The greatest attraction of *The Evolution of Reef Communities* is the synthesis of data and opinions from numerous disciplines into a very readable dissertation on virtually all aspects of the reef phenomenon. The long list of bibliographic references includes nearly 400 published during the 1980s and several published as recently as 1986. Unfortunately, however, the book has numerous spelling errors, and some of the photographic reproductions are not of sufficient quality to warrant their inclusion. The placement of all the photographic figures at the end of the book is awkward. Necessary locality and geological information is not in captions but rather in a separate register (requiring an extra inserted finger for the curious). These editorial shortcomings detract from a useful book.

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Functional Neuroanatomy

Arthropod Brain. Its Evolution, Development, Structure, and Functions. AYODHYA P. GUPTA, Ed. Wiley-Interscience, New York, 1987. xiv, 588 pp., illus. $64.95.

The wonder of the cellular architecture of the insect brain was first pointed out by Ramon y Cajal, after he had examined his silver preparations of the honeybee. Since that time brains of arthropods, especially of insects, have been subjected to the collective scrutiny of comparative neurobiologists and anatomists. This is due as much to the endlessly fascinating behaviors of these creatures as to the considerable impact of insects upon the health and economies of human societies. It is noteworthy when a book on the arthropod brain appears, because there have been so few. The modern standards start with Bullock and Horridge's 1966 classic, *Structure and Function in the Nervous System of Invertebrates*, which provided taxonomic breadth, a ground plan of the arthropod brain, and a lexicon. Nine years later, N. J. Strausfeld published his brilliant and somewhat idiosyncratic *Atlas of an Insect Brain*, which focused on the brain of the housefly. Of course, review chapters in the various generic *Advances in* . . . volumes have appeared over the years and filled some gaps in coverage, but nothing approaching Bullock and Horridge in comprehensiveness or Strausfeld in detail is available (at least in English). This is all the more unfortunate now that the widespread application of technical advances permitting visualization of single neurons has given rise to the standard of the "identified neuron" in physiologically and anatomically interconnected networks. If Bullock and Horridge gave us the layout of the "forest" of the arthropod brain, modern techniques allow us to map it out tree by tree, and it is fair to state that modern insect neuroanatomy is functional neuroanatomy. How successfully does *Arthropod Brain* convey this state of affairs?

Insects get about two-thirds of the coverage, but there are chapters on crustaceans, spiders, millipedes, mites, and ticks, as well as the evolutionarily central onychophorans—the annelid-arthropod "link." Since the time of Cajal's studies, the optic projections in the insect brain have been the subject of enormous efforts by anatomists, and this book is remarkably restrained in its single-chapter discussion of this important topic—perhaps too restrained. The mushroom bodies (MBs) get three chapters, which should please behavioral neurobiologists, because this region of the brain certainly appears to be an important integrative center in the control of behavior. In particular, Gupta advances the argument that large, well-elaborated MBs represent a relatively advanced evolutionary condition among arthropods. It is interesting that over the years honeybees, crickets, and cockroaches—all of which have large MBs—have served as the mainstays for physiological investigations of brain in relation to behavior. In this volume, Erber and co-workers contribute a cogent review of the functional role of the MBs in insects, pointing out that MB neurons receive multimodal inputs and presenting evidence for the role of the MBs in complex olfactory learning. Olfaction and vision have always been favorite subjects for entomological physiologists and anatomists. The olfactory pathways in the lepidopteran brain are capably reviewed by Christensen and Hildebrand, who draw upon their own pacesetting work in *Manduca*. Vision, as noted earlier, is treated lightly in this volume, but this is certainly forgivable given the many books and review articles already available on this subject.

Neurobiology at all levels is being driven by new techniques, and we live in a New Age of neuroanatomy. This book reflects its time. Immunocytochemical markers, especially for neurotransmitters (or biosynthetic enzymes leading to their production), have been applied to produce chemical maps of the arthropod brain, although with less spectacular effect than has been accomplished in the mammalian brain. Nonetheless, the ability to correlate structure and function at the level of identified neurons makes the immunocytochemical maps that are reported in this book, for the bee brain for example, an undeniably important advance in functional neuroanatomy. Several chapters on the ultrastructure of the arthropod brain are included, and here I sadly report that the quality of the electron micrographs is very uneven, and sometimes poor. The book does not dwell on techniques per se, nor should it; two chapters at the end deal briefly with techniques, but they are redundant; their inclusion is puzzling in light of the availability of two excellent books on insect neuroanatomical techniques, edited by Strausfeld and published by Springer-Verlag.

Is the book authoritative? Certainly some important contributors to the field are among the authors, but some of the major names are conspicuously missing. But this is perhaps compensated by the inclusion of the younger generation of functional neuroanatomists, who combine physiological and anatomical approaches to the problem of sensory-motor integration.

Overall, this is a valuable addition to the literature of comparative neuroanatomy. The emphasis on insects is not misplaced; this group has always served as important research material for investigations of the development of the nervous system, and with the infusion of molecular biology techniques, especially applied to *Drosophila*, it is all the more important to have reference volumes on the insect brain. This book, with its focus on the use of new technologies to probe the structure of one of life's marvelous "living crystals," is surely welcome, for, as Floyd Bloom said in another context, "the gain in the brain is mainly in the stain."

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Complex Dynamical Objects

Structure and Dynamics of Elliptical Galaxies. TIM DE ZEEUW, Ed. Reidel, Dordrecht, 1987 (U.S. distributor, Kluwer, Norwell, MA). xvi, 579 pp., illus. $89. International Astronomical Union Symposium no. 127. From a symposium, Princeton, NJ, May 1986.

Elliptical galaxies were once thought to be among the simplest dynamical objects held together by self-gravitation. They have a bright center that appears nearly stellar. Luminosity fades away smoothly in all directions with no detectable outer boundary. Contours of equal brightness (isophotal contours) are very nearly elliptical in shape, circular in some objects, flattened as much as 3:1 in others. Apart from the bright center

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