Vertebrate Life, 10th edition. By F. Harvey Pough and Christine M. Janis, with chapter contribution by Sergi López-Torres. 2018. Oxford University Press. (ISBN 9781605356075). 624 pp. Hardcover, $139.95.

For most biologists, Vertebrate Life perhaps came to their attention when it first appeared in 1979. Over the succeeding four decades, several of the original authors continued each version’s improvements and literature coverage. Written in an engaging style and well received by a broad array of biological researchers and educators, the book is now reissued for the ninth time. Its bold treatment and modern classification of 67,000 extant species of vertebrates, as well as coverage of fossils and their evolutionary relationships, make this text deserving of considerable accolades. For this 10th edition, the authors have reached out to numerous colleagues who suggested sources of data and photographs – over 400 full-color figures enliven the book, evenly distributed among its 26 chapters. This edition of Vertebrate Life has very few discernible errors and no stylistic issues that would detract from its first-rate prose.

Pough and Janis begin their tour with anatomical basics defining the protochordates (lancelets, tunicates) and the major groups of vertebrates: non-annamites (hagfishes and lampreys, sharks and rays, bony fishes, salamanders, frogs, caecilians); sauropsid amniotes (turtles, tuatara, lizards and snakes, crocodylians, birds); and synapsid amniotes (mammals). Throughout the text, a clear distinction between sauropsids and synapsids is a central theme for understanding key aspects of renal, respiratory, circulatory, and sensory functions.

Adding modern approaches to traditional subjects, the authors describe the role of developmental regulatory Hox genes and heterochronic processes of gene expression in embryonic development. Notably, the enigmatic evolution of jaws highlights recent discoveries of epigenetics. How early nasal placodes influence the mandibular arch mesoderm to construct jaws through an invasion of neural crest cells in gnathostomes, but not in jawless vertebrates, is explained. The authors elicit an important linkage between gene expression and morphology within a framework of modern evolutionary and developmental biology (an evo–devo perspective).

The field of phylogenetic systematics (widely adopted over the past half-century) is illustrated by 20 cladograms of both extant and extinct taxa. The authors contrast morphology-based vs. molecular-based phylogenies; critical relationships are clarified with 12 so-called “simplified” phylogenies that portray the distinctive derived characters at several major nodes (e.g.,lobe-finned fishes and tetrapods; dinosaurs and birds; early synapsids and mammals).

Diverse evolutionary adaptations and natural history of the vertebrates are at the heart of the narrative. Readers will appreciate the clear descriptions of several major evolutionary transitions or effects of selection – for example, conversion of the segmental gill arches to a single stapes (sauropsids) or three middle-ear ossicles (synapsids); derived placental membranes and the discredited notions of placental superiority of mammals; functional changes in the heart and aortic arches; body temperature regulation of dinosaurs; the evolution of color vision genes; and the negative impacts of trophy hunting on large mammals, among others.

For each major group of vertebrates, a separate chapter takes an evolutionary approach (early radiation and diversification) followed by a chapter on the living species. The eight chapters on extant groups provide recent accepted classifications, the latest IUCN Red Lists of threatened species, current species diversity, and updated nomenclature. Together, the paired chapters provide a full view of the origin, diversity, and phylogeny of the basal (ancestral) and derived (modern) groups.

The lives of aquatic and terrestrial vertebrates are covered in two chapters, “Living in Water” and “Living on Land.” Major adaptations of sensory systems and regulation of internal processes are emphasized. Mechanisms of thermoregulation and energetics are examined in two chapters (“Ectothermy: A Low-Energy Approach to Life” and “Endothermy: A High-Energy Approach to Life”). The authors stress an important ecological role of small-bodied amphibians that facilitate energy flow through terrestrial ecosystems.

Three chapters are devoted to the Paleozoic, Mesozoic, and Cenozoic eras in which the biological and climatic features of the most recent 541 million years of Earth’s history are summarized. Tectonic forces are shown by world maps of continental positions along with the geographic locations of prominent vertebrate fossils. Major variables of climatology – oxygen and carbon dioxide concentrations, mean global temperatures – are plotted. The classical story of the aquatic sarcopterygian-to-tetrapod transition describes the skeletal anatomy of the ancestral taxa Acanthostega and Ichthyostega, as well as that of the late Devonian...
Tiktaalik discovered in the Canadian Arctic only a little over a decade ago.

The final chapter ("Primate Evolution and the Emergence of Humans" by Sergi López-Torres) is an outstanding summary of the anatomical adaptations, zoogeography, and phylogeny of the primates. Many of the characteristics that students of human evolution and anthropology have traditionally studied – bipedalism, large brains, speech and language, loss of body hair, skin pigmentation, technology and culture – are treated with authority. This analysis covers the global spread of Homo sapiens out of Africa, and correlated megafaunal extinctions in Australia, Madagascar, and North America.

Excellent didactic supplements include complete chapter summaries, discussion questions, root words for biological terms, and a glossary. In preparing the 10th edition, the authors consulted over 300 citations in the primary literature, most published over the most recent 10-year period (2009–2018).

The text's background materials can easily stimulate any curious student to delve into her or his independent investigation. Student resources (available on the book's website) include more than two dozen inquiry-based activities called “Active Learning Exercises,” contributed mainly by Sharon L. Gilman. Current news items from nontechnical sources provide starting points for class discussions of current issues in vertebrate zoology (available online).

Overall, Pough and Janis remains the most engaging treatise of the vertebrates available; it easily deserves a five-frog rating.

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