sights into cellular morphology and cortical microcircuitry and into the functional role of individual cortical connections.

This volume is meant to be the first of a series on the cerebral cortex. Later volumes are projected to cover cortical function, afferent and efferent connections, and development and plasticity. The fact that the present volume is descriptive, with little information on cortical function and its relationship to cortical structure, reflects the limitations of the field. One hopes that over the next few years the development of various pharmacological, immunochemical, and combined anatomical and physiological techniques will enable one to go beyond the descriptive. The book serves a useful function in that it provides a common understanding of the cellular components of the cortical circuit and provides a basis for anatomists, physiologists, and theoreticians to develop ideas about the relationship between cortical function and the structural components of the cortex.

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Actinopterygian Neurobiology

Fish Neurobiology. R. GLENN NORTHCUTT and ROGER E. DAVIS, Eds. University of Michigan Press, Ann Arbor, 1983. In two volumes. Vol. 1, Brain Stem and Sense Organs. viii, 414 pp., illus. $45. Vol. 2, Higher Brain Areas and Functions. viii, 375 pp., illus. $45. From a symposium, 1977.

Why study the brains of fish? Three reasons are presented by Bullock in the last chapter of volume 2 of *Fish Neurobiology*: comparative neurology helps us appreciate our ancestral "roots," as inferred from the characteristics of our vertebrate relatives; some general "rules" can be proposed about physiological mechanisms, brain size, and the general organization and modification of the nervous system; and the "relevance" of studies of the nervous systems of other species to the understanding of the human brain, which is often taken for granted by researchers but should be emphasized more strongly for the benefit of those who fund the research.

Fish Neurobiology is not as wide-ranging as its title suggests. It concentrates on the topics of brain anatomy, sensory systems, and behavior. It does not include chapters on development, somatic sensation, the spinal cord, swimming, respiration, or the autonomic nervous system. However, some of the subjects it does not cover have been reviewed in the series *Fish Physiology*, edited by Hoar and Randall. It also does not consider all types of fish but focuses on the actinopterygian or ray-finned fishes, including the relatively primitive bichir, sturgeon, gar, and bowfin, but especially the teleosts, which number about 23,000 species of the total of 40,000 species of all vertebrates. Since this group is amazingly diverse, the first chapter, on taxonomy, is very useful as a reference while reading the subsequent chapters. Taxonomic nomenclature can be heavy reading, but this chapter, by Lauder and Liem, is clearly written and includes interesting comments on the biology of representative species.

These volumes are useful as references for specialists and as reviews for general neurobiologists. For the specialist the volumes have good indexes, clear diagrams and plates, summary tables, and extensive bibliographies, although most of the cited references are from earlier than 1979. For the general reader, a review by Powers and Easter of fish retinas and vision is clearly written, interesting, and thorough. Likewise, a review by Finger of the cerebellum in fish is authoritative yet written in a style that can be read and appreciated by non-specialists. Neuroanatomy is the major subject of eight of the 22 chapters. Five of these are presented in the traditional style of comparative neurology, with an abundance of neuroanatomical nomenclature. Non-anatomists most often want simple answers to the questions, where in the brain can a particular structure (such as the nucleus glomerulosus) be found? and what is the anatomical location of a particular electrode site or of a region with some type of reaction? The worst fears of non-specialists are stated clearly by Braford and Northcutt: "There are numerous instances in the literature in which the same name has been applied to different cell groups or the same cell group has received several names. Although this problem is not unusual in comparative neuroanatomy, it is particularly acute and vexing in the diencephalon and pretectum of actinopterygians." Diagrams of the brains of several species, sections, and up-to-date nomenclature are presented in the anatomical chapters. However, it would have been useful to have included a separate listing of all published atlases of the brains of different species of fish as well as additional tables with corrections of any previously mislabeled structures. The remaining chapters include thorough reviews of the physiology of the vestibular system, audition, electroreception (with a comparison of mormyrids and gymnotoids), chemoreception, visual physiology of tectum and forebrain, and neuroendocrinology. In addition, the functions of higher brain centers are inferred from electrical stimulation and from the effects of lesions on behavior, both ethological and associative. Chapters by Little and by Davis and Kassel include interesting discussions of fish behavior, including feeding, schooling, alarm, migration, and nesting.

These two large volumes are well prepared and well illustrated and should be part of any biology or zoology library. Most of the chapters are too detailed for beginning students but are well suited for advanced graduate students. In particular, actinopterygian neurobiologists should have both volumes in the laboratory or office for ready reference.

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Marine Zoogeography

A Comparative Atlas of Zooplankton. Biological Patterns in the Oceans. S. VAN DER SPOEL and R. P. HEYMAN. Springer-Verlag, New York, 1983. vi, 186 pp. $49.50.

Few scientists since Darwin have achieved the comprehensive knowledge required to synthesize the many kinds of observations relevant to zoogeography into inclusive schemes that would explain why given species occur in particular areas to the exclusion of other areas. In their *Comparative Atlas of Zooplankton* van der Spoel and Heyman have undertaken to simplify our task by presenting us with a book of maps upon which are sketched the occurrences of oceanic zooplankton, and to distill innumerable distributions into a few patterns that might provide the reduction needed as part of a comprehensive theory. Sections at the end of the book then look at geomorphology, plankton patchiness, and changes in climate and sea level as factors that might have contributed to the speciation associated with these generalized zoogeographical patterns.

The authors' attempt is a valid one, and the accomplishment of compiling thousands of distributional notes and maps into a few patterns is admirable.