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Dispelling the Darkness: Voyage in the Malay Archipelago and the Discovery of Evolution by Wallace and Darwin.

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chapters, Vogel describes the physics of the light absorption of the leaf, the diffusion and flows of water and gases in and out of the leaf, the leaf's temperature balance, its avoidance of freezing, its mechanical support, and its ability to survive storms and herbivores. Vogel is always searching for the functional consequence of each leaf feature, and he finds explanations in the first principles of physics. In most of the text, the major points are not new, but the synthetic explanation is innovative. The book's sections on light absorption, the diffusion of gases, temperature convection, surface tension, and internal pressures are especially brilliant and insightful. In addition, Vogel presents his own creative and untested explanations for phenomena such as root pressure and leaf rolling. He also highlights biomimetic applications based on leaves and analogies of leaf design in human physiology, textiles, home appliances, and building construction. The book is impressive as both a broad synthesis of so many topics and as a resource for basic equations and explanations.

The volume also abounds with ideas for teaching students of all ages the principles of physics and the basics of plant physiology. One of Vogel's missions is to reach young readers and to persuade them to take up science as a pursuit. Vogel remarks throughout the text about the fun he has when pondering and practicing science, and he includes numerous, beautiful photos of plant adaptations and Martin Gardner–esque do-it-at-home exercises. However, in this attempt to reach a general and young audience, the book faces several challenges. Vogel aims for the style of a jovial senior lecturer, laden with crusty comments, puns, and alliterations (e.g., "We're all familiar with the perverse, perfidious, and pervasive power of flatulence," p. 48), and this style can become long winded and tedious. Parenthetical tangents run off topic, sometimes rambling to dead ends. (For example, this book is not the place to read about plant water use in detail.) Sometimes Vogel attempts to meld his scientific brain with that of the reader: He stops in the middle of his description of a process to explain his attempts to guess at its mechanism; then describes how he mentally tested his reasoning; then how he chose another explanation, rejected that one, arrived at an impasse, and so on. Likewise, it is difficult reading when Vogel walks us through his calculations at length, describing in the text how he plugged numbers into equations.



Unfortunately, there are also many errors of important detail regarding plant anatomy, physiology, systematics, and nomenclature. Key terms for plant tissues are inaccurate, as is information on the size of plant cells and on stomatal and xylem anatomy and their physiological function. In addition, several sections of the book contain out-of-date information on whole topics, such as those on C_4 photosynthesis and leaf development. (On the upside, a young scientist might, in fact, use this book as a training exercise by finding the errors.) These issues arise from and are made worse by the author's apparent unfamiliarity with the recent literature. Of the approximately 110 references, only a third date from within the last 10 years, and only half of those are from the last 5 years. Vogel misses out on important breakthroughs in the last few years on leaf development; venation; economics; volatile compounds; and the evolution of leaf form, anatomy, and physiology in multiple lineages. Regarding leaf water transport and biomechanics, Vogel makes do with discussions of wood, being presumably unaware of numerous leaf-focused papers on these topics in the last decade. Most critically, classical and recent research have made obvious that diversity is the leaf's most compelling aspect and the one most necessary for science to explain. That diversity, drawing increasing attention of scientists worldwide, is barely covered in this book—mentioned only briefly in the beginning and final chapters.

The Life of a Leaf offers unique insight but does not completely live up to its title. A book that truly did that would certainly clarify and explain not only the physics of a leaf but also the rich ecology and evolution of leaves. That book has not yet been written. However, despite its weak points, this book provides an admirable template, proving that a text for a general audience can capture an innovative, sophisticated and integrative approach to science as it makes the point that leaves are important and fascinating on every level.

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WALLACE IN THE MALAY ARCHIPELAGO

Dispelling the Darkness: Voyage in the Malay Archipelago and the Discovery of Evolution by Wallace and Darwin. John van Wyhe. World Scientific, 2013. 420 pp., illus. $49.00 (ISBN 9789814458795 cloth).

