RESPIRATORY PHYSIOLOGY OF VERTEBRATES: LIFE WITH AND WITHOUT OXYGEN.

By Göran E. Nilsson. Cambridge and New York: Cambridge University Press. $125.00 (hardcover); $65.00 (paper). xvi + 334 p.; ill.; index. ISBN: 978-0-521-87854-8 (hc); 978-0-521-70302-4 (pb). 2010.

Oxygen is the fuel required for most life on Earth. This excellent comparative physiology textbook, dedicated to Peter L. Lutz, examines the central role oxygen plays in vertebrate physiology and evolution. The text details how fish, amphibians, reptiles, birds, and mammals acquire and use oxygen and the shared and unique responses to variation in normal oxygen levels. Chapter authors do a fine job outlining major questions about the role oxygen plays in vertebrate life, then providing answers, case studies, or open lines of inquiry. Readers can gain a broad overview on a topic, such as hypoxia and aquatic species, or a detailed knowledge of adaptation, such as turtles and fish that can survive for days or months without oxygen or the unique physiology of mudskippers, fish that spend much of their time out of water.

The text is organized into two parts. Part I outlines general principles of vertebrate life and oxygen—why vertebrates need oxygen, how oxygen is sensed, and oxygen uptake and transport in water and air. These chapters provide a foundation in vertebrate respiratory physiology, as well as details on the diversity and physiology of respiration in nonmodel vertebrates, particularly reptiles and fish. Part II outlines "special cases" of vertebrate respiratory physiology—hypoxia adaptations in fish, air-breathing fish, diving mammals and birds, vertebrate life at high altitude, and anoxic survival. These chapters provide exciting and unique examples of respiration among vertebrates, from the comparative lung morphology of extant species of lungfish (the ancestors of land-dwelling vertebrates) to the physiology of humans at extremely high altitudes. Each chapter is authored by an international authority on the chapter's topic, and the subject overview of the topic is, therefore, thorough and inclusive of both current research as well as studies that laid the foundation. References contain excellent reviews and are comprehensive and extensive, and figures are sufficient to outline general responses or unique physiology. Good references and figures are certainly strengths for a graduate course in comparative vertebrate physiology.

Cheers to the authors and to Nilsson for editing this volume.

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MUSCLES OF VERTEBRATES: COMPARATIVE ANATOMY, EVOLUTION, HOMOLOGIES AND DEVELOPMENT.

By Rui Diogo and Virginia Abdala. Enfield (New Hampshire): Science Publishers; distributed by CRC Press, Boca Raton (Florida). $149.95. xi + 482 p.; ill.; index. ISBN: 978-1-57808-682-5. 2010.

This volume provides a very broad summary and discussion of the musculature of the head and neck, pectoral girdle, and forelimb of selected vertebrates (based on numerous dissections by the authors) as well as a review of the literature. It does not cover musculature of the axial skeleton or hind limb. The information is heavily skewed toward lower vertebrates. There are abundant tables that summarize comparative anatomical data for selected taxa of vertebrates and numerous illustrations, both line drawings and photographs of dissections throughout the text. The final chapter addresses some broader topics in evolution and comparative anatomy, such as: whether muscular splittings or fusions are more common in the evolution of humans compared with lizards or other mammals; the value of muscular anatomy in phylogenetic analysis; and the need for a unified (and unifying) nomenclature for vertebrate muscular anatomy that accurately identifies homologies among different taxa.

I suspect most students would find the book difficult reading, but for specialists in lower vertebrate evolution or comparative anatomists, it could be a useful reference.

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DEVELOPMENT

FORM AND FUNCTION IN DEVELOPMENTAL EVOLUTION. *Cambridge Studies in Philosophy and Biology.*

Edited by Manfred D. Laubichler and Jane Maienschein. Cambridge and New York: Cambridge University Press. $90.00. xviii + 234 p.; ill.; index. ISBN: 978-0-521-87268-3. 2009.

Few topics in contemporary biology attract as much attention from philosophers and historians as does "Evo-Devo." Exploration of the developmental basis of evolutionary change, and of its twin sister, the evolution of development, has a rich pedigree that extends back several centuries and features some of the most outstanding—and outspoken—figures in the history of biology. Moreover, the discipline is in the midst of a renaissance enabled by novel genetic data and molecular tech-

niques that promise answers to long-standing questions, especially those that address the relation between form and function. The present volume is one of several recent contributions that probe the historical context and antecedents of this field and offer examples of current research.

The ten papers stem from a conference held in March 2005. An underlying conviction, expressed by the editors and many contributors, is that development is an indispensible component of any mechanistic explanation of patterns of phenotypic diversity in the history of life. Few modern workers would dispute this claim, although many might not be willing to accept Laubichler's contention that development provides the essential focal point. Perhaps I take the editors too literally when I read their stated intent and goals, but several chapters, each an excellent treatment of its particular topic, do not relate explicitly to the form-function "problem." At best, they illustrate the kinds and range of studies of developmental mechanisms that ultimately may offer a solution to this problem. A significant exception is the chapter by Brakefield which, by presenting a very effective exposition of a research program that seeks to simultaneously examine "the intrinsic roles of genetic channeling and developmental bias" and "the extrinsic processes of natural selection in shaping patterns of morphological diversity" (p. 113), is arguably the most fitting chapter of the volume.

As with many topics in biology, a historical and philosophical approach enlivens and enriches analysis of the relation between form and function. Students, in particular, will find volumes such as this a valuable means of placing their current work in its proper intellectual context.

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CELL AND MOLECULAR BIOLOGY

THE TAO OF CHEMISTRY AND LIFE: A SCIENTIFIC JOURNEY.

By Eugene H. Cordes. Oxford and New York: Oxford University Press. $59.95. xii + 414 p.; ill.; index. ISBN: 978-0-19-536963-2. 2009.

The title of this volume led me to expect an autobiography describing the author's distinguished career in academe and industry, perhaps with ruminations on the paths he chose and their consequences. Instead, one finds a sort of a textbook—not the overproduced, overpriced, lavishly illustrated, multicolored tome of today, but rather the sort of textbook we had in the 1950s: mostly text and sparsely illustrated with black-and-white line drawings. Cordes's thesis that "there are some things in chemistry that are profoundly important to all sentient beings" (p. vii) is accompanied by concern that these things are obscured in most chemistry courses. In this volume, he attempts to extract from such a course just the material that is directly related to chemical biology and pharmacology. He assumes the omitted course material is intended just for chemistry majors, but he does not explain why biology and pharmacology majors (or general readers for whom this book is intended) can be spared from having to understand such exotica as enthalpy and entropy, osmotic pressure, or the nature of the chemical bond.

What readers get is a forced march through necessary introductory concepts until the author starts talking about proteins on page 104. The tone is conversational, and ideas are often conveyed using clever and original analogies, personal anecdotes, and homey expressions. The progression from chemical basics to biological phenomena is fast paced, and I think that many novices will get lost on the way. Those who get to the medicine and biology will have only a superficial grasp of some vocabulary (assisted by a 15-page glossary) to help them understand the material, and much of the content will have to be taken on faith. But, for those who make it with curiosity intact, there is a lot of interesting material (for example, on nutrition, cell function, pharmacology, and cancer). The discussion is on the molecular level, and Cordes makes important points about the unity of life on Earth, that life is chemistry in action, and that function is a consequence of structure. There are many references to general-audience books that expand on his presentation.

Euclid is said to have told King Ptolemy that there was no royal road by which to learn geometry effortlessly. This book demonstrates, for all its good intentions, that there is no royal road to chemical biology either.

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