Animal Development

Metamorphosis. A Problem in Developmental Biology. WILLIAM ETKIN and LAWRENCE I. GILBERT, Eds. Appleton-Century-Crofts, New York, 1968. xii + 459 pp., illus. $14.

Biologists have studied metamorphosis for centuries. However, fruitful scientific inquiry into the control of amphibian metamorphosis dates back only to the feeding experiments of Gudernatsch (1912), and pioneering investigations on the control of molting and metamorphosis in insects are of even more recent date. In this book, consisting of ten chapters on various aspects of invertebrate and vertebrate metamorphosis, current knowledge of this developmental phenomenon is systematically presented with a minimum of duplication, and the complexities and variety exhibited by metamorphosing organisms become vividly apparent.

Etkin and Gilbert write in their preface that they are attempting to present a "single up-to-date source that deals with the several aspects of metamorphosis in an integrative way." To this end, they have included four chapters on insect metamorphosis—surveys of morphological changes, hormone production, biochemical events, and hormonal control of genetic activities during metamorphosis. The amphibians are accorded similar treatment except that one chapter deals with the nature of hormone action during metamorphosis rather than with the genome. In addition, a chapter is devoted to metamorphosis in crustaceans and one to metamorphosis in lower chordates. The editors and authors have succeeded admirably with respect to the stated mission. First of all, accounts of so many aspects of metamorphosis have not heretofore been assembled in one volume. Literature appearing through late 1967 is included. In addition, the book reflects a determined effort to integrate the large quantity of experimental data that are available for each topic. Each author has made major contributions to the field to which his chapter is devoted. Thus occasional excesses such as Whitten's concern with the details of metamorphic changes in the tracheolar system of insects are to be forgiven.

It is to be hoped, however, that integration means more than a certain perspective of the progress in one's own field. A few tentative steps are taken by Herman and Etkin toward correlating neuroendocrine control mechanisms in amphibians and insects. It would appear that further integration could have been achieved for certain topics with little risk of artificiality. For example, such biochemical events as oxygen consumption and protein synthesis during vertebrate and invertebrate metamorphosis might yield interesting comparisons. At first glance, it would seem that half of the book would prove useful to those interested in invertebrate metamorphosis and half to those interested in vertebrate metamorphosis. One hopes that subsequent editions will further clarify the similarities and emphasize the dissimilarities of metamorphosis in the two groups. One immediate conclusion to be drawn from a comparison of research approaches and progress is that amphibian metamorphosis is a likely candidate for further ultrastructural investigation. The only ultrastructural studies cited are those on metamorphosing skin, the tympanic membrane, intestinal epithelium, and tail and heart muscle, whereas ultrastructural changes in numerous kinds of insect tissues undergoing metamorphosis have received extensive scrutiny.

Of three very stimulating chapters, two deal with areas that are still in preliminary stages of investigation and one with a closely delineated area currently receiving intensive study. The treatment of crustacean metamorphosis by Costlow and that of metamorphosis in lower chordates by Barrington should engross both the student and the advanced researcher, primarily because of their emphasis on unexplored areas. Kroeger provides a careful analysis of progress in unraveling the insect genome. The continuing search for the operon and the established sensitivity of the genome to electrolyte balance, altered by insect hormones, exemplify progress that one hopes will soon be emulated for vertebrate metamorphosis.

Thorough author and subject indices are included. The quality of the book suffers slightly from numerous typographic errors and from the restriction of illustrations for some chapters to drawings. Other chapters are more completely illustrated with photographs and electron micrographs; a plate of photographs in color is included as a frontispiece.

A. L. Lloyd, in introducing Franz Kafka's book also entitled *Metamorphosis*, suggested that only the great naturalists study beasts merely as themselves. It is readily apparent in *Metamorphosis* edited by Etkin and Gilbert that metamorphosing beasts offer themselves as ample but approachable challenges to biologists of all sorts.

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Band-Edge Structure

Energy Bands in Semiconductors. DONALD LONG. Interscience (Wiley), New York, 1968. xiv + 212 pp., illus. $9.95.

The object of this book is to present a simple, unified account of our present knowledge of the band-edge structure in the better-known semiconductors. The first part of the book provides some useful background material, both theoretical and experimental. The second part surveys Si, Ge, and gray Sn; some III-V, II-VI, and IV-VI compounds; and a number of semiconductor alloy systems. Additional semiconductors such as Te and Bi_2Te_3 are treated in the third part. There is also a useful discussion of practical semiconductor devices whose mode of operation depends in one way or another on the details or the peculiarities of the band-edge structure. The importance of these practical devices in commerce and industry provides ample justification for all the theoretical and experimental effort that has been devoted to the study of the band structure of semiconductors over the past two decades.

The book is clearly written, and quite accurate technically. There is little of interest for the specialist, or for the mature solid state physicist, but this book was not intended for such individuals. The book could be quite useful to chemists, metallurgists, ceramicists, and beginning students of solid state physics who would like a gentle but accurate introduction to a broad and difficult subject. One of the prime virtues of the book is that it explains much more than the details of the band structure. It also explains how these details affect some of the principal optical and electronic properties of semiconductors.

