how, for a given retina, the subtypes of neurons are readily distinguished on the basis of dendritic and axonal arborizations, which in turn determine the pattern of synaptic connections made by the cell. Naka, however, on the basis of an extensive structural and functional study of single neurons in the catfish retina, demonstrates that the three-dimensional distribution of a cell's processes is not always an unambiguous indicator of its response properties. As Kaneko and Shimazaki find in their study of bipolar and horizontal cell responses in carp retina, the conductance changes effected at a particular synapse are more appropriately related to morphology on an ultrastructural, or even molecular, level than to the distribution of cell processes in space. McReynolds raises comparable issues in a lively review of the ionic basis of receptor responses in several molluscan and protochordate species. Whether membrane or synaptic ultrastructure will provide a clue to the nature of the conductance channel or the polarity of the synapse remains to be seen.

Strausfeld and Wehner present comprehensive and esthetically pleasing reviews of neuronal geometry in various insect visual systems. In the second layer of the visual pathway, Golgi impregnation and electron microscope studies reveal numerous subtypes of interneurons and centrifugal neurons, each with a highly specific geometry and set of synaptic connections. Laughlin and Zettler and Weiler describe spatial integration and lateral inhibition phenomena that occur in some of these cells and that underlie contrast detection and visual adaptation. However, insufficient functional data are available as yet to make it possible to assign a particular integrative role to each class of neuron that is described morphologically. In this regard, the book as a whole convinces one of the many important differences in visual neuron morphology in both closely related and distantly related species; hence the importance of pursuing structural and functional studies on a single organism.

One beautiful correlation between form and function is provided by Wehner's description of polarized light perception in hymenopterans. Their ommatidia are of the fused rhabdom type in which nine retinular cells of different spectral classes contribute microvilli to a central light-sensitive structure, the rhabdomere. The different optimal directions for polarization sensitivity among the retinular cells, the length of the cells, the electrical coupling between neighboring cells, and the twisting of the rhabdom in its central course all serve to reduce the possibility of polarized light detection. One short, ultraviolet-sensitive retinular cell fulfills this function, however, and the fact that some rhabdoms twist clockwise and others counterclockwise provides the bee with two polarization analyzers of different optimal orientations.

This collection of essays is provocative and timely, but it will not be easy reading for those not familiar with visual system organization. Each essay is a review of a small area of current research, and, for that reason, the book would have been well served by a final chapter that reconsidered the question that motivated the symposium—whether a close examination of the visual systems of diverse animals yields generally applicable principles of neural organization. Even without such a chapter, there is much of interest for the patient reader.

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Marine Organisms

Calcareous Algae. JOHN L. WRAY. Elsevier, New York, 1977. xiv, 186 pp., illus. $28.75. Developments in Palaeontology and Stratigraphy, 4.

With the increasing interest in the study of ecosystems, it has become apparent to most benthic marine scientists that algae, calcified and not, are the key to shallow-water carbonate environments. While there is a fairly voluminous literature, extending over the past century, that treats calcareous algae, most of it was developed by biologists and geologists with little appreciation for the ecological and physiological relationships of the organisms with which they were dealing. A resulting failure to recognize ecological variation and to appreciate biological and physiological factors, coupled with a lax approach to taxonomy, produced a quagmire of literature that extended up to the 1960's. Consequently, many workers with Recent and fossil marine environments have been content to be blind to even the existence of some of these algae.

John Wray's book is a very timely summary of an often obscure field and its literature. It has been written for geologists, paleontologists, and sedimentologists and is obviously intended as an introduction to the field. I personally would have preferred a more thorough treatment, especially one including more of the biological-ecological literature that has been developed during the past decade. Phenomena of calcification, grazing, and microenvironment in modern carbonate systems are critical for paleoecology, and students as well as more classical paleontologists should be made aware of them.

Wray has been careful to point out a stumbling block for biologists and paleontologists who have approached calcareous algae in the past several decades: dimensional data and species identification should be approached with great caution and greater understanding of phycology than one derives from invertebrate courses and a quick swim through the literature.

On the other hand, the book is weaker than I would regard as desirable on the basic cytological level. Also, systematics is not adequately presented. For example, the statement that the taxonomy of the major genera of crustose corallines has changed but little is fortunately true—that is why we have a Rules of Nomenclature. However, there is little relationship between modern coralline systematics (and the biology on which it is based) and that of the 19th century (or even the 1940's). Unfortunately, many biologists and paleontologists are still producing identifications in the 19th-century mode that are virtually useless for modern ecology. Many genera are also omitted on the grounds that the anatomic or reproductive characters needed do not appear in fossils. That would not be a problem if all workers would recognize that a specimen identified as *Lithothamnium*, for example, might really belong to any of several genera. Paleoecological conclusions based on such an identification could be greatly in error.

These are not intended as strong criticisms at all. I am sure the author recognizes these problems and has reflected at length over the level of presentation. For the paleontologist and stratigrapher seeking to recognize fossil algae and to have some feeling for what they mean paleoecologically, the treatment is excellent, and it will help him through the literature. For the paleontologist, biologist, or ecologist who would work at some length with calcareous algae, this book is a good introduction.

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