March 1998

Book Review: *Microscopic anatomy of invertebrates*, Harrison, Frederick W. (editor) and Michael Locke.

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Microscopic anatomy of invertebrates, Vol. 11, A, B, C, **Insecta.** Harrison, Frederick W. (editor), and Michael Locke. New York: Wiley-Liss, vol. 11A, xxii+381 [+index 1-74], vol. 11B, xxii+385-840 [+index 1-74 (repeated)], vol. 3, xxii+843-1296 [incl. 74 page index]. Cloth: $675.00. [ISBN 0-471-15955-7 (set).]

Seldom does one have the opportunity (and honor) to review a work of the magnitude of this volume, 1 volume (in 3 parts) of a series of 15 volumes. Not being a specialist in microscopic anatomy, I cannot look for, or expect to find, errors. That was the job of the peer reviewers. Only extensive usage will determine whether or not they did their job.

The Insecta part was written by 46 authors, representing scholars from 12 countries. [Managing this group of authors and having continuity in just this volume is a massive accomplishment in itself.]

Before I go into details, I would like to state the need, and objectives of this work. Oh, if such a series were available to me in my teaching days, both for my anatomy of invertebrates, and for the insect morphology courses. True, we had Libbie H. Hyman's 6 volume (incomplete) work of the anatomy of some phyla of invertebrates, but she never got to the insects. Until this year, insect morphology texts were restricted mainly to the gross aspects, mostly external, of insect structure. Details of the cells and tissues were confined to thousands of widely scattered papers in scores of journals and written in many different languages.

Obviously then, one objective of this work should be to bring together the literature on the subject. A brief check of the literature cited sections of each article shows that most references are dated in the 1980's to early 1990's, with a few in the 1960's and 1970's. General works are not cited, nor does this book contain a general introduction to insect histology. The length of the literature sections vary greatly with the chapters. Therefore, we can conclude that a comprehensive review of the literature was not one of the objectives.

That being said, what are the objectives of this treatise? "The conceptual framework of the treatise is a straightforward one. The overriding thrust of the treatise is *functional* morphology." [p. xxi.]

Contents

The body of the work on insects consists of 8 sections divided into 47 chapters. To give the reader a view of the comprehensive nature of the work and the way the authors divide the subject matter, it seems worthwhile to list the topics discussed:

Volume 11A:

1. Specialization of insect cells: basal laminae; connective tissue; cell associations; reticular systems and intercellular lymph spaces.

2. The surface integument and epidermal derivatives: epidermis; the cuticle as an exoskeleton; significance of insect cuticle; insect epidermal gland cells: ultrastructure and morphogenesis; lenticles; silk glands.

3. Cuticle specialization: hairs, bristles, and scales; setae and microtrichia: structure for fine particle feeding in aquatic larvae; tracheae and tracheoles; gills; the anatomy of light production: the fine structure of the firefly lantern.

Volume 11B:

4. Sense organs: the structure of integumental mechanoreceptors; bimodal thermo- and hygrosensitive sensilla; compound eyes.

5. Nervous system: insect neuroglia; neurosecretion; the insect neuron: types, morphologies, fine structure, and relationship to the architectonics of the insect nervous system; networks of neurosecretory (neurohemal) endings.

6. Movement: muscle structure; muscle insertions.

7. Internal metabolism: the open hemolymph system of Holometabola and its relation to the tracheal space; accessory pulsatile organs; the fat body; pericardial cells or athrocytes.

8. The gut and associated organs: the foregut; the midgut; the peritrophic membrane; the hindgut with rectum; Malpighian tubles; labial kidney.

Volume 11C:

9. Male reproduction: spermatozoa.

10. Female reproduction: the ovarioles: structure, type, and phylogeny; vitellogensis; developmental biology of insect ovaries: germ cells and nurse cell–oocyte polarity; structure of the egg.

11. Endocrine glands: the corpora allata; comparative structural aspect of development in neuroendocrine systems; prothoracic glands of Lepidoptera. (Continued on p. 116.)

(Continued from p. 80.)

12. Insects for experiments: tissues and cells in culture; viruses in insect cells; gap junctions; Golgi complexes and GC beads; portasomes.

Glossary, p. 1191-1222.

Taxonomic index, p. 1223-1235.

Subject index: p. 1237-1296.

Some comments

The impressive list of topics covered in the treatise indicates the objective of recording the descriptive functional morphology of insects has been met so far as a discussion of the cell and tissue types are concerned.

If one were to sit down and read these volumes as one would a textbook, the reader would have a comprehensive idea of the variety of structures known to occur in insects. Talented teachers could distill these data and feel confident that they were passing on to their students a comprehensive view of the microscopic anatomy of insects. If one made available a series of microscope slides of these tissue properly stained and made the subject of laboratory studies, these fortunate students, on completion of the course, could go away with a secure feeling of having the ability to identify insect cells and tissues encountered in their researches.

Obviously I think very highly of these books. I am filled with wonder at the beauty of the typography and illustrations contained in this volume. I know that no entomology department can be, henceforth, without these books at hand for frequent reference. Long before thoughts of a new edition come about, these volumes will be dog-eared. I am sure new research will enable specialist to find errors unsuspected at the time of writing, and they will hurriedly point this out in their papers, and appear unaware that this will happen to them as soon as more research is done.

Why then do I have some hesitation to fully endorse the book. I do not criticize, which I believe I made clear at the beginning of this review.

Instead, I refer you to a much overlooked book, "CRC handbook of animal diversity" by Richard E. Blackwelder and George S. Garoian, Boca Raton, FL: CRC Press, [7]+555, 1986. In this book, the authors reviewed vast amounts of the literature, mostly comprehensive works, to find out what cells, tissues, and organ systems occur in what group of animals from the most "primitive" to the most "advanced." There is no space here to review this book, my only point is that Blackwelder and Garoian clearly show that not all is well in our use of terms and our attempt to build classifications on what Louis Agassiz would consider extremely weak in number of characters.

Thus, my excuse for reviewing a morphology book in a journal dealing with the systematics of insects, is that all classification is based on morphology, from the morphology of the DNA molecules to the size of the grown animal. If we don't know their morphology, how can we classify them? This is especially true of the very useful procedure designed to make classification objective–cladistics.

When one looks at the taxonomic index of this book, one quickly sees that our knowledge of the cells and tissues of insects is based on only the very few species generally used as experimental animals in the laboratory. These structures are described at most in a few species. How broadly are they distributed throughout the Orders of insects? What unique structures enable *Micromalthus debilis* to carry on larval reproduction? Might this be possible in other groups of beetles? How far can we go with this?

One quick example. I have always been interested in the peritrophic membrane. Its origin and evolution apparently is unknown. The authors of this chapter (K. C. Binnington, M. J. Lehane, and C. D. Beaton) in this book say that this tubelike lining of the insect gut is present in most insects. They list 8 Orders in which it has never been found, but admit that it could be in these Orders. One beetle (*Ptinus tectus*) is cited, and probably there are more known. Do most beetles have this structure? Are there some that don't? If there are, does this have an evolutionary significance?

The real question is, can we talk about the relationship of insect species, genera, families, and orders as shown by cladistic analysis, without knowing whether they have a peritrophic membrane? Where should we draw the line when it comes to the number of characters used in these analyses? What is the duty of the editor who is offered a paper that supposedly describes a new species, Genus, Family, or even an Order, that does not give us some indication of what is present *inside* these organisms?

These are questions to ponder, especially as you read these chapters and learn about these many wonderful structures. But they are still unknown in most insects. So much needs to be learned about the microscopic anatomy of insects.

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