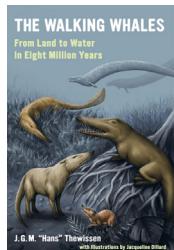


A whale of a tale

The Walking Whales: From Land to Water in Eight Million Years by J.G.M. 'Hans' Thewissen, University of California Press, 2014. US\$34.95/£24.95, hbk (256 pp.) ISBN 978-0-520-27706-9

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In this new work by preeminent paleontologist and anatomist J.G.M. 'Hans' Thewissen, the author mixes memoir, adventure, history, and popular science to tell one of the most fascinating stories to emerge from paleontology in the last quarter century, that of the transition of cetaceans (whales and dolphins) from hooved mammals to fully fledged kings of the modern seas. Thewissen begins the book by reminding the reader that not so long ago, creationists used the evolution of whales as an example of how the lack of transitional forms in the fossil record remained a big obstacle for evolutionary theory. A number of important fossil finds in the 1980s to 2000s revealed several forms that displayed an elegant sequence of incremental adaptations to life beneath the waves [1–4]. Since then, the evolution of cetaceans has emerged as an example of one of the most well-documented phenotypic transitions in the vertebrate fossil record [5]. This is the first book of its kind to specifically detail this critical period in cetacean history.

Although early whale fossils had been known at least as early as the 1830s, they were often mistaken for giant marine reptiles, as evidenced by the genus name *Basilosaurus* (Greek for 'king lizard'), a long, snake-like whale from the Late Eocene [38–34 million years ago (Mya)]. Based on teeth, the famous anatomist Richard Owen was the first to acknowledge that *Basilosaurus* was possibly more akin to whales rather than reptiles [6]. Thewissen describes that, as more material from Late Eocene whales like *Basilosaurus* became known, it still left few clues as to which living mammal group may have been the closest relatives to whales. The discovery of *Pakicetus* in the early 1980s in Pakistan showed that whales had a more ancient history (~48 Mya) [1] and the discovery of *Ambulocetus* in the 1990s by Thewissen himself established that early cetaceans indeed had functional hindlimbs adapted for powered swimming [2]. More pakicetid remains revealed that the shape of the distinctive bones of the ankle unequivocally grouped cetaceans with even-toed hoofed mammals such as cows and pigs [3], agreeing with molecular estimates [7].

In *The Walking Whales*, Thewissen weaves a tale rooted in the chronology of fossil finds rather than a sequential description of important anatomical changes through time. This allows him to move in and out of an unwinding

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narrative of discoveries, most of it experienced first hand by the author. Interspersed throughout the book, Thewissen reconstructs dialogs with other scientists and demonstrates that intense discussion and collaboration is fundamental to any successful scientific enterprise. Within these pages, readers will also find an adventure story, including riveting accounts of failed expeditions and the intricate geopolitics of digging in Pakistan and India, as well as the general difficulties and hard work that go into successful field work. One particularly memorable vignette is told of Thewissen carefully persuading a paranoid widow of an Indian paleontologist to let him view and describe a cache of potentially important fossils. This interaction led to the publication of Thewissen's most recent high-profile find, that of *Indohyus*, the semiaquatic fossil hoofed mammal and closest to the cetacean lineage [4].

Throughout the book, much of the rough-and-tumble nature of paleontology in the field is juxtaposed against high-tech modern analysis and the ingenious techniques developed to uncover the secrets of fossils, such as radioactive isotope analysis and CT scans. For example, the analysis of oxygen isotope ratios in teeth can determine whether a fossil whale drank either fresh- or saltwater, and therefore can provide evidence of the degree of osmoregulation in ancient whales. This is an important aspect of Thewissen's research and shows how far paleontology has come in the past 25 years.

This is one of those rare books that anyone will find informative, from the general public to established scientists from multiple fields. Students will especially appreciate the detailed explanation of jargon and difficult concepts, such as the bones and anatomical landmarks of the mammalian ear. In addition, Thewissen's illustrator Jacqueline Dillard has done a terrific job in bringing these ancient cetaceans to life in numerous color paintings, meticulous drawings, and wonderfully instructive diagrams. All in all this is an excellent, accessible summary of a fascinating and fruitful career and a treasure trove of information regarding the first 20 million years of cetacean history that will be used for years to come.

