Book Reviews

Jawless Vertebrates

The Biology of Lampreys. Vol. 1. M. W. HARDISTY and I. C. POTTER, Eds. Academic Press, New York, 1971. xiv, 424 pp., illus. $22.50.

As the closest living relatives of the earliest known vertebrates and the systematic group most distantly related to all of today's jawed forms, the lampreys and hagfishes have great potential value in both general and comparative biology. The contributions that studies on these jawless and otherwise strikingly different fishes could make are still mostly unrealized, because only within the past decade have biologists begun to give them the attention they deserve. Even the devastating invasion and spread of the sea lamprey through the Great Lakes resulted solely in investigations directly concerned with its control: a modicum of population biology and a great deal of larval toxicology. This two-volume series on *The Biology of Lampreys* is an expression of the growing interest of ichthyologists and comparative physiologists and will surely accelerate it.

To judge from their execution of the first volume (as well as the table of contents of the second), the editors have put together a compendium that truly lives up to its title with its extended treatment of the systematics, evolution, ontogeny, ecology, behavior, and physiology of the lampreys. Moreover, the book is exceptionally well integrated and has liberal cross-indexing throughout. That the editors wrote or coauthored six of the nine chapters has undoubtedly helped unify it.

Hardisty and Potter are well known for their studies on the lampreys of the northern and southern hemispheres, respectively, and they have selected outstanding, currently active authorities to assist them. Carl L. Hubbs, who has been making significant contributions to our knowledge of lampreys for more than half a century, has helped present a comprehensive review of the systematic relationships and geographic distribution of the 31 species of living lampreys. David Bardack and Rainer Zengerl, who recently described the first and only fossil lamprey known, have expanded that description and discussed the evolution of the group. E. S. Robinson and George W. Piavis have contributed their specialties, lamprey karyology and embryology, and B. R. Smith, long associated with sea lamprey control in the Great Lakes, has reviewed the history of this effort. Detailed accounts of ecology, complicated life histories, and unusual sexual development of lampreys are provided by the editors themselves.

Fascinating questions about the speciation, migrations, and metamorphosis of the lampreys are broached in this book, but the most interesting question of all, and by far the most difficult to answer, is, of necessity, only touched upon: In what ways and to what extent have the living lampreys retained the structures and functions of the earliest vertebrates?

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Cellular Processes

The Biology of the Cell Cycle. J. M. MITCHISON. Cambridge University Press, New York, 1972. vi, 314 pp., illus. Cloth, $14.50; paper, $4.95.

A major aim of this book, which grew out of a graduate course Mitchison taught at the University of California at Berkeley in 1969, was to "provide a reasonably comprehensive survey of work on the cell cycle from bacteria to mammalian cells, with the main emphasis being on patterns of synthesis and their control." I think this goal has been achieved in admirable fashion.

Coverage in the first nine chapters includes methods used to study the cycle and consideration of the variables which have been measured, such as the synthesis of nucleic acids and proteins, growth patterns, changes in cell organelles, and problems of pools and uptake. The author integrates a wealth of material from diverse areas of biology, pointing out gaps in our knowledge, suggesting new experiments and new avenues of approach.

The tenth and final chapter, entitled "The control of division," deserves separate mention. It begins with a detailed analysis of heat-shock synchrony in *Tetrahymena* as studied by Zeuthen and his co-workers because this "is the only case of induction synchrony where there is a well-developed theory, with experimental backing, on the mechanisms that control division in individual cells and cause division synchrony in cell populations." With this as background Mitchison develops a series of models for division control and then examines the relationship of data from a variety of biological systems to the models and to the findings in *Tetrahymena.*

A number of subjects one might expect to find treated in a survey of the cell cycle were omitted, but this was by intent rather than neglect. In particular, mitosis and cleavage are not included because "they have been so well analyzed in the review by Mazia (1961)." This, I think, points up the long-range value of certain kinds of reviews. Those, such as *The Biology of the Cell Cycle*, which are thoughtful and relate new findings to the total pool of available information from all types of organisms will not suffer early obsolescence.

The writing style is lucid and often conversational in tone, and there are some unusual features in format which enhance its value and make it easier to use. One is the addition of a postscript at the end of the book in which findings published after the body of the book was written are presented chapter by chapter and placed in the context of earlier discussions. Also, the extensive bibliography (over 1000 entries) includes the numbers of the pages on which the references are cited, in a sense combining the functions of bibliographies and author indexes into one unit.

The book seems well suited for use in a graduate course, which is not surprising considering the way in which it was developed, and may stimulate more people to teach courses along these lines. However, its potential utility is much broader than this. I think it will

enjoy prolonged use among a variety of biologists, will serve as a standard against which future books will be judged, and will be a tough act to follow.

