There is a wistful tone throughout. The craft with which this book is written reflects an abiding respect. It was as if the deeper Lewis explored nature, the stronger her regard for it became, as well as her understanding of everything else.

Silent Sparks is constructed of eight chapters, each of which builds upon its predecessor to deliver the basics of firefly biology in nontechnical terms. The author's engaging and very readable style reduces the complexities of topics such as firefly lantern morphology, bioluminescence chemistry, and sexual selection into retainable memory bites. The intended audience is clearly not the author's peers. She targets instead those readers who are intelligent, but who still retain a youthful curiosity and wish to enjoy the process of learning as a means to understand more about these charismatic beetles. Lewis promotes this process as a kind of revelation, one that can alter the trajectory of your life, as it did hers. The book provides a broad introduction into the fascinating world of firefly sexual behavior, chemical defenses, and the evolution of their flash signals, much of which is based on research coming out of her own laboratory. These topics can easily excite developing minds, screenagers notwithstanding.

Not all behavior is adaptive. Just on 50 years ago, George C. Williams made the case that adaptation is a special and "onerous" concept that should only be used where necessary. The validity of this point is at the core of a long-standing debate between firefly researchers. Suffering from a bit of cognitive dissonance, Lewis tries to summarize her take on the rift between John Buck and James Lloyd, both major contributors to our knowledge of firefly biology, and both major influences on the author's development as a scientist. Having a foot in the laboratory ("controlled") studies and also one in the field, I can understand the controversies surrounding much of their early firefly work. This is not an issue of why *versus* how approaches, but one of epistemology: whether or not scientific inferences must be made using factual evidence. An example of this ongoing dispute is found in the book's "Vampire" section of Chapter 7, which covers the phenomenon of firefly mimicry, a topic far from settled science, but reported as such. The mechanism of mimicry, whereby *Photuris* "femme fatales" attract and prey upon interspecific males by responding to their courtship flashes, is thought by some in the behavioral physiology camp to be the function of an entrainable flash oscillator that can adjust its period to different photic inputs. The output need not be very precise since most females have roughly the same response delay. These investigators prefer to call this phenomenon "predatory responding." The other camp, the erstwhile behavioral adaptationists, argues that *Photuris* flash responses represent precise, fixed outputs from a genetically programed suite of species-specific female responses. Which model do you prefer? The physiological model is more parsimonious, since the entrainment mechanism has been shown to approximate, to a sufficient degree, the female responses of a wide range of prey species. With the mimicry model, *sensu stricto*, one would need geographical segregation (i.e., no gene flow) among *Photuris* populations, whereby each of its sympatric male prey species would select for their corresponding female response time delays to shape the preprogrammed, local "femme fatales" repertoire. No such barriers to gene flow exist today. We are then carried away to another thought-space with "hawking"—the alleged ability of predatory females to track down males in flight. All of this selection pressure is supposed to have been intense enough to result in prey males shortening flash durations or reducing the number of flashes they emit over evolutionary time. Yet Asia, where these predators do not exist, has numerous, rapidly flashing species. The point here is that rather than pat, just-so stories, uncritically promulgated throughout the literature, we could be confronted with testable alternatives, which might foster more research by the next generation of investigators. This would make a more inspiring penultimate chapter for the book.

In summary, *Silent Sparks* is a thoroughly delightful look into the astonishing firefly "Umvelt." It is a delightful montage of natural history, biochemistry, behavior, ecology, and evolution. The book will appeal to younger students and anyone fascinated with the natural world. This volume will be a wonderful resource for the curious biophilic, one who has an instinctive bond to nature, or the amateur naturalist, who yearns to know more about what's going on outside, for many years to come. A "world of wonder" begins with *Silent Sparks*.

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THE BRACONID AND ICHNEUMONID PARASITOID WASPS: BIOLOGY, SYSTEMATICS, EVOLUTION AND ECOLOGY.

By Donald L. J. Quicke. Hoboken (New Jersey): Wiley-Blackwell. $219.95. xv + 681 p. + 63 pl.; ill.; author index, general index, host index, Ichneumonoid genus, tribe and subfamily index, and Ichneumonoidea species index. ISBN: 978-1-118-90705-4. 2015.

