BOOK REVIEW

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Bats share unique morphological and life-history traits that ecologically and physiologically set them apart from all other mammals. They emerge from the early Eocene fossil record fully capable of powered flight (Simmons et al. 2008). Although fossils yield only hints of the evolutionary relationship among bats and other mammals, morphology and molecules from extant lineages tell us different stories about their relationship with other mammals, and relationships within Chiroptera. These issues, and the evolution of echolocation and flight and their possible trade-offs are hot topics in the evolutionary history of bats.

In zoology in general, efforts to construct consistent evolutionary hypotheses combining evidence from morphology and molecules are increasingly common. *Evolutionary History of Bats* is a timely volume that reflects this movement. The book originates from a symposium held at the 2007 meeting of the Society of Vertebrate Paleontology, in Austin, Texas. The contributions are excellent syntheses on different aspects of bat evolution, and most of them include original information. Some chapters reflect integrative approaches, combining molecular and morphological data sets with the fossil record, whereas others concentrate on new evidence from fossils, morphology of extant bats, or molecular approaches alone.

Contributors include zoologists, geneticists, and paleontologists (from 9 countries and 4 continents) who are at the top of their game on different aspects of bat evolution. The editors—Gregg F. Gunnell (Duke University Lemur Center) and Nancy B. Simmons (American Museum of Natural History)—are prominent leaders in their research fields. Gunnell, a paleontologist, has devoted the last 3 decades to studying the origin and diversification of modern mammals through the perspective of the fossil record. Since the beginning of the 1990s Simmons, an evolutionary biologist and systematist, has been in the forefront of discussions on the origin of bats, evolution of powered flight and echolocation, and relationships of extant and fossil bat lineages. Among other collaborations, both editors, along with other colleagues, described *Onychonycteris finneyi*—a (approximately) 52-million-year-old fossil that represents the most ancient bat, an animal capable of powered flight but without osteological traits related to echolocation (Simmons et al. 2008, 2010). Their findings support Norberg’s (1989, 1994) “flight first” hypothesis for chiropteran evolution; and provide the background to reassess some of those hot-topic hypotheses in various chapters of *Evolutionary History of Bats*.

The book is not organized into formal sections, but the distribution of chapters provides an organization for the topics covered, as follows: phylogenetic relationships of higher taxa and evolution of echolocation (chapter 1); systematics and biogeography of fossil and extant lineages (chapters 2–7); population genetic structure (chapter 8); biomechanics and origin of flight (chapters 9 and 10); evolution and diversification of feeding strategies within phyllostomids (chapter 11); functional morphology, craniodental and postcranial skeletal ontogeny, and evolution (chapters 12–15); implications in the evolution of echolocation variation (chapter 14); and the evolution of body size (chapter 16). Many chapters contain high-quality figures in black and white, and the 2nd half of the book includes 8 high-quality color plates. Among the many themes covered, I have selected several to provide a sketch of this landmark work.

Emma Teeling and colleagues begin the discussion with *Phylogenies, fossils and functional genes: the evolution of echolocation in bats*. Using the largest nuclear data set so far investigated for bats, the authors retrieve phylogenetic relationships among families. Based on the results recovered, they discuss higher-level relationships within and among superfamilies, providing insights for previous phylogenetic controversies. Against that background, the authors analyze implications for the evolution and enhancement of echolocation. Considering the topology only with living bats, they find support for 2 equally parsimonious scenarios to explain the origin of laryngeal echolocation: 1) originated in the ancestor of all extant bats, and lost in Pteropodidae; or 2) originated twice. The inclusion of the fossil record favors the 1st hypothesis. Based on previously known inferences of divergence times for the major bat lineages, and Paleocene–Eocene climatic reconstructions, the authors speculate on the key role of niche adaptations in the diversification of laryngeal echolocation modes. Teeling and colleagues discuss candidate genes that underlie echolocation, and close the chapter indicating future directions to improve the resolution.

Based on new findings about the fossil record accumulated in recent decades, new scenarios on the evolution and paleobiogeography of bat lineages are available. From chapters 2–7, the book explores a range of perspectives about the fossil history of bats, covering extinct and extant lineages. Among them, chapters 2 and 4 stand as the most comprehensive. Smith and colleagues (chapter 2) provide an overview of the systematics and paleogeography of early bats, which includes all extinct and 2 living families. Morgan and Czaplewski (chapter 4) focus their contribution on the evolution of the Neotropical fauna. The chapter is organized into spatial, temporal, and taxonomic sections. The 1st part discusses North...