Dispelling the Darkness: Voyage in the Malay Archipelago and the Discovery of Evolution by Wallace and Darwin is the latest book by science historian John van Wyhe, who is currently a senior lecturer at the National University

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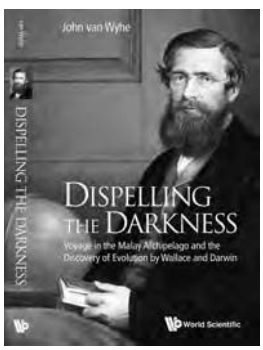
of Singapore and the editor of both *Darwin Online* and *Wallace Online*. This title, one of many appearing this year for the 100-year anniversary of Alfred Russel Wallace's death, concentrates on Wallace's grandest adventure—his 8 years in Indonesia and Malaysia. During this period (1854–1862), Wallace made a number of notable discoveries in biology, biogeography, physical geography, and ethnography. Among these, his independent discovery of the principle of natural selection surpasses all others. Not surprisingly, dozens of authors have treated this story from various biographical and analytical angles, but *Dispelling the Darkness* is the first to purport to offer an overview of the adventure's unfolding from start to finish.

After receiving a grant from the Royal Geographical Society, Wallace was able to travel to Singapore. From that point, he was on his own, sink or swim. It was the spring of 1854, and his hope was to finance a series of expeditions using the sales of specimens that he collected. This hope was realized, and Wallace remained in the East for 8 years. Van Wyhe takes the reader on these expeditions, bringing out many details of the cultural and natural environments along the way (to the extent of providing photographs of some of the vessels on which he traveled).

The author's thorough descriptions are excellent, but within them are subtle, underlying views on Wallace's intellectual evolution. For example, van Wyhe seems to lean toward the notion that Wallace's voyages to South America and the Malay Archipelago were mere collecting expeditions and unconnected to any search for evolutionary mechanisms. There is compelling evidence to the contrary, including the following words from Wallace's "Sarawak Law" essay of 1855:

> The great increase of our knowledge… has accumulated a body of facts which should afford a sufficient foundation for a comprehensive law embracing and explaining them all, and giving a direction to new researches. It is about ten years since the idea of such a law suggested itself to the writer of this paper, and he has since taken every opportunity of testing it by all the newly ascertained facts with which he has become acquainted. (Wallace 1855, p. 185)

Wallace is referring here to his reading of *Vestiges of the Natural History of Creation* ([Chambers] 1844), a transformist tract that focused his attention on the subject of evolution. At least a dozen of Wallace's letters and writings from that time and later attest to his interest then in evolution and how it might work.



Another argument that van Wyhe makes is that Wallace was not thinking in evolutionary terms until he came on some interesting variations in tiger beetle coloration on the island of Sulawesi and related them to local conditions of the environment. If that were the case, we would all know of Wallace's tiger beetles just as we know about Darwin's finches. But nowhere in any of his writings does Wallace give more than mere mentions to tiger beetles, as examples of mimicry or adaptive coloration; no such epiphany was independently documented. By contrast, Wallace later related in print no fewer than seven times the story of how he arrived at the concept of natural selection during a period of illness and fever, an event that led to his writing what has become known as the "Ternate paper" (published as part of Darwin and Wallace 1858).

Van Wyhe also brings up the issue of Wallace's memory loss in his later years and how this detail may complicate the story. It is true enough that, in some of his later writings, Wallace's memory was apparently faulty (he often cited dates and places that were not accurate), but perhaps this is a forgivable offense. However, it is in the context of those writings and in what other people have said about them that certain relevant facts remain. Van Wyhe argues, for example, that Wallace sent his "Ternate paper" to Darwin a month later than Wallace said he did—a claim that Wallace made on five separate occasions spanning more than 30 years. Van Wyhe points (see also van Wyhe and Rookmaaker 2012) to the only existing evidence supporting the later-date theory: a remark Wallace made in his autobiography that seemingly shows his mailing was a reply to a letter from Darwin that arrived on 9 March 1858. But, according to Charles S. Peirce, in a review of that same autobiography (1906), Wallace habitually wrote long compound sentences combining disparate thoughts, a result of his early instruction in Latin. Understanding this, we can see that the point of Wallace's comment has been mistaken, and the later-date theory is left without supporting evidence.

Irrespective of its subtitle, *Dispelling the Darkness* is mostly about Wallace, and the book slants toward the supposed "darkness" surrounding his discovery of the principle of natural selection. It appears to this reviewer, however, that Professor Van Wyhe is creating more darkness than he is dispelling. Despite the great adventure story and the author's penchant for geographical detail, there remain good reasons to doubt many of the historical conclusions that have been reached.

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