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Strongly Nonequilibrium States

Thermodynamic Theory of Structure, Stability and Fluctuations. P. GLANSDORFF and I. PRIGOGINE. Wiley-Interscience, New York, 1971. xxvi, 305 pp., illus. $15.50.

Thermodynamics, as conventionally taught, is concerned with states of thermal equilibrium; or more occasionally, with states that are very near to equilibrium. Glansdorff and Prigogine have long been involved with the thermodynamics of states that are very far from equilibrium. Their views are summarized in this book.

Can one construct a thermodynamic theory for strongly nonequilibrium states? If the macroscopic state of the system can be described by the same variables as are used near equilibrium, for example if "local equilibrium" prevails, then the answer is yes. Further, many interesting nonequilibrium situations appear to obey this local equilibrium condition.

Why should one want to construct such a theory? Aside from academic curiosity, there are many practical reasons. The world is filled with nonlinear phenomena, for which conventional (that is, linear) nonequilibrium thermodynamics is not valid. Some examples are turbulent fluid flow, laser action, and oscillating biochemical reactions. And, in fact, there is an extensive and well-developed theory of many such nonlinear phenomena. The authors attempt a unification and generalization of this existing theory.

When a system is near equilibrium, it tends to relax toward the equilibrium state; and it is stable to small fluctuations. But when it is far from equilibrium, it may be unstable to small fluctuations, and may tend toward a nonequilibrium steady state that involves new structures not present at equilibrium. An example (not discussed in this book) is the development of self-oscillation of a laser. The authors present general criteria for stability to fluctuations in nonlinear thermodynamic and hydrodynamic systems, and they discuss some of the new structures that develop in systems maintained in nonequilibrium states. They present a variational method which often allows practical computations of these new structures, and they show how the variational method works for some hydrodynamic problems. Finally, they discuss coupled chemical reactions in open systems far from equilibrium.

Altogether, this book is not easy to read. It is quite mathematical, in parts highly formal, and written in a heavy style. One annoying feature is the quite unnecessary use of tensor notation; this saves space, but will be unfamiliar to many potential readers. The first half of the book is quite abstract. Only toward the end of the book are there any numerical treatments of practical problems, and those are drawn mainly from previous publications on hydrodynamic instabilities and chemical reactions.

At the end of the book the authors say, "Concluding rather optimistically, we feel that the unified description of the macro-world, developed in this monograph, may prove useful for future progress." They may be right, but I suspect that this will come about only after another book is written, explaining their ideas in simpler and more digestible form.

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Active Volcanism

Volcanoes. GORDON A. MACDONALD. Prentice-Hall, Englewood Cliffs, N.J., 1972. xiv, 510 pp., illus. $18.

Anyone interested in active volcanism will enjoy reading this book. The introductory chapter, which describes the two contrasting eruptions of Hibokhibok in the Philippines and Kilauea in Hawaii, and the chapter describing the classical types of volcanic eruptions are exceptionally well-drawn word pictures of these events. The geologist will find the material on conduits, pipes, plugs, and dikes to be an effective summary. The chapter on the relationship of volcanoes to man is interesting and informative.

The book is written so that it may be appreciated by those who have an elementary geologic knowledge, but elementary student and professional will both applaud the comprehensive collection of so much material descriptive of volcanoes and volcanic processes. Quantitative material is not overlooked.

The references (over 500 items) are well selected. Most of the important volcanological papers of recent years are cited. One wonders why the English edition of Rittman's standard book on volcanology was not included, although both German and French editions are referenced. I noticed no articles in the Russian language in the bibliography. Although many readers will have no command of this language, some material in Russian (not yet or perhaps never to be translated) should have been included if only to indicate the importance and extent of the Russian volcanological literature. Meniailov's 1955 monograph on the Shiveluch dome (*Trudy Laboratorii Vulkanologii*, No. 9) is an example of a study that would have been a welcome addition.

The many photographs which illustrate this volume are well chosen and credited. Unless one objects to Hawaii's having more than proportionate representation (this reviewer does not), almost all the selections will appear to be appropriate. They are informative, supplement the text, and are good photographs as well. The Hawaiian photos are particularly good; the background of the author might suggest that they would be.

The geologist may regret the omission of data of chemical petrology related to magmas and their origin, but the author tells us in his preface that he will not consider this material, so we are forewarned. There are a few errors of scientific or geographical fact, such as the statement that Hatherton and Dickerson relate Na_2O/K_2O, rather than K_2O as the graph on the adjacent page shows, to depth to the Benioff zone, or the listing of Mexican volcanoes under the heading Central America. But these minor faults do not invalidate the characterization of the book as well printed, well organized, well written, and up to date. It will be a very welcome addition to the libraries of geologists and other scientists interested in volcanoes.

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