

Forest, Jacques, ed. 1994. *Traité de zoologie*. Tome VII. Crustacés. Fascicule I. Morphologie, physiologie, reproduction, embryologie.—Masson, Paris, France. Pp. 1-917, 434 plates and figures, 32 tables. Price 1733 FF.

The series "Traité de Zoologie. Anatomie, Systématique, Biologie," published under the general editorship of Pierre-P. Grassé, is organized into 17 tomes, each dealing with a major group or groups of animals, with most tomes composed of two or more volumes or fascicles. The first volumes appeared in the early 1950s, and fascicles from various tomes have been published throughout the following decades until the present. If this first fascicle from Tome VII on Crustacea, edited by Jacques Forest, is an indication of the fascicles to come, the long wait for the volumes on crustaceans has been worthwhile.

The volume begins with a short, lucid, introductory chapter by Forest on the definition of Crustacea, a balanced discussion on primitive traits, and an overview of the history of classification. Given the varied and discordant views on the systematics of Crustacea, Forest has adopted a traditional classification for this and following volumes. The succeeding chapter, by H. E. Gruner, on segmentation, tagmosis, and appendages, is an excellent and detailed comparative review of body and appendage morphology presented in a functional and evolutionary context. Richly illustrated by figures from the literature, this chapter has considerable didactic value for students of crustacean morphology and evolution. Somewhat bothersome is the lack of literature citations for opposing points of view on controversial issues such as the evolution of the carapace and the basic nature of the crustacean limb. Additionally, sources for most figures are cited in the figure captions, but complete citations are not given in the bibliography, so that the reader will have to do some extra work in order to get at these references.

The next three chapters deal with features of the integument and molting. The

first, by G. Goffinet and Ch. Jeuniaux, is an up-to-date, well-written synthesis of the literature on the morphology, ultrastructure, and biochemistry of the crustacean integument. The following chapter on chromatophores and pigmentation, written by two world authorities on the subject, P. Y. Noël and C. Chassard-Bouchaud, is informative but a bit brief. The description and illustration of chromatophores are excellent and hard to find in other reviews on Crustacea, and there is a brief but well-done synthesis on control of color change. A more extensive treatment of the literature on the adaptive (ecological) value of coloration and color change would have enhanced this chapter. G. Vernet and M. Charmantier-Daures' chapter is a lengthy and thorough coverage of molting, autotomy, and limb regeneration. It is thoroughly illustrated, with several data-rich tables and an extensive bibliography. Their efforts have produced an excellent reference on these areas of crustacean biology.

The first of two chapters by A. Mayrat deals with relative growth and allometry. It consists of an extensive mathematical and graphical demonstration of the theoretical basis of allometry, its measurement, interpretation, and application to crustacean growth. The bibliography is a bit short and out-of-date, with two 1980 references and the rest dated prior to 1964. The chapter would have been more useful and informative if more of the many (and more recent) examples of relative growth studies on crustaceans had been cited and discussed.

The next eight chapters might be loosely grouped under internal anatomy and physiology, although certainly the general emphasis is on the former rather than the latter. Two chapters deal with the nervous system. The first, by J. Chaigneau, is an exhaustive review on the cytology of nerve cells and synapses, the morphology and microanatomy of the central nervous system, and neurosecretory structures such as the x-organ-sinus gland complex in different crustacean taxa. It is well-written with numerous cita-

tions and many figures illustrating the complex structure and "wiring" of the nervous system. The following chapter, by G. Martin on neurosecretion and neurohormones, thoroughly reviews the literature on the histology and ultrastructure of neurosecretory tissues, as well as that on the biochemistry and action of neurohormones and the techniques used for their study. Next is another chapter by J. Chaigneau on mechanoreceptors, internal and external, chemoreceptors, and the rather mysterious "organ of Bellonci." Again, Chaigneau presents a thorough, detailed, richly illustrated and highly informative review on these sensory structures, with an extensive bibliography. The emphasis is on description of morphology rather than on physiological studies of these structures. Light organs and bioluminescence are treated in a short but informative and nicely figured chapter by H. Gruner. Emphasis is on the morphology and distribution of bioluminescent tissues and organs in the Crustacea, with short sections on the chemistry and adaptive significance of bioluminescence in the group.

