Bioluminescence: Living Lights, Lights for Living.

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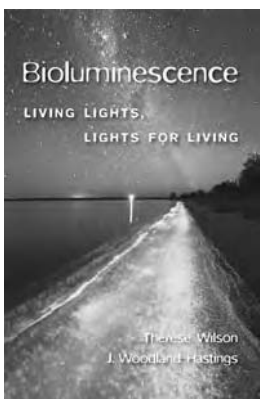
A Personal Synthesis of the Research on Luminous Species

Bioluminescence: Living Lights, Lights for Living. Thérèse Wilson and J. Woodland Hastings. Harvard University Press, 2013. 208 pp., illus. $45.00 (ISBN 9780674067165 cloth).

There have been a few notable scholarly books about bioluminescence in the last 60 years. E. Newton Harvey's (1952) *Bioluminescence* is still a useful and comprehensive reference. Peter Herring's (1978) *Bioluminescence in Action* captures a thorough cross section of the state of research before 1978, and Osamu Shimomura (2012) gave the best in-depth look at the chemistry of luminescence in *Bioluminescence: Chemical Principles and Methods* (the first edition of which was published in 2006). With the recent release of *Bioluminescence: Living Lights, Lights for Living*, authors Thérèse Wilson and J. Woodland (Woody) Hastings aim to fill a niche between these previous works by providing an accessible account of the research, animals, chemistry, and anecdotes associated with a lifetime of work on bioluminescence. The result is a mixed bag—a book that succeeds on many counts but also introduces some flaws and idiosyncrasies.

Wilson and Hastings are long-time collaborators, having written several review articles on bioluminescence. During their careers, they have produced important research on bioluminescence in bacteria and dinoflagellates, with additional contributions on cnidarians and fish. Although the text of *Bioluminescence* is more formal than a personal reminiscence, the content reflects personal views on luminescence research—one of the book's greatest strengths. However, much of the material covered seems to be limited to knowledge already in the authors' heads and is presented seemingly without the benefit of rigorous literature searches for the newest developments.

The book's personal perspective also means that the authors have synthesized many results before presenting them. This is one of my favorite aspects of the book. Progress in science comes as a series of inferences pieced together over time, but when reading the primary literature, it is difficult to sort out which beliefs were later modified or proven incorrect. Wilson and Hastings have provided a great service by walking through the development of understanding for some cases and by pointing out which conclusions were eventually modified.



It is challenging to organize a comprehensive text about bioluminescence, because many topics are interlinked, and, as Wilson and Hastings point out, understanding one subtopic requires knowledge of another. Does one arrange the narrative by taxonomy, chemistry, habitat, or function? When and how is the concept of fluorescence introduced in relation to bioluminescence? As Harvey (1952) famously stated in his book, the evolution of bioluminescence has resulted in a seemingly haphazard distribution of capabilities among diverse taxa, "as if a handful of damp sand has been cast over the names of various groups written on a blackboard, with luminous species appearing wherever a mass of sand stuck" (p. x). Harvey's observation is again reflected in the seemingly haphazard organization of material in this book. Taxa and concepts crop up unpredictably in different sections, almost encouraging the reader to jump around throughout the text. For example, the chapter titled "A marine *crustacean*" employs the subtitle "Bioluminescent *fishes* as plagiarists and thieves" (emphasis added), and the chapter called "Bioluminescence in the oceans" limits its discussion to two species. Another disappointment is the barely five-page chapter devoted to "The many functions of bioluminescence," which neglects to mention the burglar-alarm hypothesis at all and mainly reiterates functions already described in previous chapters.

The enjoyable sections of the book, for me, are those in which the authors imaginatively speculate on the evolutionary origins of bioluminescence (Calcium-binding proteins may have evolved from early luciferases instead of the reverse? Wow.) and in the chapter that walks the reader through the luminescence systems of dinoflagellates and krill with a satisfactory blend of chemistry, biology, a synthesis of the literature, and the authors' own insights.