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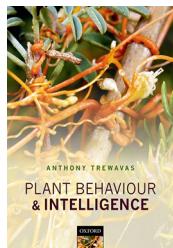
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Suicide is painless, but salad is not

Plant Behaviour and Intelligence by Anthony Trewavas, Oxford University Press, 2014. £55.00, hbk (291 pp.) ISBN 978-0-19-953954-3

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Human patients with severe brain damage due to trauma or ischemia may never regain recognizable mental functions and they never speak because of absence of function in the cerebral cortex. Such patients were described in a classic paper as being in a ‘persistent vegetative state’ [1], referred to as ‘plants’ or ‘vegetables’ by the lay public, depending on the language. This common attitude towards plants, even from many biologists, is gradually changing, although not without skepticism and even disbelief. The more we know about the developmental, physiological, reproductive, ecological, communicative, and defensive mechanisms (molecular, cellular, and organismic) used by plants, the less the above-mentioned attitude towards plants reflects reality. An increasing number of plant scientists view plants as capable, although sessile organisms. Still, the emerging new attitude towards plants presented in this important and certainly unorthodox book must be hard to digest for many.

For some 15 years, Anthony Trewavas has been a prophet and leader in the movement for better appreciation of plants as sophisticated organisms. His book *Plant Behaviour & Intelligence* manifests, although in a more modest, typically British understatement, what I use as a humorous phrase to my students: ‘salad is murder’. In its first seven chapters, the book gradually presents to the reader the picture of where plants originated in the tree of life, their critical role for animals and other groups of organisms, and the sophisticated ways by which plants, the proletarians of the world, manage in a cruel world where so many other organisms do their very best to consume them. Plants do this when they cannot move as quickly or from place to place in the way that most animals do. Trewavas compares plants to animals, listing the many environmental factors that plants sense to respond in a fruitful way. Chapters 8–18 present systematically the complex organization, decision-making, and behavior of the major plant organs and tissues, and also demonstrate plant learning and memory capacities and their ability to use other organisms. All the above data and ideas serve the

final chapters (19–26), which discuss plant behavior and intelligence.

The fact that the ideas presented in this book will probably not always be easy to accept gives it a unique value. There are oceans of data papers and books, but many fewer intriguing and inspiring ones. Given the, in general, historically wrong view about plants as almost inanimate creatures, they have not been studied as deeply as have animals. Therefore, there are many aspects of plant biology, especially those that can illuminate their behavior and intelligence, that have been left almost untouched. If this book stimulates researchers to address descriptively, theoretically, and experimentally these many overlooked or neglected aspects of plant biology, the book will be a great success, because it is certainly not a typical scientific book, but rather a manifesto.

There are several statements in this otherwise excellent book that either contradict other statements within it, or seem to be incorrect. Some seem to indicate that the author himself did not shed all the old views he was brought up with, views that he has been fighting tirelessly against for over a decade. The first (p. 69), which I have already come across in the past in other publications, is that angiosperms have only about 30 cell types. Even just the root of the best-studied plant species, *Arabidopsis thaliana*, has at least 28 cell types. I also did not like the simplistic view that seed number is an ultimate measure for fitness (p. 80), because plants such as *Oxalis pes-caprae* may spread over thousands of kilometers and evolve via somatic mutations without producing seeds. I also did not agree with his statement on p. 83 that phenotypic adjustments are considered irreversible because it is known that certain woody plants, such as *Pinus pinea*, may revert to morphological juvenility because of stress. The statement on p. 111 that plant cells are permanently joined together is incorrect because intrusive growth is well known for several cell types [2]. Similarly, on the same page, it is stated following Steeves and Sussex [3] that pressure is involved in the formation of cambium. This is an old mistake originating in a paper from 1962 [4], a study in which, as in many others, wound effects (and, therefore, wound hormones and signals) were not considered, still causing confusion for many. However, such issues do not lower the high value of this special book.

Plant Behaviour & Intelligence is not a book to read in one go, but rather one that should be consumed in small bites and digested slowly. Who should read this book and

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