

## The Biology of Small Mammals

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Some readers may find it slightly surprising that this book about remarkable creatures and their natural history was written by a molecular biologist. The divide between organismal and molecular biologists has fractured a number of prominent academic departments over the last two decades, and I find it reassuring that a prominent molecular biologist such as Carroll recognizes the role that natural history has played in the development of modern biology. This illustrates an implicit point of Carroll's—evolution is a unifying theme throughout biology, whether one speaks of remarkable creatures themselves or their molecular underpinnings.

Before reading this book, I was a bit skeptical that a molecular biologist could effectively capture the essence of early naturalist expeditions such as those by Humbolt, Darwin, Wallace, Bates, and others. I had little doubt that Carroll would do justice to the more recent (molecular) work of Linus Pauling, Allan Wilson, and Svante Pääbo, but how could a bench scientist such as Carroll appreciate African expeditions, seasickness, tropical diseases, and the other trials and tribulations of field work? In fact, Carroll does so masterfully. Furthermore, I think it is the very juxtaposition of fieldwork (by naturalists and paleontologists) with laboratory work (by geophysicists and molecular biologists) that makes this book so persuasive. The evidence for evolution comes from many scientific disciplines, and Carroll covers each of them—and spins a good yarn while doing so.

*Remarkable Creatures* is relatively small, with an attractive layout and a pleasant font. I love the beautifully designed and illustrated dust jacket, which depicts a diverse mural of plants and animals on tattered parchment. The book contains a captivating diversity of figures (photographs, portraits, drawings, maps, etc.); unfortunately, the publisher's rendering of many is subpar. Some figures (e.g., 9.4) appear as though they were printed on an old dot matrix printer;

perhaps the quality can be improved in subsequent printings.

In summary, this book is a genuine pleasure to read. I think this is evidenced by its popularity with the general public and the various accolades it has garnered (e.g., a finalist for the National Book Award). I highly recommend *Remarkable Creatures* to anyone interested in science.

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### SMALL, WARM, AND FUZZY

#### **The Biology of Small Mammals.**

Joseph F. Merritt. Johns Hopkins University Press, 2010, 336 pp., illus. \$60.00 (ISBN 9780801879500 cloth).

**A**t least 90 percent of the 5416 known species of living mammals are “small.” They are cosmopolitan in distribution and the subjects of extensive research, most notably as model organisms in medical research. Because they are often common members of their communities, they frequently play major roles in the structure and function of community systems. Furthermore, they can invade agricultural crops and carry diseases transmitted to humans.

*The Biology of Small Mammals* provides an overview of the diversity of life histories exhibited among small mammals, and thereby promotes increased interest, appreciation, and understanding of these creatures that impinge so much on human life. Author Joseph F. Merritt, a senior mammalogist with the Illinois Natural History Survey (University of Illinois, Urbana), is a respected scientist with many years of experience researching these interesting

and important organisms. His book aims for a “broad readership” ranging from amateur naturalists and students to wildlife professionals (p. xi, xiii). He makes no pretense to be comprehensive but writes engagingly about the species he simply finds particularly unusual or informative. He defines “small mammal” as those species weighing 5 kilograms (11 pounds) or less; however, most appropriately, he ignores this arbitrary boundary whenever it seems sensible to do so.

After an introductory chapter that lays out the scope and context of the book, Merritt divides 12 additional chapters into three parts: “Modes of Feeding,” “Environmental



Adaptations,” and “Reproduction.” These chapters are followed by a one-page list of useful Web sites, a 10-page glossary, literature cited, and an index (17 pages). Some organizational anomalies occur, but this is not surprising since life histories resist being compartmentalized according to just one or a few of their attributes.

*The Biology of Small Mammals* has many important strengths: (a) In most cases, chapters begin with a brief overview of the taxonomic context of the chapter's subject matter; (b) Merritt often provides a welcome historical context for the topic being discussed; (c) the information is up to date, an example being the discussion of the white-nose syndrome currently devastating bats in

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northeastern North America; (d) the book contains a plethora of illustrations, their sources carefully documented; (e) there are few typos or spelling errors; and (f) units for body mass, area, and temperature are given in both metric units or Celsius and English units or Fahrenheit.

However, careless errors, contradictory statements, poor word choices, organizational problems, and an apparent lack of serious editing compromise the author's good intentions and enthusiastic treatment of the subject matter. I will mention only a few illustrative examples of these transgressions that unfortunately pervade all chapters. The introductory chapter includes brief overviews of those 14 orders of living mammals that contain small-sized species, and here we find the word "fertility" used in the way that most biologists use the term "fecundity"; neither is explicitly defined. There are also serious errors in the use of the terms "altricial" and "precocial," although both terms are defined correctly in the glossary.