Unfortunately, the book does not treat the overall band structure, but only the principal and subsidiary valence and conduction band edges. Though the book was quite up-to-date at the time it was written, so much has happened

since then that the book could easily double in size if it were rewritten today at the same level. Nevertheless, this is a most useful book, and it is warmly recommended to a broad audience. I hope the author writes a sequel soon in which he discusses the band structure of semiconductors away from the band edges, and treats reflectivity, differential reflectivity, and photoemission experiments with the same warmth and enthusiasm with which he has treated the older experimental techniques in the present volume.

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Optics of the Sea

Optical Oceanography. N. G. JERLOV. Elsevier, New York, 1968. xvi + 194 pp., illus. $13.50. Elsevier Oceanography Series.

A monograph on optical oceanography is a welcome addition to the literature of oceanography. N. G. Jerlov of the University of Copenhagen is qualified by many years of experience in the field to write such a monograph and has prepared a book that will certainly be of value to students and research workers in physical oceanography and related fields.

The organization of the material is straightforward and systematic. A brief introduction sets forth the terminology, definitions, and symbols used to represent the important quantities. This is followed by a section on the scattering and beam attenuation of pure water and of sea water. The next section, the major part of the monograph, applies the information presented in the previous parts of the book to the sea when illuminated by light from the sun and sky. The monograph closes with brief chapters on applications to physical oceanography and to marine biology. Appendices include an extensive list of references to publications in optical oceanography—a very valuable part of the book—and an index.

The author has excluded the consideration of underwater photography and television and included little on the problems of image formation with natural or artificial light. There is essentially nothing on the velocity of light in the sea (refractive index) and its dependence on the nature and amount of the material dissolved in the water, the temperature, and the pressure.

The book appears to be intended more as a guide to the literature than as an explanation of it. The reader is usually left to find details in the original articles to which he is referred. The inclusion of more complete explanations and references to standard text and reference books would have made it more useful to students. The inclusion of more references to work by physicists and chemists would have shown the close connection between optical oceanography and other fields of science. (This list of references as it stands gives the impression that knowledge of the optical properties of liquids and of liquids with solid particles suspended in them is of recent origin and the exclusive property of oceanographers.)

Although in general the figures and tables are clear and easy to follow without going to the text or the references, in a few cases some information such as the depth of the water or the precise meaning of different markings is lacking. (There appears to be a mistake in table 3, which lists the refractive indices of pure water rather than sea water as indicated in the title.) Since the plan of the book makes references to tables and figures in other chapters essential, it would have saved the reader's time if the cross-references had included page numbers.

The presentation is scholarly, direct, and concise. On the whole, the wording is clear and well chosen. The book is remarkably free of typographic errors and the few that are present are not likely to cause misunderstanding.

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Earlier Biology

Dawn of Zoology. WILLY LEY. Prentice-Hall, Englewood Cliffs, N.J., 1968. viii + 280 pp., illus. $7.95.

Origins of Modern Biology. URL LANHAM. Columbia University Press, New York, 1968. xii + 273 pp. $7.50.

Some recent studies in the history of biology have captured the sense of excitement and imminent discovery that characterize contemporary biology. But while biology has a long tradition, history of biology is in its infancy as an academic discipline. This means, among other things, that history of biology has not yet become crystallized and that there is a variety of different approaches to the rapidly growing discipline. The books under review illustrate two such approaches.

Willy Ley's eminently readable book does not, on the surface, resemble a history of zoology. The reproductions of old woodcuts, the absence of footnotes, and the attention given to writers whose names are virtually forgotten give the appearance of a popularization, suitable as a Christmas gift but valueless to the scholar. That impression is revised quickly upon reading. Ley's knowledge of Greek, Latin, and several modern European languages serves him well. From the first page onward, the reader is conducted through a score of the most influential zoological texts ever written. The author, throughout, withstands the temptation to rationalize ancient zoomythology or to poke fun at the allegorical whimsicalities and teleological exaggerations of the Middle Ages, all of which are a part of Romantic Zoology to which he has devoted several books. Rather, the texts are examined against their contemporary intellectual background. The net result is a running account of the development of our knowledge of the animal kingdom, interspersed with extracts, anecdotes, and bibliographical data, all contributing to the thesis that the road to modern zoology has had its share of blind alleys and costly detours. Naturally, Aristotle bulks large in the early pages, but due attention is given to medieval and renaissance zoology. In fact, the chapters on the allegorical and clerical attitudes to zoology are among the most valuable in the light of the fresh translations from early printed texts usually ignored by the textbook writer. From experience, the reviewer appreciates the patience and good humor required to make sense of medieval zoology with its different emphases and set of values.

Compared with the former book, Lanham's book is a clumsy rehash of second- and third-hand sources. Not that it is without value, for it is well written and contains some remarkable insights bearing upon those gray areas between biology and philosophy. As a series of loosely connected essays on various aspects of biology, the book may serve the function of stimulating