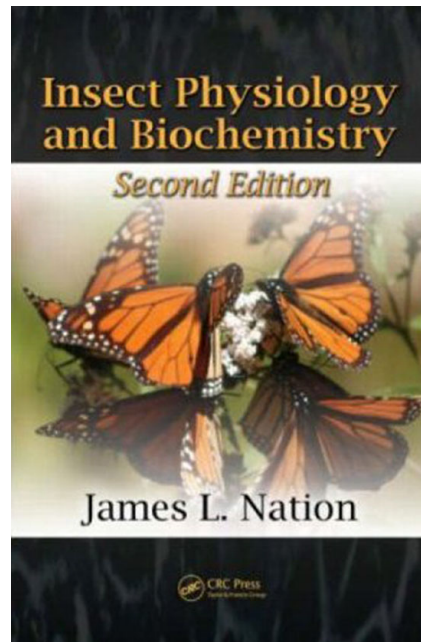


**PHYSIOLOGICAL PRINCIPLES
MEET INFORMATION
EXPLOSION**



**Insect Physiology and
Biochemistry, 2nd Edition**

J. L. Nation

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J. L. Nation's 2nd edition of 'Insect Physiology and Biochemistry', which builds on the 1st edition published in 2002, provides a timely, updated snapshot of modern insect physiology. The book strives to be comprehensive, and the array of topics covered is impressive – from insect developmental biology to all major organ and sensory systems to muscle physiology and reproduction. The book also contains two new chapters, one on flight and another on vision, subjects that Nation rightly identifies as hot spots of new work. The figures are appropriate and well paced, and the production values are solid. Instructors of courses on insect physiology could productively assign the book as a text, although it contains too much information for a single-semester course; this problem could be resolved by dropping chapters.

Nation opens the book with a chapter on embryogenesis and moves on to digestion, nutrition, integument, endocrinology and development, and diapause. There follows a group of chapters – intermediary metabolism, neuroanatomy, neurophysiology, muscles – that provides the groundwork for the subsequent chapter on flight. Next are two chapters on senses –

one on sensory systems in general and a subsequent one on vision. Oddly, the chapter on pheromones, which complements the other sensory chapters, occurs far away toward the end of the book. The remaining chapters cover circulation, immune function, respiration, excretion and reproduction.

These positive aspects aside, the book suffers from what I perceive as an audience problem: it is aimed at two distinct groups, and although it hits a mark somewhere between them, it may not satisfy either of them. In the preface, Nation indicates that the book is meant for 'advanced undergraduate and graduate students' and also for 'working scientists' with expertise in other subjects but an interest in insect physiology. To write for divergent groups is admirable. The difficulty, of course, is that students and scientists have different needs. Students need lucid writing and hard-headed separation of wheat from chaff. Scientists need broad syntheses and up-to-date summaries of new work.

The student problem comes into focus when 'Insect Physiology and Biochemistry' is compared with other books aimed at similar niches. Nation's major competitor is Klowden's 'Physiological Systems in Insects' (Klowden, 2007). Nation's book covers more ground and, importantly, provides extensive in-text citations, making it easy to pursue threads in the literature. Klowden's book covers less material and does not provide in-text citations, but it does, on balance, contain better figures and smoother writing. Smooth writing is, of course, always important – but more so for books intended for students, who may have poorly developed conceptual scaffolds for organizing new information. My own partially built scaffolding provided a mixed reading experience of Nation's book: although some sections were transparent, others seemed to consist of ideas and sentences each with their own logic that nonetheless did not gel into cohesive, larger units. My guess is that students may also be overwhelmed by detail; the book could use more wheat and less chaff.

For working scientists, the book presents a different problem: it seems not to focus enough on recent material. Recognizing the absence of new material of course depends on one's background. In theory, it should be easier to spot omissions when reading about one's own field than about distant subjects. For the sake of fairness, I decided to give both kinds of chapter an especially close look – the respiration chapter because that's my own specialty, and the pheromone chapter, about which I knew essentially nothing *a priori*.

