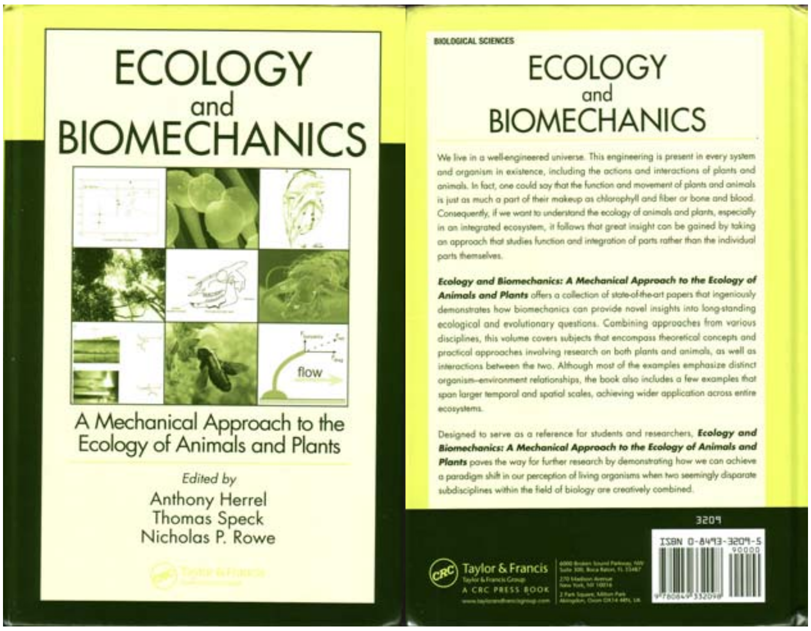
Herrel, A., T. Speck & N.P. Rowe. Eds. 2006. Ecology and Biomechanics: A Mechanical Approach to the Ecology of Animals and Plants. – Boca Raton, CRC Taylor & Francis

Book review by B.L. Beatty



'Ecology and Biomechanics' is an edited volume of papers mostly derived from the proceedings of a Society for Experimental Biology symposium with the same title held in Edinburgh, U.K. in April 2004. Over the years, journals like American Zoologist (now known as Integrative and Comparative Biology) and series like those published by the Society for Experimental Biology have provided the scientific community with thorough reviews of the most up–to–date research going on in various specialized fields of biology. As any reader of Integrative and Comparative Biology or SEB Symposia volumes knows, these collected papers are often full of insight into methods and unique, but pertinent questions that encourage all of us to think "outside the box". Though sometimes these symposium volumes can be too specialized to be useful to one's own research, they are tantalizing because they make us recognize the variety and breadth by which people with different abilities and views can tackle similar questions and ultimately get further by this diversity than if they acted alone.

What Herrel, Speck, and Rowe accomplish with their edited volume, 'Ecology and Biomechanics' is similar, though the subject matter covered in this volume is far broader than most symposia volumes attempt to encompass. Each chapter is well edited, and most do well as reviews of the subject at hand. The major difference between this volume and the others mentioned above is that the diversity of subject matters covered in this volume is much broader in scope. Though at $140, this breadth may ultimately make purchase of this book not worthwhile for the average palaeontologist, it is definitely one of those books that every institutional library should have so that biomechanics–minded researchers can draw from it for ideas and novel approaches to research. Those more broadly interested organismal biologists and palaeobiologists out there will find this book an inspiration with its diversity of subjects and approaches. But, as this is a Vertebrate Palaeontology journal, I will try to elucidate the chapters of particular interest to our field and avoid detailed comments on chapters with other foci.

The first eight chapters (out of fourteen total) focus on the mechanics of plant tissues – yes, plants. I hope that palaeobiologists that study herbivory in vertebrates can appreciate the need to understand the mechanics of plant tissues. Though well written and interesting, chapters such as those by Fournier *et al* on Tree Biomechanics (chapter one), Rowe *et al* on climbing plants (chapter two), Harder *et al* on bullkelp buoyancy (chapter three), and McCulloh & Sperry on vascular architecture (chapter four) are less useful for these purposes because they focus on plant tissues in the context of the plant alone. I must admit that for a vertebrate palaeontologist, my interests in plants are enhanced by my interest in the mechanics of herbivory, which is why I would still suggest a good look at these chapters (especially McCulloh & Sperry) for anyone interested in herbivory.

But, because of my biased view from having an interest in feeding mechanics of herbivores I found the most thought–provoking chapter of the whole book to be that of bite procurement in grazing ruminants by Wendy Griffiths (chapter five). Here, Griffiths adeptly reviews the sparse literature and describes her own work on the mechanics of how grazing ruminants utilize different oral tools to break grasses. Any palaeobiologist that studies feeding mechanics of large herbivores, whether mammal or dinosaur, should take a good look at this chapter. You will never think about uprooting a fern, or about the configuration of incisors in your study animals the same way. As a palaeobiologist, this opened my eyes to a wide avenue of research waiting to be explored.

Chapters six (by Reith *et al*), seven (by Gorb & Gorb), eight (by Federle & Bruening) and nine (by Borrell & Krenn) all focus on the mechanics of plant–insect interactions in very clever ways that include lever mechanics, fluid mechanics, and the role of waxes in friction reduction on insect feet. Though not particularly relevant to vertebrate palaeontology, I found these to be excellent reminders of the role of scale in the functions of biological materials. And though focused on insects, neontologists studying small nectivorous vertebrates should take a look at these as well.

Chapters 11 and 12 focus on interindividual variation in muscle physiology (by Navas *et al*) and power generation during jumping in lizards (by Vanhooydonck *et al*). These chapters are perhaps the most useful for the vertebrate palaeontologist, not just because of their focus on vertebrates. Navas *et al*'s focus on interindividual variation is a rarity in itself, and puts to light many issues about the role of living animal physiology in evolution that have evaded much discussion. Vanhooydonck *et al* provide a study of the relationship between jumping mechanics and habitat use that could enhance our understanding of paleoecological studies of microfauna, and be extrapolated to a better understanding of the link between ecology and fossil vertebrate locomotion.

Chapter 13 (by Christensen–Dalsgaard) is an excellent reminder of the role of microbial life in ecosystems and how the motility of these organisms plays a role in water column ecosystems. Though not as applicable to vertebrate palaeontology itself, it is another reminder of the role of all organisms in ecology and the impacts that biomechanics can have at vastly different scales.

Chapters 10 (by Golding & Ennos) and 14 (by Podos & Hendry) focus on the role of biomechanics in two fields of ecology that I had not expected here, behavioural mimicry of insects and ecological speciation. Though at first sceptical of their role in this book, after careful reading there are insights here that I think should be considered by all evolutionary biologists in general. Though driven by less data and experiment than other chapters, these two succeed in spanning the full distance between the more common ideas of what ecology and biomechanics are and left me feeling more aware of the connectivity of the full expanse of biology as a whole.

When I first read the title, 'Ecology and Biomechanics' my first reaction was, how can one volume successfully connect two such disparate fields? Though all of these chapters do this within their own categories, I believe the true value of this volume is that it does something that few other volumes of this nature have accomplished. It is full of insightful connections that I have rarely seen attended to, and does so by means not just supported by logic and well written arguments, but by the backing of physical data. 'Ecology and Biomechanics' does well to bridge the gap between these two ends of the spectrum of biology, serving as a good example of what E.O. Wilson (1998) meant by 'Consilience'.

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Cited literature

Wilson, E. O. 1998. Consilience: The Unity of Knowledge. – New York, Alfred A. Knopf.