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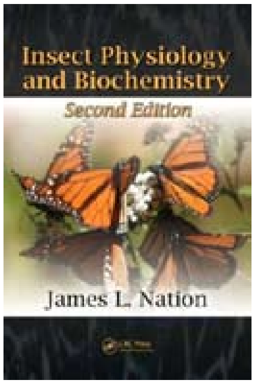

Insect Physiology and Biochemistry, 2nd Ed., 2008, James L. Nation, CRC Press, Boca Raton, Florida, ISBN 978-1-4200-6177-2 (Hardcover), USD79.97.

What is a review of a hard copy insect physiology text doing in an online paleontology journal? The insects pose some big and tantalizing evolutionary questions that depend on physiological issues. How did flight evolve and how could giant dragonflies and mayflies flourish in the Carboniferous? These issues are not directly addressed in *Insect Physiology and Biochemistry*, but its contents are germane to any approach to these questions.

Insect physiology began as a discipline in 1939 with the publication of V.B. Wigglesworth's *The Principles of Insect Physiology.* Its many subsequent editions mirrored the rapid growth of the subject in later decades though the 1980s. Nation continues the challenge to put all of insect physiology in one volume. This is a second edition of a book intended for advanced undergraduates and graduate students. It attempts, not always successfully, to be current but at the same time to include references that give a sense of the history of the subject.

The organization of this book is idiosyncratic. It dives immediately into embryogenesis without any preliminary perspective to introduce readers to the general factors that define the life of insects as terrestrial arthropods. What are the physiologically limiting factors for a terrestrial animal with an exoskeleton and how do these play out in their successful exploitation of both optimal and extreme habitats? Why deal with embryology in the first chapter and development five chapters later? Why is nervous system function presented in chapters on neuroanatomy and neurophysiology that are separated from sensory systems? Another concern is the uneven incorporation of general introductory material, for example, on basic intermediary metabolism and electrophysiology, which are treated very well elsewhere, and whose omission would have made space for insect-specific material or a shorter text. A pervasive shortcoming is the quality of the illustrations, many of which are rather unrefined and oversimplified freehand versions of already simplified diagrams in the original source material. This is especially true in the nerve, muscle, and flight chapters.

The storyline of how insects have adapted ancient and conserved pathways to meet their specific physiological demands is sometimes difficult to follow. Students might come away with the impression that some of the highlighted biochemical processes are somehow unique to insects. For example, the glycerol-3-phosphate shuttle is very important for regenerating NAD^+ in aerobically active, insect flight muscle, but it would have been worth mentioning that the pathway is also widespread in yeast, plants, and protozoa, as well as other animals. The discussion on the metabolism of proline as an energy source for flight in some insects is appropriate. Helpful would be a reminder that the essential chemistry of proline catabolism is common to all life, even the Archaea. Meanwhile, no mention is made of the how some insects have harnessed proline catabolism as a physiological response to cold stress.

Though some effort is made to venture into molecular aspects of insect biochemistry, the level of analysis is resolutely from the pregenomic era (other than a brief mention of sequenced genomes in the conclusion of a new chapter on immunity). A full page is dedicated to a phylogenetic tree of a member of the IDGF growth-factor family within several *Drosophila* spp. and a few other insects, but the significance of this gene in imaginal cell development is not explained.

The chapter on vision begins with the assertion that "the visual process and visual cascade in insect compound eyes appears to be essentially the same as that in the eye of vertebrates" (p. 268). To the contrary, photoreceptor signaling pathways are fundamentally different in insects and vertebrates: vertebrate receptors use cyclic GMP, whereas insect photoreceptors use inositol triphosphate (as elaborated in the text). Further, the end result of light detection is a membrane depolarization in most insects and a hyperpolarization in vertebrates. This is more than an arcane fact of interest to cell biologists, as it provides an example of how insect and vertebrate eyes have evolved on independent trajectories for at least 530 myr, diverging from a Precambrian light-sensing ancestor.

The treatment of insect ecdysone and juvenile hormone receptors has not been updated from the mid-1990s, leaving out an enormously productive decade of research in this arena. A passage on egg development in anautogenous mosquitoes omits seminal investigations illuminating the roles of the TOR kinase and insulin signaling pathways. Surprisingly, a reference from Henry Hagedorn follows a statement that juvenile hormone also stimulates vitellogenin synthesis (in a paragraph on anautogenous mosquitoes). Henry Hagedorn famously demonstrated that 20-hydroxyecdysone, and not juvenile hormone, stimulates vitellogenin synthesis in yellow-fever mosquitoes.

No textbook is perfect. This one is a tightly packed but loosely focused source book. Perhaps in these times when scientific references with links to literature citations and other resources are available free from Google Scholar, expensive hard-copy compendia that are neither comprehensively updated nor entirely reliable deserve to go extinct.

REFERENCES

Wigglesworth, V.B., 1939, The Principles of Insect Physiology: E.P. Dutton and Company, New York, 434 p.

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