Part 1 on feeding modes is organized into chapters on insectivory, herbivory, carnivory, and omnivory, and these are particularly rich in information. Chapter 3 on herbivory includes many highlights, including separate sections on colugos (Dermoptera) and hyraxes (Hyracoidea), and a treatment of the interesting but seldom discussed feeding mode of gummivory. Chapter 4 is on carnivory, where the author struggles with, but does not resolve, the semantic issue of what is meant by "carnivore." Is it members of the order Carnivora, or mammals that "feed primarily on animal material"? Adding confusion, this discussion is followed by a section titled "General Characteristics" that deals only with the order Carnivora, thus equating carnivory with this taxon. Three sections follow: "Flesh-eating Carnivores," "Piscivores," and "Sanguinivores." A reference to sand cats entering torpor implies that aestivation, and by implication, the winter lethargy indulged in by bears, is the same as torpor. The definition of

"torpor" in the glossary is no help, as it does not even exclude ordinary sleep.

The final chapter in this first part is on omnivory; it begins with the statement, "Each order of mammals contains omnivorous species." However, I can think of at least six orders that are not habitually omnivorous. Nevertheless, omnivory is widespread among mammals, and is discussed in three sections: "Omnivorous Carnivores" (meaning members of the order Carnivora), "Mycophagy," and "Case Studies." The section on mycophagy focuses mostly on herbivores that include fungi in their diets. Sporocarps are confused with spores in several places, and the widespread mutualism between mycorrhizal fungi and trees is mistakenly termed "a mycorrhiza." The case studies are about insectivores, not omnivores, plus there is a misplaced paragraph on nectarivorous bats.

Part 2 is vaguely titled "Environmental Adaptations." Its five chapters (6–10) concern only adaptations to temperature extremes and water scarcity. The introductory comments include inaccurate statements, such as: in deserts "small mammals...conserve water by...using metabolic water." This assertion perpetuates the common error that only desert mammals use metabolic water, whereas all mammals do this, and moreover, such usage does not conserve water. Conservation is accomplished by a suite of adaptations discussed in the ensuing chapter. Chapter 6 on endothermy effectively summarizes the basic features of temperature regulation in mammals. Chapter 7 is an excellent summary of heterothermy, but leaves photoperiod out of a list of environmental cues for hibernation, and fails to mention the spleen in a discussion of arousal from hibernation in bats.

Chapter 8, "Coping with Cold," contains much useful information, but lacks any mention of high altitudes as relevant cold places. Chapter 9 treats coping with heat and aridity, and is a generally well-written and informative chapter. It includes,

however, a statement explaining that oxidation of foods "creates" metabolic water, "especially carbohydrates," but Merritt does not mention fats, which actually generate more water per molecule than do carbohydrates. Then there is the careless claim that a group of desert rodents "do not require water." Chapter 10 is devoted to "Ecogeographic Rules" (Allen's, Gloger's, and Bergmann's), a topic that seems to be mainly of historical interest. The chapter starts boldly with the statement that these rules "explain morphological variation of animals on a geographic scale," but fails to incorporate the critical words "in some traits and in endotherms."

The final part is about reproduction, and consists of three chapters: "Reproductive Variations" (chapter 11), which is limited to modes of gestation; "Mating Systems and Reproductive Strategies" (chapter 12), which highlights the strategies of six carefully selected taxa; and "Population Cycles: Lemmings and Snowshoe Hares" (chapter 13), which is a brief discussion of multiannual cycles. The introduction to this final part contains an erroneous definition of "cloaca" that leads to the incorrect labeling of the marsupial urogenital sinus as a cloaca. Ironically, the glossary definition is correct. The six groups of mammals chosen to illustrate various reproductive strategies in chapter 12 are well chosen. Tenrecs represent a high fecundity strategy, and indeed boast a record litter size of 32. Elephant shrews or sengis (Macroscelidea) exemplify a monogamous reproductive strategy. "Absentee maternal care" is the undefined term given for the tree shrew's (Scandentia) strategy. Leking behavior is illustrated by the hammer-headed bat (*Hypsignathus monstrosus*), and eusociality by the naked mole-rat (*Heterocephalus glaber*). Lastly, semelparity is illustrated by the marsupial *Antechinus stuartii*. The final chapter on population cycles is notable for its treatment of early myths about lemmings, and its inclusion of recent data on the disappearance of multiannual cycles from some regions.