A. Mayrat's second chapter of the volume deals with the structure and variation of crustacean circulatory systems, which are presented in detail. Past work is synthesized and critically analyzed in this valuable presentation. A similarly comprehensive and useful review of the anatomy and physiology of the digestive system is presented in a chapter by H. J. Ceccaldi. The structure and function of gills and excretory organs (maxillary, antennal glands) is reviewed in a research-oriented chapter on morphological and biochemical aspects of osmoregulation by E. Schoffeniels and G. Dandrifosse. The chapter, well written and profusely illustrated, focuses on the structures and physiological processes involved in osmoregulation, ion exchange, and excretion. A relatively minor complaint is that in this chapter, as in one previously mentioned, many citations in figure captions are not given in the bibliography. In a short chapter with an extensive bibliography, M. Charmantier-Daures and G. Charmantier describe the structure, histology, and ultrastructure of two major endocrine glands, the Y-organ ("molting gland") and the mandibular organs, as well as that of other suspected endocrine organs. A short but infor-

mative discussion on the Y-organ, ecdysones, and molting physiology is included.

The next four chapters deal with sex and reproduction. The first, one of the largest and most interesting (to the reviewer, at any rate) in the volume, by J.-J. Legrand and P. Juchault, deals with far more than the topics (sexual development and sexual physiology) given in the title suggest. There is a detailed and informative presentation on the role of the androgenic gland in the development of primary and secondary sexual characters in males and females, as well as one on hormonal control of gametogenesis. A major part of the chapter is one of the best treatments I have seen on sex determination and its genetic and environmental control in crustaceans. Parthenogenesis and hermaphroditism are also briefly treated. A very short chapter follows by the same authors on secondary sexual characters. This could have very well been included in the previous chapter or, better, expanded greatly to treat the subject in detail. Gametogenesis is covered in depth in the next chapter by J. Pochon-Masson. This chapter is actually divided into two parts, one on spermatogenesis, the other on oogenesis, each section with its own extensive bibliography. The following chapter, also by J. Pochon-Masson, is on fertilization, and is as well-written and informative as the previous one. It deals mainly with sperm-egg interaction and formation of egg membranes in Crustacea, and, like the previous chapter, is very informatively and profusely illustrated for easy understanding of the text.

One of the best chapters is the last one, that by P. Weygoldt on embryonic development, a fine and stimulating review. In an extensive up-to-date treatment, Weygoldt leads us through the complexities of embryonic development in various crustacean taxa. Processes such as cleavage, gastrulation, formation of germ layers, segmentation, and development of major organs and organ systems are clearly described and critically analyzed, and made clear with extensive use of figures. Weygoldt synthesizes all this material with an excellent discussion about phylogenetic issues which can be addressed with data from embryonic development of crustaceans. Although his strongly stated views are sure to

be controversial, he gives and cites opposing points of view as well.

One drawback of this volume is that, in spite of a 1994 publication date, several chapters are somewhat dated with respect to the literature on which they are based. A foreword explains the long history of development of the plan of work for the three volumes devoted to the Crustacea, and most chapters in this volume were first written in the early to mid-1980s. The volume was put together in 1991, and authors were apparently given the opportunity to update their chapters in 1993. The extent to which such revisions were done is quite variable with, at one extreme, a chapter in which the most recent reference is 1967, to several chapters with references in the text up to the early to mid-1980s, to the other extreme in which a few chapters are completely up-to-date (references up to 1993).

It was interesting to compare this first volume of the *Traité* on crustaceans with *The Biology of Crustacea* series. Several chapters, like the ones on the circulatory system, digestive system, light organs and bioluminescence, are not extensively covered in *The Biology of Crustacea* and thus are "new" as far as a review volume on Crustacea is concerned. Naturally, there was extensive overlap of some chapters, e.g., those on molting, osmoregulation, embryonic development, integument, etc., with their counterparts in *The Biology of Crustacea*, but there was sometimes a more

extensive coverage or a treatment of the subject from a somewhat different point of view. Also quite naturally, there is a greater emphasis on the European, especially French, literature in the *Traité* than in *The Biology of Crustacea*. Thus, this volume from the *Traité* complements rather than duplicates *The Biology of Crustacea* series.

The editing and production of this volume are superior, and compliments are due the editor, Jacques Forest, who also translated at least two chapters by German authors into French, the language used throughout the volume. Chapters are well written and organized, typographical errors are almost nonexistent, and black and white as well as half-tone reproductions of figures are excellent. The index is useful and there is a detailed table of contents at the end of the volume.

This volume is a fine reference that should be on the shelf of any institutional library. At well over \$300 US, it might be a bit expensive for many personal libraries, but it would certainly be a desirable item for the bookshelves of carcinologists and other invertebrate zoologists. I look forward to the next two volumes, one continuing with aspects of general biology of crustaceans, such as *genetics and parasitism*, and beginning with individual taxa (through the Sycarida), the other dealing with the Peracarida and Eucarida.—Raymond T. Bauer, Department of Biology, University of Southwestern Louisiana, Lafayette, Louisiana 70504-2451, U.S.A.