The chapter on respiration was good. Naturally, it focuses on the structure and function of tracheal systems – development, epithelial structure, modes of gas transport, discontinuous ventilation, effects of gas exchange on water balance, etc. It also has a meaty section on gas exchange by aquatic insects. Altogether, the chapter makes a good effort to point out findings from the past 6–8 years. Nonetheless, given that older material has been so thoroughly picked over in other books, I would advocate even clearer emphasis on new material. For example, over the past 10 years there has been substantial progress in our thinking about the origins and functions of discontinuous gas exchange cycles (DGCs). Nation mentions all of the major papers, but the vitality of the debate doesn't come through. It would be unclear to a neophyte, I think, that the hypotheses and data of different groups stand in stark and interesting contrast. Also, to my surprise, Nation devotes only one sentence to Stefan Hetz and Tim Bradley's 2005 paper, which articulated a major new hypothesis on DGCs that has fundamentally shifted the conceptual playing field (Hetz and Bradley, 2005). Another coverage gap occurs in the section on respiratory pigments. Nation cites older papers on hemoglobins of unusual species (*Gasterophilus*, *Chironomus*). However, in the past 6 years Thomas Hankeln, Thorsten Burmester and others have found that hemoglobins occur in diverse insect orders and may be part of the standard gene repertoire in most insect species.

Of course, my observations above could reflect my own research interests in respiration – what about a distant field? The chapter on insect pheromones was useful

too; if I were to divert my research program to pheromones, the chapter would be a good starting point. However, I did notice a curious lack of references to work more recent than 2002, the date of the previous (1st) edition. A quick count of references at the chapter's end indicated that, of 197 references, only nine were from the period 2002–2007. Lack of recent citations could, of course, indicate lack of progress in the field – but that seemed unlikely. Indeed, a search on Web of Science using the key words (insect* and pheromone*) and years 2002–2007 pulled up 1145 hits; of these, 91 were classified as reviews. Many of these works surely have contributed little to conceptual progress in the field and are worth ignoring. But some clearly have contributed substantially, and Nation's chapter feels correspondingly out of date. For example, the section on pheromone detection spends a subsection describing pheromone binding proteins, which carry lipophilic pheromones from contact sites on antennae to receptors on antennal dendrites. Here, Nation appears to cover the older literature well, but in my Web of Science search I found a major review in *Nature* from 2006 (Van der Goes van Naters and Carlson, 2006) that wasn't cited. Worse, that review summarized substantial progress made since 2002 on several fronts – especially the identification of new binding proteins and development of a robust molecular genetics of odorant and gustatory receptors – that went unmentioned in Nation's chapter.

These complaints highlight the broader problem, for all of us, of keeping up with the literature. Indeed, the information explosion raises the larger issue of whether books like Nation's are even a good idea

any more. Before the rise of electronic media, book authors could provide value-added products by acting as topic-specific search engines, distillers and synthesizers. If, in 1967, you wanted (with considerable prescience) to google 'insect physiology', you picked up a copy of Wigglesworth's 'The Principles of Insect Physiology' (Wigglesworth, 1965). If, in 2009, you wanted to google 'insect pheromones', well, that's what you did – books be damned! Because the online smorgasbord is now so rich, one can easily find lucid, up-to-date reviews on almost any topic. Online information thereby devalues books that aim for topical breadth, because usually someone else will have said it better, and with more recent data in hand, than the book author has. Information technology thus constricts the niche space for books so that it may now exclude broad coverage of fields, like insect physiology, undergoing rapid expansion on multiple fronts. Perhaps the days are behind us when the principles of insect physiology could be laid out in one volume. Such a conclusion probably indicates either a rapidly maturing field of insect physiology or my own lack of imagination; perhaps both.

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