

Preface

This is a book about structures built by animals—sort of. I actually wish to explore an idea: that the edifices constructed by animals are properly external organs of physiology.

The subject of animal-built structures has traditionally been dominated by students of animal behavior and evolutionary biology. Consider the following. A collection of classic papers on animal architecture, *External Construction by Animals* (1976), compiled by Nicholas and Elsie Collias, is part of a series entitled *Benchmark Papers in Animal Behavior*. The authoritative work on the subject, *Animal Architecture* (1974), was written by Karl von Frisch, the Nobel Prize-winning behavioral biologist. A more recent book, by Michael Hansell, is entitled *Animal Architecture and Building Behavior* (1984); the title makes the point. Students of evolution, for their part, have long valued the fossilized remnants of animal-built structures as probes into the past, a view reflected in such books as S. K. Donovan's *Paleobiology of Trace Fossils* (1994) and Richard Crimes's *Trace Fossils: Biology and Taphonomy* (1990). Finally, of course, there is Richard Dawkins's eloquent book, *The Extended Phenotype* (1982).

For the most part, these treatments have been utilitarian in their approach to this subject—animal-built structures as examples of “frozen behavior,” tools to probe the past, devices that genes use to project their influence beyond the organism's skin. I felt that a treatment of how these structures function for the animals that build them was lacking, and since I am a physiologist, I decided to try to fill the breach.

I have tried to make the book appealing to a broad audience. I hope students of animal behavior will enjoy a functional analysis of how such structures work. I hope physiologists will enjoy seeing the novel ways physiology can be applied to something besides organisms and cells. I hope evolutionary biologists will appreciate seeing the functional “flesh and bones” of the extended phenotype. Finally, I hope ecologists will enjoy delving into their discipline's historical roots as a physiological science.

Writing for breadth can be hazardous, though, for it is impossible to anticipate every reader's needs. Some passages may cover ground already familiar to some readers, but I hope all will find something new of interest. I have not shied away from quantitative and mathematical analyses, but all are straightforward and none require advanced training. I have used as many concrete examples as possible, but I have had to be very careful in making my selections: the hardest part of writing the book was in deciding what to leave out. I know many will wonder why I have left out their “favorite” structures—if so, please let me hear from you, just in case there is a second edition. For reasons more of personal interest than anything else, I have focused on invertebrates, so structures like birds' nests or beaver lodges have not been considered.

During the conception and writing of this book, I have been the beneficiary of numerous acts of generosity and good will. My editor at Harvard University Press, Ann Downer-Hazell, has been extraordinarily patient in helping me resolve difficult issues of style

and presentation. She took a chance with me, an untested author, and I hope she now feels the gamble was worth it. Kate Schmit brought art and style to the final copy-editing, taking innumerable sentences and paragraphs that I thought I had tortured into a semblance of respectability and, with a brush and a flair, making them elegant. Three anonymous reviewers of earlier drafts of this book provided many thoughtful, perceptive, and critical comments. I hope they agree that they helped me make the book better. Bill Shields, my colleague at the SUNY College of Environmental Science and Forestry has been invaluable in challenging, openly, honestly and joyfully, some of my stranger thoughts—he is, in short, a *mensch*. Jim Nakas has been

my resident expert on Greek and Latin etymology and phraseology. I have enjoyed talking with Charlie Hall about Howard Odum and maximum power. Earth-Watch, a remarkable organization, has been steadfast in supporting my work on termites; it was this work that got me thinking seriously about animal-built structures. The Trustees of the State University of New York generously granted me a sabbatical leave, which gave me the time I needed to complete writing the book. Finally, my wife Debbie and my two girls, Jackie and Emma, have had to put up with a husband and father who, while present physically, was often absent mentally. Their unwavering support and faith in me is more valuable to me than I can ever hope to express.