The writing is confident and clear, but technical terms are sometimes left unexplained. For example, glycosylation sites are not discussed, so why mention them? The term *tentacle* is used in the text, but, in the figure caption, it is replaced by *peduncle*, and is misspelled as *peducle*, so the reader will not be able to easily find a definition. No citations or credits are given in the text or with the figures, which can leave a reader frustrated by an inability to follow up. What is the basis for saying that "bioluminescence powers photosynthesis"? Why would violet light have four times the energy of red light, as the book indicates it does, instead of two or three times,

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as one would expect from the ratio of their wavelengths? Factual glitches include neglecting to highlight Rhizaria (radiolarians) in a tree-of-life figure depicting where bioluminescence has evolved; stating that the sea pansy *Renilla* is found only in the North Atlantic Ocean; referring to pineapple fish as having been covered in previous chapters, when no earlier mention of the species could be found; and claiming that all green-fluorescent proteins have a chromophore consisting of the same three modified amino acids, when, in fact, only two of the three are conserved.

Noticeably absent are mentions of any researchers in the field, including the modern giants of luminescence. The only names that I noted in the text are Aristotle and Dubois, and one sentence even begins, "Someone calculated…." Why Wilson and Hastings are reluctant to give credit for the sources of research findings, even when the work was carried out in their labs, is a mystery. Maybe they are being modest. Perhaps related to this omission is the intriguing fact that the book is written as if the term *photoprotein* had never been coined. Although it is one of the most commonly encountered terms in modern luminescence applications, I noted it used only once in passing, and it apparently did not merit a glossary entry. My understanding is that the authors consider photoproteins to be luciferases and not a separate class of protein, but this perspective should be explained in the text. To me, the term *aequorin*, which the authors use liberally, is more objectionable, because it implies that there is only one protein of interest in the hydromedusa *Aequorea*.

Bioluminescence: Living Lights, Lights for Living is a unique book that would be of interest to marine scientists, beginning chemists, and students looking to improve their knowledge or write a report on the subject. For more in-depth chemistry, I would recommend Shimomura's (2012) book, and for a more up-to-date overview of the field, I would suggest a recent review paper in a scientific journal.

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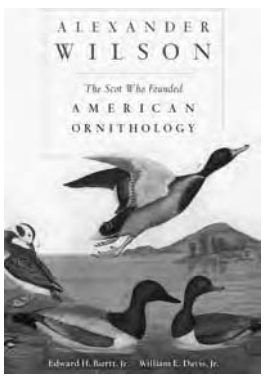
FANFARE OF FEATHERS FOR THE COMMON MAN

Alexander Wilson: The Scot Who Founded American Ornithology. Edward H. Burtt Jr. and William E. Davis Jr. Harvard University Press, 2013. 464 pp., illus. $35.00 (ISBN 9780674072558 cloth).

By any measure, Alexander Wilson is one of the most important ornithologists in the history of the field in America. Born in Scotland in 1766 and later becoming an American citizen, a poet, a marksman, and an artist, Wilson was indefatigable in his consuming interest in instructing ordinary folk in the science and identification of birds. He is the author of a natural history of living American birds—almost 80 percent of the species of the area in which he lived and through which he personally traveled. He adopted the Linnaean system of naming—the first American ornithologist to do so. Admittedly, he got some things wrong mainly as a result of financial problems, and he left much to do, but it is with good reason that many today consider him the father of American ornithology. The final intense process of researching and publishing his major work, the nine-volume *American Ornithology* (1808–1814), took its toll on Wilson, however; he died prematurely and penniless. *Alexander Wilson: The Scot Who Founded American Ornithology* is the story of this man's life, his work, and his legacy.

Wilson's formal education ended at age 10, soon after which he began an involuntary apprenticeship to his brother-in-law as a weaver. While traveling between home and work, Wilson developed his keen interest in birds (and a willingness to shoot some for the family table). During this period, it became clear that he also possessed a talent as a poet. He wrote one poem called "The disconsolate wren," but his best-selling work was a ballad that sold over 100,000 copies. (This poem was published anonymously, and all the profit went to the publisher in order to settle a debt that Wilson owed him.) Both skills—with the gun and with the pen—proved to be critical in the fulfillment of his ornithological goals.



Wilson developed strong feelings about the conditions of weavers and other workers, which brought him into conflict with the authorities. As a result, at age 28, he set sail for Philadelphia. In America, he published patriotic verse as he worked as a weaver, a peddler, and an engraver. Then he landed two successive jobs as a schoolmaster. The second, in 1802, was near the home of the descendants of the early American botanist and

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