the last two volumes, although the present ones contain no clues as to their contents.

J. W. WELLS
*Department of Geological Sciences, Cornell University, Ithaca, New York*

## Structures in an Aqueous World

**The Hydrophobic Effect.** Formation of Micelles and Biological Membranes. CHARLES TANFORD. Wiley-Interscience, New York, 1973. viii, 200 pp., illus. $12.50.

Charles Tanford has performed a valuable service for many species of biologists and biochemists in writing this book. It contains in concise (in fact, almost spartan) form the fundamental physicochemical information anyone with a serious research interest in membranes or related organized systems must have in order to work and think intelligently in the field. Unfortunately many membranologists are not aware of the basics outlined here, which is understandable since these basics have never before, to my knowledge, been presented so clearly and directly within a single short volume. I would hope that all laboratories engaged in membrane research will purchase the book, for it is admirably suited to serve as a reference standard on which molecular hypotheses of the structure and stability of membranes (and of all other macromolecular systems which are at least partially stabilized by hydrophobic interactions) can be constructed. This would go far toward assuring that everyone begins with the same physicochemical understanding, and the same semantics.

The book opens with chapters on the thermodynamics of the solubility of hydrocarbons in water and then moves to an equivalent consideration of the solubility of amphiphiles in water and organic solvents. An amphiphile is defined as a molecule containing a polar ("sympathetic" to water) and a nonpolar ("antipathetic" to water) end. As Tanford clearly states, it is the existence of such amphiphilic molecules,

with their simultaneous "need" (in free energy terms) to position their polar ends in contact with a polar environment and their nonpolar ends in a nonpolar surround, that is basically responsible for the establishment of all micelles and membranous structures in an aqueous world. By the end of chapter 4 the reader has a concise view of the behavior of these molecules in various environments, and (one is tempted to say) everything else follows as a natural consequence of these thermodynamic considerations.

A short chapter on water comes next, which in my view is the weakest part of the book. Here Tanford's insistence on not even alluding to anything that might be viewed as a speculative model makes it difficult for him to put across the notion of the many forms water must be able to assume in establishing thermodynamically and mechanically stable structures around the nonpolar, polar, and ionized functional groups inserted into it. At this point, a speculative model, presented purely as an illustration of the kinds of possibilities one needs to consider, might have served the reader better than a rigid adherence to fully established facts.

Tanford then moves on to micelles, introducing the ideas of cooperativity and the principle of the balance of opposing forces (intermonomer head group repulsion and tail group attraction) in determining the shape and stability of the resulting micellar "micro-phase," and then to the structural and thermodynamic restrictions on polar molecules inserted into a nonpolar surround of the sort presented by the interior of a micelle. The properties of monolayers are briefly presented, and then the reader is sequentially introduced to the various molecular components actually found in biological membranes, together with a discussion of their similarities to, and differences from, the simpler species discussed in the preceding "model systems" presentation. The book concludes with a very brief survey of the highlights of what (in Tanford's view) is known (and not known) about membrane structure.

This is a beautifully crafted book. In going through it one feels that one is watching a skilled cabinetmaker at work, installing supports and dovetailing joints in clear view of the audience so that the relations of the parts are apparent throughout and all can follow how each development underpins the next. Such coherent insight is not often available, and most readers will be amply repaid in the coin of increased understanding for the time they invest in reading this volume.

PETER H. VON HIPPEL
*Institute of Molecular Biology* and
*Department of Chemistry,*
*University of Oregon, Eugene*

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