The last chapter of the book concerns seasonality and insect pest management. Methodology is briefly discussed, including treatment of genetic control strategies. There is no critical review in this part, and one wonders to what extent the information on seasonal adaptations of insects has benefited the development of pest management tactics. There is an optimistic tone, however, given the progress of research in discovering some of the mechanisms underlying insects' seasonal adaptations.

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INSECTS-IN-DEMAND

Fundamentals of Insect Physiology. Murray S. Blum, ed. John Wiley & Sons, New York, 1985. 598 pp., illus. $39.95 (cloth).

The amount of information on the physiology of insects doubles roughly every ten years, if the size of reference works is any gauge. There are over 45 programs in the United States alone offering a Ph.D. in the field of entomology or the equivalent, with insect physiology obviously an important part of any curriculum. Therefore, a contemporary text in insect physiology is always in demand. The recent volume by Blum and his colleagues is a valiant effort to fill the void and will definitely be useful.

In 14 chapters contributed by 14 physiologists, the book covers circulation, nutrition, excretion, respiration, metabolism, integument, reproduction, muscles, behavior, hormones, the nervous system, pheromones, and defensive secretions. Growth and development are not covered per se, but some egg development is described in the chapter on reproduction. The excellent hormone chapter deals mostly with development during late instars and metamorphosis, where most of the current knowledge is centered.

An excellent treatment of integument contains new information on the structure of silk protein. The only minor drawback in the chapter is a lack of sharp distinction between sclerotization, tanning, hardening, and darkening. The chapter on circulation, while being one of the more useful treatments available on hemocytes and cellular defensive reactions, does contain a few minor errors. Chapter eight presents us with a lovely treatment of sensory structures. The full use of examples and anatomy are very helpful and will be good lecture supplements. The chapter on respiratory systems is not only descriptive, but quantitative.

In general, I would have been happier with more chemical formulas in the book. The chapter on metabolism documented numerous reactions and is very useful, but has only one incomplete structure of trehalose. The general lack of chemical structures is in marked contrast with lists of chemical formulas used with the final chapter on exocrine systems. A textbook on insect physiology may not be the place for what appears to be essentially a review of this particular subject, since it really does not deal with fundamental principles of insect physiology. I would have preferred to see a balanced account of the pheromone biosynthesis scheme in the leafroller complex, a topic that has been ready for the textbooks for a few years now, and which every student should know.

Two notable features present problems. First, few references are used. Although I assume this was done intentionally, checking a subject for accuracy or knowing what authority is referred to is difficult or impossible. Second, there are omissions and inconsistencies throughout the index, making it difficult to get at specific subjects. When authors strayed into unfamiliar areas, they tended to get into trouble; however, this textbook contains large amounts of useful information and most of the chapters make good outlines around which to design lectures.

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ON CRUSTACEANS

Crustacea. F. R. Schram. Oxford University Press, New York, 1986. 606 pp., illus. $59.95 (cloth).

The need for a major single-volume reference on crustaceans has been evident to both specialists and nonspecialists for some time. Given the amount of attention devoted to crustacean research, it is rather surprising that the last major one-volume compendium written on Crustacea was the classic work of W. T. Calman (*Crustacea.* 1909. Pt. VII. In E. R. Lankester, ed. *A Treatise on Zoology.* Adam & Charles Black, London) published almost 80 years ago. The book *Crustacea,* by F. R. Schram, was written to serve as a reference text in crustacean evolutionary biology. Although it covers many aspects of crustacean biology, the primary emphases are morphology and phylogeny. The author is to be commended for bringing together recent literature on these themes. The book is comprehensive, including detailed chapters on taxa not usually covered in other one-volume texts or references.

The author, whose background is in paleontology, presents separate chapters on fossil taxa or integrates fossil groups into appropriate chapters on recent forms; he also describes the embryology of those groups for which such information is available. The author uses current biogeographical and geological concepts to interpret geographical distributions of several taxa. The book begins with a short introduction to the Crustacea, contains a chapter on their relationships to other arthropod groups, and ends with chapters on the author's view of crustacean phylogeny and evolutionary patterns. Most of the book is made up of chapters on individual taxa, and the author follows a basic format similar to Calman's in providing a definition of the group; a short historical account; a detailed t morphology; and sec- atural history, taxonomy, f topics.

unfortunate, after amassing so information and detail from the rature, that the author has been areless in the presentation of this material. I was struck by the sheer number of outright errors and orthographic mistakes but it would take too much space to detail all of them here. As an example, in one page (p. 256) in the chapter on the Procarididea, there is a mix-up of figure captions (paragnaths with maxillule), a misspelling of the figure label scaphognathite, and a mistake in the gill formula of *Procaris* (this animal does have maxillipedal epipods, correctly stated in the first source given for the table).

Errors and inconsistencies in the use of family names and their vernacular forms are common throughout the book. For example, the vernacular form of the family Physetocarididae, correctly "physetocaridids" is given as "phycetocarids" and "physetocarids." The caridean taxonomy also omits the family Eugonatonotidae and has several typographical errors. Among the goals stated for this book is that it serve "to standardize the terminology and orthography used in the discipline." To meet that goal, the many inaccuracies, errors, and orthographic mistakes must be eliminated from any future editions.

It would have been useful if the author had followed Calman in giving an outline of his classification, or at least referring the reader to it, before beginning his chapters on specific taxa. Schram's classification is not given until the next-to-the-last chapter, and the reader is not directed to it in the chapters on particular groups. The higher taxonomic categories to which a group belongs are frequently mentioned, but their features are not given. The interested reader must do a lot of searching to find a definition for some of these groups. For example, Peracaridans are defined in Chapter 43, but the reader coming across the term "peracarid" will not find it in the subject index, and the page citations to "Peracarida" in the taxonomic index do not refer the reader to Chapter 43. As frustrating as this problem is to the reviewer, a practicing carcinologist, how much more frustrating and confusing it will be to the novice student of crustaceans or nonspecialist using the book as a standard reference or text.

Although the author hopes to standardize terminology with this reference, he has not done a great deal to promote such a goal. A glossary of the many terms specific to crustacea would have gone a long way to help both the aspiring and practicing specialist in this regard. An alternative to a glossary would be a brief definition of a carcinological term, set off by parentheses or commas, the first time the term is used.

In the chapter that deals with crustacean phylogeny and classification based on standard cladistic methods, the author's approach is organized and rigorous. But, I object to his statements that his cladograms "afford a much clearer understanding of crustacean phylogeny than anything proposed heretofore" (p. 526) and that "The taxonomy proposed here is more natural than any proposed heretofore" (p. 541). The choice and interpretation of characters used by the author to generate phylogenetic trees seem no more natural, objective, or lucid than other recent studies on crustacean evolution. On the contrary, the brilliant analysis of Hessler (1983), to pick one example, on eumalacostracan and, in particular, peracaridan evolution and phylogeny is far more objective, balanced, and informative than that presented by the author. As the author himself points out, in reference to his cladogram on the Maxillopoda, "choices of slightly different characters or elimination of some others can produce some significant changes in the tree." This book would be much better if the author had followed Hessler's (1982) style of clearly stating both sides of a phylogenetic controversy.