The World of Nematodes: A Fascinating Component of the Animal Kingdom

David R. Viglierchio
agAccess, Davis, CA, 1991
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MANY ENTOMOLOGISTS AND NEMATOLOGISTS share a common motivation—the desire to control invertebrate pests of agricultural crops, livestock, or humans. Linkages between nematologists and entomologists are few, however, except for researchers investigating insect-parasitic nematodes or for nematologists formally housed in entomology departments. Moreover, nematological literature intended for the general reader is nonexistent.

The World of Nematodes is a modest book that attempts to provide "an overview of the fascinating world of nematodes for the nonnematologist." The author, David Viglierchio, recently retired as chair of the Department of Nematology at the University of California at Davis after a distinguished career. His attempt to convey his enthusiasm for nematodes to the general reader is successful and informative.

The book's intended target audience of *The World of Nematodes* includes naturalists, biologists, gardeners, and students, i.e., people with sufficient scientific background to appreciate some of the finer technical details contained within the broad general context. Because of the substantial technical content, the book is not intended for the general public, which is woefully ignorant of these usually inconspicuous pests. Even among the intended audience, some may follow the author's advice to ignore technical matter whenever too intricate for their tastes, as may occur in the chapters on nematode anatomy and motion.

The two introductory chapters focus on the abundance and ubiquity of nematodes, which arguably may exceed insects with respect to the number of species. The author presents the history of the development of nematology chronologically and describes a likely phylogeny. The major substance of the book is composed of 12 remaining chapters. Detailed presentations of the external and internal anatomy of nematodes and their organ systems provide a thorough conceptual framework for subsequent chapters. The chapter on nematode life cycles focuses on the fascinating strategies used by mammalian parasites to successfully adapt to a myriad of environments. A technical presentation of the physics of nematode movement is followed by a somewhat anecdotal, engaging description of long-range dispersal and biogeography. The chapter on reproductive biology includes interesting sections on hermaphroditism, parthenogenesis, sex reversal, and copulation. The varieties of reproductive strategies used by nematodes are numerous and impressive.

A chapter entitled "Environmental Biology" addresses related areas such as mechanoreception, chemoreception, osmoregulation, excretion, phototaxis, survival mechanisms, and hatching. Two chapters discuss aspects of feeding, disease symptomatology, and interactions with other agents describe the complexity of nematode damage and the often sensationalistic symptoms they cause. Two chapters on nematode control and societal effect conclude the book, after which the reader will realize that these usually microscopic organisms exact a terrible burden on the health of humans, livestock, plants, and pets. These latter two chapters could be read first and, indeed, should be read by all Americans.

The book is written in a combination of styles. Technical sections frequently are juxtaposed with anecdotal recountings of the personal experiences of the author or other nematologists. The technical material sometimes focuses on broad aspects of nematode biology. But, at other times, examines highly specific research fronts in detail. Because of the author's background in plant nematology, most of the anecdotes center upon plant parasites. As expected, there is a slight bias in presentation of information about phytoparasitic nematodes, especially with respect to control strategies. Some entomologists who read this book may have the opinion that insufficient attention is focused upon the rapidly developing area of insect-parasitic nematode research. Similarly, molecular biologists working with *Caenorhabditis elegans* (Maupas) may believe also that their chosen organism of study may not receive proper emphasis. A book of reasonable length, however, must necessarily focus on some nematode groups more than others, however. Viglierchio has done an admirable job of maintaining an even editorial balance among plant-parasitic, animal-parasitic, and microbivorous nematodes.

Viglierchio uses his many years of familiarity with nematology to examine on the state of development of the discipline in an often entertaining manner. He notably points out the areas in nematoloty in which knowledge is deficient, such as the physiology and raison d'être of molting. The book is illustrated amply with line drawings and photographs that attract and maintain the reader's interest.

The general biology reader desiring a broad nematological overview written somewhat nontechnically previously has had no place to turn. *The World of Nematodes* fills this void in an admirable manner. Entomologists should find this book to be a valuable addition to their libraries, one that could very well provide useful ideas for their own research.

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The Dance Language and Orientation of Bees

Karl von Frisch
Harvard University Press, Cambridge, MA, 1993
(originally published in 1967)
566 pp., $29.95
ISBN: 0-674-19051-3 (paperback); 0-674-19050-5 (cloth)

WHEN THE HARVARD UNIVERSITY PRESS was approached about reprinting von Frisch's book, their first question was, "Would a twenty-six-year-old book be of value and interest to modern students?" The answer is, of course, a resounding "yes." Not only is this book of importance to those working with honey bees, it is also a classic for behaviorists in all fields, even beyond entomology. No doubt von Frisch would have been pleased to see this reprint, too, for, although many have stated that his first love was science, those of his students that I have known have told me of his equal

concern for the welfare and success of all students.

