

a suitable level for an introductory course. There is no discussion of embryology and very little of nutrition or metamorphosis.

The book is set in attractive print with wide lefthand margins for annotation. The illustrations are uniformly good, especially the line drawings, many of which are adapted from Snodgrass and others. There are few errors in letter transposition or spelling, although unfortunately one of them, *corpora cadica* (sic), occurs in boldface at the top of a page. In one drawing, Fig. 3-12, the arrow for a thoracic spiracle points to a lateral tracheal trunk.

There are two substantive errors. I was astonished to read on page 61, "Not all insects have chitin in their cuticle, but when present, it is a component of the procuticle, particularly the endocuticle. . . ." To my knowledge, no member of the Class Insecta exists without a chitinous cuticle, and chitin is found in both endo- and exocuticle. On page 119, there is the statement that "after a sperm enters an egg, a fertilization membrane is secreted that seals the micropyle and prevents the entry of additional sperm cells." This may hold true for animals in general, but it is not true for insects, where polyspermy is the rule.

The chapter "Insects as a Manageable Resource" is instructive. The importance of insects as pests and control of them by integration of a wide variety of practices is explained very well. In numerous places, the author speculates on the evolutionary paths taken by insects. He suggests that the predatory habits of Crustacea, which colonized the seas first, were a deterrent to sea colonization by insects, a novel explanation of this ancient riddle. He is in unsafe territory, however, when he speculates that early man acquired his parasitic lice from birds in caves. The

Anoplura of man are closely related to those of monkeys, whereas the unrelated Mallophaga of birds possess biting and chewing mouthparts.

The author was faced with the monumental task of attempting to put all aspects of entomology into perspective, and my criticisms are meant to document that the great diversity of insects justifies the contemporary trend of multiple authorship. This book succeeds quite well in the stated endeavor, since the student will surely be impressed with the variations in habit and distribution of insects that make them so successful.

Fundamentals is an extremely condensed presentation of all aspects of entomology, which could be useful as an introduction. There are 223 figures in the first 8 chapters, leaving little room for text. Anatomy is described system by system; development and ecology are discussed briefly; and behavior and relations of insects to plants and humans, beneficial as well as detrimental, are outlined. At the end of each chapter, there is a list of questions that the student should be able to answer, making the book a programmed learning device.

Whereas *Perspectives* gives a classification only to orders, about 20% of *Fundamentals* is devoted to classification, with keys to adult and immature forms of orders as well as keys to common families of major orders. This book also contains a section on techniques of collecting and preserving insects. Each book has a glossary, selected references, and an index.

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MICROBIAL PHYSIOLOGY

Relations Between Structure and Function in the Prokaryotic Cell (Society for General Microbiology Symposium 28), edited by R. Y. Stanier, H. J. Rogers, and J. B. Ward. Cambridge University Press, New York, 1978, 369 p., illus., \$36.00.

This is a fitting and timely continuation of the 15th symposium of the Society for General Microbiology, held in 1965. Particularly useful are the general review chapters on translation mechanisms and ribosome structure, gram-negative and positive cell walls and membranes, bacterial flagella, gas vacuoles, and endospores.

Also included are more specific chapters on the purple membranes of halobacteria, the reversion of protoplasts and L-forms, and immunostimulant properties in enzyme excretion by bacteria. Particularly interesting in this last group is Lampen's and his collaborators' elegant solution to a question posed in the 15th symposium concerning penicillinase excretion in *Bacillus licheniformis*.

Volumes of this nature are always incomplete and subject to the pressures of deadlines. Additional chapters one might have hoped for are on advances in bacterial adherence mechanisms, bacterial cell division, chromosome replication, and transport. Nevertheless, taken as a whole this collection of papers could be considered as the basis for an excellent seminar on advanced microbial physiology and would be useful for general readers.

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NITROGEN FIXATION

Recent Developments in Nitrogen Fixation (Proceedings of the Second International Symposium, Salamanca, 1976), edited by W. Newton, J. R. Postgate, and C. Rodriguez-Barrueco. Academic Press, London, 1977, 622 p., illus., \$31.25.

Nitrogen fixation research spans an unusually broad spectrum of interests. Scientists in disciplines ranging from chemistry to agronomy are involved in the elucidation of a complex, yet well-defined goal: an intimate understanding of the mechanism of dinitrogen reduction. The practical significance bestowed on biological nitrogen fixation as a result of the energy crisis of recent years has led to an explosive growth in research and to a corresponding expansion of research reports in this field. Efforts to summarize the available information resulted, unfortunately but perhaps unavoidably, in much repetition of the same results in competing compendia.

Such repetition is not the case with *Recent Developments in Nitrogen Fixation*, which presents information available otherwise only in pertinent journal articles. Continuing in the same mode as that initiated at the First Symposium in 1974, this summary of the Second International Symposium on Nitrogen Fixation, of 1976, outlines all of the major and many of the more peripheral lines of work of the intervening two years. A truly interdisciplinary report, it appears to be the most comprehensive and authoritative, one could almost say an encyclopedic, work on nitrogen fixation. It can serve as an excellent reference for the specialist in any of the disciplines involved. It also offers an overview of the entire field to the serious worker interested in developments outside his specialty. Voluminous bibliographies appended to each chapter serve as a guide to background information for the part-time student of nitrogen fixation, since an advanced degree of initiation is often necessary for immediate comprehension of some of the material.

More than two-thirds of this 600-page book are devoted to the inorganic and organic chemistry and biochemistry of nitrogen fixation. The editors and contributors succeeded commendably in creating a smooth transition from the purely abiotic to the biological aspects of the transformation of dinitrogen to ammonia. A chapter on the physiology of nitrogen fixation serves as the bridge to the next major topic—genetics. The balance of the volume is dominated by articles discussing associations consisting of diverse symbionts, but is interspersed with significant chapters dealing with such varied subjects as growth regulators, energetics, modeling, and visions of the future of nitrogen fixation research. *Recent Developments in Nitrogen Fixation* is a must on the nitrogen fixer's shelf.

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