Overall, *The Biology of Small Mammals* is a complex mix of favorable and unfavorable features. The subject matter is inherently interesting and important, and for the most part has been well chosen. Merritt writes with evident enthusiasm for his subject, he is impressively up to date on most topics, and the book is copiously illustrated. Care is exercised in providing supporting documentation and in the use of scientific names. All of these favorable attributes would seem to guarantee a superb product; unfortunately, hurried writing and lack of comprehensive editing can compromise even a good plan. A more subtle critique of this book is that it misses opportunities to encourage a scientific perspective for the nonscientist readership that it covets. The author hardly mentions that the majority of small mammal species are little known. He misses multiple opportunities to educate by making statements that falsely imply complete knowledge about something. For example, the statement, "Of the 376 species of shrews, only 7 cache food" could easily have been transformed into a factual one—with a science lesson as a bonus—by adding the words "are known to."

All things considered, I can recommend this well-conceived book to the broad audience intended, but with the caveat that one must be wary of the widespread lapses in scientific and editorial rigor that weaken its impact.

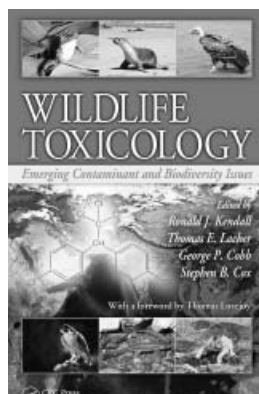
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## WILDLIFE TOXICOLOGY WITH A GLOBAL PERSPECTIVE

**Wildlife Toxicology: Emerging Contaminant and Biodiversity Issues.** Ronald J. Kendall, Thomas E. Lacher, George C Cobb, and Stephen Boyd Cox, eds.

Taylor and Francis, 2010. 340 pp., illus. \$119.95 (ISBN 9781439817940 cloth).

**W**ildlife Toxicology: Emerging Contaminant and Biodiversity Issues follows another edited book on wildlife toxicology published in 1994. That book, *Wildlife Toxicology and Population Modelling: Integrated*



*Studies of Agroecosystems*, was also edited by Ronald J. Kendall and Thomas E. Lacher. The present volume is designed to update, expand the scope of, and add new perspectives to biodiversity and emerging contaminants. The goal, as stated in the preface, was to integrate the broader issues of loss of biodiversity and global climate change to allow for better assessment of wildlife exposures to environmental contaminants. The result is a multiauthored volume of review articles on various topics. Lead editor Ronald J. Kendall is director of the Institute of Environmental and Human Health at Texas Tech University; two of the other three editors are also from Texas Tech, as are six of the nine lead authors, so it is almost an in-house effort. After an introduction and overview chapter by Kendall, the topics covered are toxicology of munitions-related compounds; pesticides and biofuels; pesticides, contaminants, and disease; contaminant effects on biodiversity and ecosystems; carbon dioxide and climate change; statistical models; global perspectives and emerging issues;

ecological risk assessment; and looking forward—the future of wildlife toxicology, again by Kendall.

Each of the chapters is a reasonable review of the topic at hand. I very much enjoyed the chapter on biodiversity and ecosystem function by Lacher and coauthors, which presents four interesting case studies of how contaminants have had effects at the population and ecosystem levels. From veterinary pharmaceuticals reducing ungulate-carrion-eating vultures in India to diclofenac and amphibian declines, from genetic and evolutionary changes in wildlife in Azerbaijan to agriculture and birds, these four case studies provide insight into events in parts of the world unfamiliar to many of us, places with less regulation of pesticides and toxic substances than we have here. Similarly, interesting insight is provided by the chapter on global perspectives, which presents information about contaminant threats to wildlife in different geographical regions, each region being covered by a different set of authors for a total of seventeen. It is frightening to learn about the excessive use of pesticides in developing countries that lack environmental regulation.

Describing the situation from the perspective of different continents seemed appropriate, but the inclusion of the ocean as a separate region to be covered in a few pages struck me as odd, since the organisms, exposures, and environment of the marine world are so totally different. I was also surprised by the emphasis on flame-retardant compounds (polybrominated diphenyl ethers) and the lack of discussion of metals such as mercury, which is a major pollutant to wildlife and threat to human health in a number of regions of the world as a result of mining and industrial activity. None of the chapters really deals with metal contamination. There are also some chapters that don't seem to fit together and that are not well integrated into a volume with such an

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