BOOK REVIEWS

KLEIN, N., REMES, K., GEE, C. T. & SANDER, P. M. 2011. *Biology of the Sauropod Dinosaurs: Understanding the Life of Giants*. xii + 331 pp. Indiana University Press. £40.00, US$59.95 (HB). ISBN 9780253355089. doi:10.1017/S0016756811001166

Sauropod dinosaurs represent some of the most bizarre animals to have ever existed. Their enormous body weights, of up to 70 tonnes, suggest that they were pushing at the physiological and structural limits of what the vertebrate *Bauplan* could allow. These limits have been the subject of an intensive research programme over the past few years, conducted by a German-based research unit under the leadership of Prof. Martin Sander (University of Bonn). This research group has been funded by several successive grants from the Deutsche Forschungsgemeinschaft (DFG), a remarkable achievement for pure curiosity-driven research: it is sadly inconceivable that UK-based research councils would be visionary enough to countenance funding such a blue-skies project with no obvious alignment to perceived societal or industrial 'value'. Sander assembled a team of around 40 colleagues to address issues related to sauropod gigantism, drawing on experts with backgrounds in palaeobotany and the physiology and biomechanics of living animals, as well as vertebrate palaeontologists, in order to attempt a comprehensive understanding of the factors promoting large body size in sauropods. This volume, together with what will become a benchmark review paper (Sander *et al*. 2011), is the major output of the project (along with the numerous specialist journal papers already published and in gestation).

The volume is divided into four sections of several chapters each, book-ended by an Introduction and Epilogue. Each section deals with a different topic: nutrition, physiology, structure and growth. Although I have numerous individual disagreements with some of the detailed conclusions presented therein, this nevertheless represents a valuable addition to the literature on these animals as it contains many novel ideas and quite a bit of new data. It will definitely instigate more work on sauropod biology and help to focus future work in new directions. In some cases, however, the chapters contain substantial reviews of the other peer-reviewed papers already published by the research unit, which seems a bit superfluous, given their recent publication. I particularly enjoyed the chapters by Hummel and Clauss on sauropod feeding and that by Sander *et al.* on bone histology. Many topics are addressed, ranging from the use of finite element analysis in understanding sauropod structural performance, to thoughts on sauropod lung structure and respiratory physiology.

My major criticism of this volume is that almost all discussion of sauropod evolution (in terms of the development and elaboration of the organ systems discussed) proceeds in a phylogenetic vacuum. Only a couple of the chapters attempt to investigate functional morphology/physiology within an explicit phylogenetic context, although excellent sauropod phylogenies are available in the literature. This omission (and the surprising absence of any original phylogenetic work under the auspices of the project) probably results from an aspect of the long-standing German tradition of *Konstruction-Morphologie*, whereby organisms are assumed to evolve in response to biomechanical and architectural constraints, and the trajectory of this evolution can be determined without the need to include the taxa under consideration in genealogical analyses. Absence of a rigorous evolutionary context reduces the utility of the work overall, however, as it is not always clear when some of the adaptations for large body size appeared, nor how these functional complexes might have evolved in a step-like fashion. Moreover, almost all of the work of the unit involves investigation of how to maintain or reach a large body size: there is almost nothing on the factors that might have led to the initial acquisition of large body size in the sauropodomorph lineage, which represents a missed opportunity given the funding and expertise available.

Nevertheless, *Biology of the Sauropod Dinosaurs* is welcome on my bookshelf. It is full of new hypotheses and will enliven debates on sauropods for many years to come. Its publication is evidence of the strong resurgence of interest in these animals that, until recently, was largely overshadowed by work on the ferocious, feathered and flying members of the dinosaur family tree.

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Reference

SANDER, P. M. *et al.* 2011. Biology of the sauropod dinosaurs: the evolution of gigantism. *Biological Reviews* **86**, 117–55.

LOWRIE, W. 2011. *A Student's Guide to Geophysical Equations*. xiv + 281 p. Cambridge University Press. Price £50.00, US$80.00 (HB); £19.99, US$29.99 (PB). ISBN 9781107005846 (HB); 9780521183772 (PB). doi:10.1017/S0016756812000143

Lowrie's book is essentially a geophysicist's 'guidebook' of solutions to the 'classic' problems in solid earth geophysics. The book presents step-by-step derivations of the most important governing equations that geophysicists use to describe the physics of the Earth. Many of the solutions presented were first realized in previous centuries by the type of great geophysicists for whom parameters are named. The topics covered include gravitation and gravity (including Earth's figure and geoid), the tides, Earth's rotation, Earth's heat, geomagnetism, and the fundamentals of seismology. Solutions are presented in a clear and thorough manner, starting from first principles.

Lowrie's book serves as a basic resource for anyone who needs to revisit the basic theory of classical geophysics. Students of geophysics – primarily advanced undergraduates and graduate students – will clearly benefit, because this book provides derivations for the governing equations that are often presented alone in more standard textbooks. In fact, Lowrie wrote a prominent geophysics textbook *Fundamentals of Geophysics* (Lowrie, 2007) that covers the same basic topics using a different, and yet complementary, approach. While the *Fundamentals* textbook discusses the geological ramifications and historical context of the geophysical equations, this *Equations* guidebook largely replaces this narrative in favour of full derivations. Thus, students who want to expand upon these solutions, who use numerical codes that are based on them, or who simply