Amphibians


The class Amphibia consists of three orders, two of which, the Anura (frogs) and the Caudata (salamanders), are familiar to many and the third of which, Gymnophiona, containing the fosorial and rather bizarre caecilians, remains relatively little known even to those who study their biology. Studies of amphibians have made essential contributions to our understanding of a number of biological subjects, especially development, ecological competition, functional morphology, molecular evolution, sensory physiology and neuroethology, and social behavior. Although these studies encompass a diversity of scientific interests, researchers must take into account the fact that the animal is an integrated whole. For those of us with amphibians as our specialty, the most reliable source of information about the biology of our study organisms has since 1931 been G. Kingsley Noble's monumental The Biology of the Amphibia, reprinted by Dover in 1954. I am not urging by any means that researchers retire their copies of Noble; I predict, however, that Duellman and Trueb's Biology of Amphibians will soon become the key reference for details of amphibian biology.

Duellman and Trueb truly review the biology of amphibians, covering most conceivable topics from cytogenetics and development to biogeography and phylogeny. They do this in 19 chapters in four sections: Life History, Ecology, Morphology, and Evolution. The outstanding feature of this work is its extensive and up-to-date (as of about 1983) documentation. The book lists more than 2500 references in 12 languages, and more than a third of these appeared between 1980 and 1983. Duellman and Trueb have, moreover, collated large quantities of data (or added to such collections by others). These collections, especially those in the section on life history, are sure to provide a catalyst for inquisitive minds. Although at times the authors' own presentation becomes a mere litany of facts, for the most part there is an attempt to summarize and synthesize. Of course, in a work of this breadth a thorough consideration of all aspects of amphibian biology is not possible. For example, about 15 pages are devoted to the amphibian ear, a subject to which E. Wever recently (1985) devoted a 500-page book. However, the authors usually provide accurate and concise summaries, along with key references, especially to review articles. Another welcome feature of this book is the abundant, clear, and well-labeled illustrations. Most that have been taken from the primary literature have been redrawn, and some are works of art. Their illustrations especially add to the chapters on morphology, which I found the most comprehensive and rewarding. The index is thorough and easy to use—not a trivial point for a book of this nature.

There are some mistakes and misconceptions. For example, attenuation of sound pressure level with distance does not follow the inverse square law (it changes linearly), and the authors seem to imply that low-frequency sounds (<1000 Hz) reach the papilla amphibiorum of the inner ear only through the opercularis system, whereas data presented by Lombard and Straughan in the paper cited for this conclusion clearly show that perturbation of the tympanic-columella system influences thresholds of low-frequency hearing and Wever, in a paper also cited, questions the mechanism implicating the opercularis in low-frequency hearing. There is occasionally uncritical acceptance of studies in the literature; but it is not clear how any two authors could be expected to assess accurately all studies contributing to a work of this breadth. Even though the book is fairly current, the reader should be aware that there have been significant new developments since it went to press, for example with respect to energetic costs of reproductive behavior.

There is no recent textbook on amphibian biology that is worthy of comparison with Duellman and Trueb's. This work also compares favorably with analogous books on other vertebrate taxa, such as Vaughan's Mammalogy, Weir's The Life of Birds, Pettigrew's Ornithology, and Bond's Biology of Fishes. If only there were a counterpart of this quality for reptile biology.

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Measuring Selection


Field biologists these days are succeeding at the difficult task of measuring selection in natural populations. Much of the current effort is directed at large organisms (for example, deer, birds, lizards, dragonflies, flowering plants). Such organisms can be individually marked, observed, and recaptured in the field so that statistical relations between phenotypic traits and reproductive success can be determined. The focus is on traits with direct relevance to ecological interactions and evolutionary history (for example, body size, feeding structures, running ability). The challenge is to adapt census techniques, developed to answer simpler demographic questions, to the task of estimating selection and addressing unanswered questions in evolutionary biology.
Invertebrate Neural Systems


If we are to believe higher neurobiological authority, there are on the order of 10^12 neurons in our brains, and from this incredible number are carved the neural networks that generate our behavior. Given this daunting quantity, it is little wonder that some neurobiologists have taken to the study of invertebrate animals, with numerically simpler nervous systems, in search of insights into the cellular bases of neural function. This volume surveys the simple (“model”) neural networks approach to neurobiology. A major advantage of working with invertebrate neural systems is that it is possible to study neural structure and function by means of unique and identified single neurons. In every chapter of this book it will be seen that this advantage has translated into remarkable advances in our understanding of neural function.

This is a big book, with 28 chapters by 60 authors, including many of the leaders in their fields. The title of the book is misleading; only a third of the chapters deal with neural networks and behavior, and even then the subject is limited to such (albeit important) aspects as locomotion and learning. Omitted are more comparative studies of ethologically oriented behaviors such as navigation and biocommunication. The use of invertebrate neural systems has made a ringing impact on neurochemistry, membrane biophysics, neurogenetics, and especially neural development, and these topics are nicely surveyed here.

The book has something for everyone. This reviewer enjoyed the network analysis of the snail brain by Benjamin, Elliott, and Ferguson because it proceeds from the biophysical properties of neurons right on to feeding behavior of the animal. An essay on central pattern generators in Tritonia by Getting and Dekin and one on lobsters by Miller and Selverston are provocative. Historically, rhythmic behaviors have been favorites for the model systems approach. Current studies indicate that the idea that there are simple/fixed circuits hierarchically organized to generate central rhythms is due for revision. The reality seems to be that networks of anatomically connected neurons can be subdivided into different pattern-generating circuits, depending on such factors as the behavioral and neurohormonal context of the animal. Four chapters on insect and molluscan development, by Heilbronn, Bastiani et al., Weisblat and Kristan, and Kater, will bring the reader up to date on developmental neurobiology, especially with respect to studies of prenatal growth and regeneration. Drosophila has been a model system for geneticists for half a century, and it now promises to illuminate the neurobiological landscape as well, though a chapter on the generic dissection of potassium channels by Jan and Jan and one on the specificity of neural connectivity by Wyman et al. only introduce the reader to the riches of Drosophila neurogenetics. The mollusk Aplysia californica, like Drosophila, has become so celebrated in neurobiology as to nearly transcend its taxonomic status as a “mere” invertebrate. We see in a paper by Abrams that learning in Aplysia has become Pavlovian and in one by Scheller and Schaefer that the egg-laying behavior of Aplysia can now be examined at the level of gene expression. These brief sketches can only hint at the other treats that await the reader.

The pioneers of invertebrate neurobiology correctly foresaw behavior as being the primary target for the model system approach; clearly invertebrates are going to be even more important for our understanding of the genetic and developmental controls that operate in the formation of nervous systems. The reader of this nice collection of research essays will learn how the analysis of invertebrate neural systems has provided key insights into major neurobiological problems.

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Books Received