There are 538 pages of text, a seven-page glossary, and a comprehensive set of references. Together these present a summary of what is known about

the Hymenopteran superfamily Ichneumonoidea. It is comprised of two extant families, Braconidae, and Ichneumonidae, both of which are among the most species-rich and functionally diverse families of organisms.

Quicke is a professor who held joint appointments at the Natural History Museum, London, and Imperial College until his retirement in 2013 to live in Thailand. No one in the world is more qualified to write a book of this nature. Although there are some who have expertise in ichneumonoid systematics and others in their biology, Quicke is unique in having a profound knowledge of both of these disciplines and he has published extensively on both.

The volume begins with an overview followed by a comprehensive chapter on external morphology. The latter is an essential read for any student of Hymenoptera interested in identification. Morphological nomenclature in the group is replete with synonyms for almost every structure and although these have evolved over time, many are still in use, especially those terms associated with wing veins. The author provides tables that compare the different wing vein systems that are, and have been, employed.

No more important but certainly more interesting is Chapter 3, which concerns the functional morphology of the ovipositor (egg-laying apparatus). These have evolved into a plethora of forms across the superfamily to gain access to hosts that occupy a diversity of niches, from deep inside wood to leaf-miners to free living and exposed.

In all of the chapters we do not see simple descriptions; rather information is placed in the context of biological and ecological function. For example, over various chapters Quicke describes the diversity of ichneumonoids: to locate their hosts, to employ ovipositor structures to access the host, to overcomes host defenses, to feed on the host causing minimum damage for prolonged periods, and to modify host behavior. Readers will obtain a comprehensive picture of morphology, taxonomy, and functional ecology.

All of the above is found in Part 1 of the book; Part 2 summarizes the current status of our knowledge of ichneumonoid classification and phylogeny beginning with higher relationships and then treating each subfamily, including extinct taxa, separately. Included is not a dry rehash of published relationships but a comprehensive treatment of the biology, morphology, functional ecology, and economic importance of each. These chapters are a must read for any student of the group.

The last part is titled Ecology and Diversity. I imagine that the author had a difficult time finding an appropriate title because it might better be named, "everything else you might like to know about Ichneumonoidea." In these chapters interesting topics as varied as biological control, mimetic patterns, biogeography, biodiversity, and rearing and collecting are discussed.

Overall, the book is fascinating, comprehensive, and it efficiently summarizes in an engaging way an enormous quantity of valuable information. It is suitable, or rather essential, for both beginning students and expert hymenopterists. Another volume such as this will not be forthcoming as no one in the world has the breadth and depth of knowledge of the author. The book ends with a look to the future where Quicke introduces intriguing topics yet to be explored.

A few negatives: some of the editing is sloppy and the text can be repetitious in places. The quality of the illustrations, especially those that are not in color, is sometimes poor; neither of these criticisms distract significantly from the quality of the volume.

Michael Sharkey and Sarah Meierotto, *Entomology, University of Kentucky, Lexington, Kentucky*

Annual Fishes: Life History Strategy, Diversity, and Evolution.

Edited by Nibia Berois, Graciela García, and Rafael O. de Sá. Boca Raton (Florida): CRC Press (Taylor & Francis Group). $107.96. xv + 327 p.; ill.; index. ISBN: 978-1-4822-9971-7. 2016.

The appearance of this first book-length treatment of the biology of "annual" fishes is timely, for interest in them has recently increased sharply, undoubtedly fueled by the success of *Nothobranchius furzeri* as a model organism for studies of aging/senescence (its most widely used laboratory strain is arguably the shortest-lived vertebrate known) and by the work of a growing cadre of professional biologists from South American countries where annual species are part of the native fish fauna. "Annual fishes" are oviparous African and Neotropical aplocheiloid killifishes whose life histories are adapted to ephemeral waters that evaporate during dry seasons; populations then persist until the next rainy season solely as drought-resistant eggs/embryos buried in the substrate. The general outlines of annual fish life history and some key features of their developmental biology have been known for many years, and they have attracted some attention because of their rapid growth and aging, extreme sexual dimorphism, and resistance of embryos to desiccation and other environmental stressors. However, detailed analyses of some of the mechanisms underlying characteristic annual adaptations have begun to appear only recently.

The book contains 18 chapters organized into three parts. Unsurprisingly for a multiauthored,