On the third floor of Brunnwinkl, his summer home in the Austrian Alps, von Frisch had a wonderful museum filled with animals, nests, and zoological artifacts that showed his wide interest in life on earth. For much of his life, however, his chief concern was honey bees. He once wrote that studying honey bees was like taking water out of a well. One could remove several pailfuls, and more would run in, and so it was with bees—one piece of knowledge gained led to another question.

The Austrian Alps proved to be a perfect place to study honey bee behavior, especially the dance language. There is not an abundance of food for bees in the vicinity, when von Frisch and his students wanted to train bees to a feeding station, they could do so without the bees being distracted by a richer, natural source. As von Frisch himself reports, bees prefer natural nectar and pollen much more than artificial substitutes.

Von Frisch had no fear of hard work, nor was he deterred in requesting his students to take on onerous tasks. On pages 173–178, he describes his "detour experiments," which are classical but typical among his studies. These experiments ask, how do scout bees dance when they are forced to fly around an object, such as a mountain, to gather food? Von Frisch writes, "Their behavior is sensible." Bees forced to fly around a mountain to gather food on the opposite side do not indicate the direction of the two legs of the journey; rather, they indicate the true direction, which is to fly through (or over) the mountain. Thus, whereas the scouts may continue to fly around the mountain to gather food, the recruits go over the top. Interestingly, some of the recruits that flew over the mountain stopped at a feeding station on the top, which von Frisch had placed there to determine if they would do so. A photograph on page 175 illustrates the rough ground on the Schafberg mountain where the research was done. The study was not complete, however, when the professor returned to Munich to teach in the fall. He soon found a tall apartment building in the city, complete with an elevator, in which one could reach the roof with ease and watch the bees fly over the structure rather than take the ground-level, scout-route around it (see page 179). Von Frisch does not admit in his writings that the city work was much easier than the mountain work, but some of his students delighted in telling me that they were glad to be done with cliff-hanging.

The work on the detour experiments also tells us much about von Frisch the researcher. He never stopped asking questions, and his ability to design experiments to obtain clear answers was phenomenal. He deserved the Nobel Prize in physiology or medicine that he received in 1973.

A sentimental note of appreciation (and new to this reprint) by one of his well-known students, Martin Lindauer, tells us much about von Frisch the man and how he inspired others. A new and thoughtful foreword by Thomas Seeley tells us why von Frisch's work "caused a revolution in the study of animal behavior" and why his book was worth reprinting and will continue to be important to biologists.

I always am pleased to end a book review on a happy note that, I believe, also would please von Frisch: the price is an affordable $29.95. That is almost as revolutionary a price for a biology text as von Frisch's book is classical. The Harvard University Press is to be congratulated on continuing to be service oriented and of great help to those in science.

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Living with Killer Bees: The Story of the Africanized Bee Invasion

Greg Flakus
Quick Trading, Oakland, CA, 1993
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AFRICANIZED BEES COMMAND FRONT CENTER stage in the eyes of the public. They are not simply insects relegated to societal obscurity, whose presence is appreciated only in the minds of entomologists. Lay people are keenly interested in this insect and seek virtually anyone with a knowledge of insects for killer bee information. Until now no book has addressed the question of Africanized bees in an accurate, meaningful, understandable, and enjoyable manner for the popular reader.

The author, Greg Flakus, a former *Voice of America* correspondent, brings a rare communication talent to a subject heavy with technical baggage and high in emotion. As a skilled reporter working in the heart of Africanized bee territory in Costa Rica, he used his observational and investigative skills to separate fact from fantasy and to produce a balanced treatment of the subject. Although scrupulous attention to accuracy was a major part of the author's effort, his obvious goal was to inform and entertain the readership, a point that is evident from his writing style.

The first chapter, "The Latest Stinging Sensations," describes examples of bee attacks, including several not found in other major accounts. Then a presentation of bee biology with emphasis on ecology and evolutionary trends sets the stage for subsequent analyses of the history and politics surrounding the introduction of the bees into Brazil, the northerly movement of the bees, and the various attempts by governments to deal with the biological and political repercussions of this movement. Next, the reader is invited to share in the often lively disagreements among the various research figures investigating Africanized bees. The reader is also apprised of the situation and opinions from the perspective of the beekeeping industry. The remaining chapters compare the situation vis-a-vis fire ants and Africanized honey bees and explore how one can live with them safely and sanely. The book finishes with three useful appendices, an annotated list of books for reference, and an index.

Overall, the book provides as much useful and entertaining information on the subject of Africanized bees as anyone, possibly excluding active bee researchers, would ever need to know. It achieves a new synthesis by cutting through the chaff to get to the scientific, social, and political heart of the issue. The fifteen halftones in the text include photos of many of the people discussed, with Warwick Kerr, appropriately, the only person with the distinction of having a full-page portrait. This book has few production or scientific errors, though on page 46 the height of queens during mating flights is mistakenly reported as 1,200 feet. If nonspecialists were to read only one book on the subject, I would recommend this one. Although the book is written for the general public, I recommend it as reading for anyone, including entomologists, who has even the slightest interest in bees or other insects.

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