BOOK REVIEWS

Evolutionary Transformations

Early Vertebrates. PHILIPPE JANVIER. Clarendon (Oxford University Press), New York, 1996. xiv, 393 pp., illus. $135 or £75. ISBN 0-19-854047-7. Oxford Monographs on Geology and Geophysics, 33.

Interest in the major features of vertebrate evolution has never been greater. Developmental biologists have begun, through comparative studies of gene expression and tissue development, to understand the genetic bases of major vertebrate traits such as segmentation of the axial skeleton and musculature, as well as the segmental design of the head. Molecular evolutionists continue to reconstruct the broad outlines of vertebrate evolution, to assess the congruence of these reconstructions with phylogenetic patterns derived from morphological data, and to consider patterns of gene homology and evolution from arthropods to mammals. And paleontologists have continued making discoveries of new taxa with novel anatomical features. Fossils of particular relevance for our understanding of basic vertebrate design are those that represent early stages of vertebrate evolution, from nearly 500 million years ago (with the first vertebrate fossils found in the early Ordovician) into the Permian 250 million years later. During this time span, all major features of vertebrate design (such as jaws, sensory systems, segmental organization of the body, brain, spinal cord, and head, and the structure of the internal and external skeleton) were established. Furthermore, clades originating during this time represent all major groups of vertebrates with extant representatives (sharks, ray-finned fishes, coelacanths, lungfishes, and tetrapods), as well as an enormous diversity of extinct taxa.

And yet there has been no accessible synthesis of recent paleontological discoveries of early vertebrates and the wealth of anatomical detail that these new fossil discoveries reveal about the origin of vertebrate life. Janvier's well-written overview of the pattern of early vertebrate evolution is thus a welcome synthesis, presenting a complete survey of early vertebrate fossils, their anatomy, and their phylogenetic relationships as currently understood. A potentially confusing array of early vertebrate taxa is presented clearly and logically with a great deal of phylogenetic and anatomical information. After a general introduction to the rise of vertebrate diversity and the origin of major extant clades, Janvier presents his survey of early vertebrates, which constitutes the bulk of the book. For each major clade, he presents external morphology, internal anatomy, taxonomic diversity and phylogenetic relationships, and stratigraphic and geographic data. The evidence supporting each phylogeny is presented as a nested series of shared derived traits (rather than as a complete taxon-by-character data matrix). The last section of the book discusses alternative interpretations of both early vertebrate phylogeny and selected anatomical features.

I found two features of this book particularly useful. First, there is an abundance of illustrations, both of taxa and of anatomical features. The reconstructions of individual taxa and of the collections of species found in individual fossil localities are outstanding and provide a clear visual representation of early vertebrate diversity. Furthermore, a great deal of anatomical detail is presented for each clade, and the illustrations of these anatomical features are essential for understanding the characteristics used for phylogenetic reconstruction. For many readers, the extensive discussions of anatomy will be excessive, and they can be skipped if a general appreciation of early vertebrate life is all that is desired. But anatomical features are the primary data, and I suspect that many vertebrate biologists will find these discussions a useful summary of an even more extensive, complex, and detailed primary literature that is inaccessible to all but the most anatomically knowledgeable.

Second, Janvier successfully mixes detailed description of clades with summaries of the major characteristics of more inclusive monophyletic levels such as Gnathostomata (jawed vertebrates). This means that one can read the book selectively, focusing on those sections that detail significant vertebrate innovations and the origins of major clades.

It is striking how much information is now available on early vertebrates. Thanks to new preparation techniques and discoveries of well-preserved material, the origin of many fundamental vertebrate traits is now accessible. As neontologists investigate basic features of vertebrate design such as the genetic basis of segmental organization, the development of the head, and the structure and function of the axial skeleton, they would do well to recall the early history of key vertebrate traits so well described in this book.

George V. Lauder
Department of Ecology and Evolutionary Biology, University of California, Irvine, CA 92612, USA

Trunk Lines

The Proboscidea. Evolution and Palaeoecology of Elephants and Their Relatives. JEHESKEL SHOSHANI and PASCAL TASSY, Eds. Oxford University Press, New York, 1996. xxx, 472 pp., illus. $175 or £95. ISBN 0-19-854652-1.

Proboscideans, spectacularly trunked and tusked mammals, encompass the two living African and Asian elephants, plus fossil relatives. The extinct relatives already include the less familiar mammoths, mastodons, gomphotheres, deinotheres, barytheres, moeritheres, and numidotheres. Perhaps even the elephants, at least in the wild, are soon to join them as just a grand memory. Possessing a useful hide, ivory tusks, and edible meat has not been fortunate for elephants, but their fascination and usefulness may save at least the Indian elephant in domestication or in ever smaller preserves. The Proboscidea have a long and well-documented history, partly because of their generally large size, which makes their fossil remains relatively conspicuous. Few museums have large collections of them, but the group is now well sampled in Africa, Eurasia, and the Americas. Known proboscideans are arrayed in about 38 fossil and two living genera, but this number may drop as methods of classification change.

Africa was the earliest well-documented proboscidean homeland, as far back as the Paleocene 60 million years ago, but the early African proboscideans are closely related to *Anthracobune* of Asia and their common ancestor with *Anthracobune* was therefore not necessarily restricted to Africa. Early semiaquatic proboscideans are also related to Tethyan ocean-dwelling desmostylians and sirenians and to hyraxes on land. During the Eocene and Oligocene, proboscideans continued in African isolation, represented by animals like *Moeritherium* and by the more elephant-like *Phiomia* and *Palaeomastodon*. These latter animals had tusks in the lower jaw as well as in the