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BOOK REVIEW

Avian Evolution: The Fossil Record of Birds and Its Paleobiological Significance

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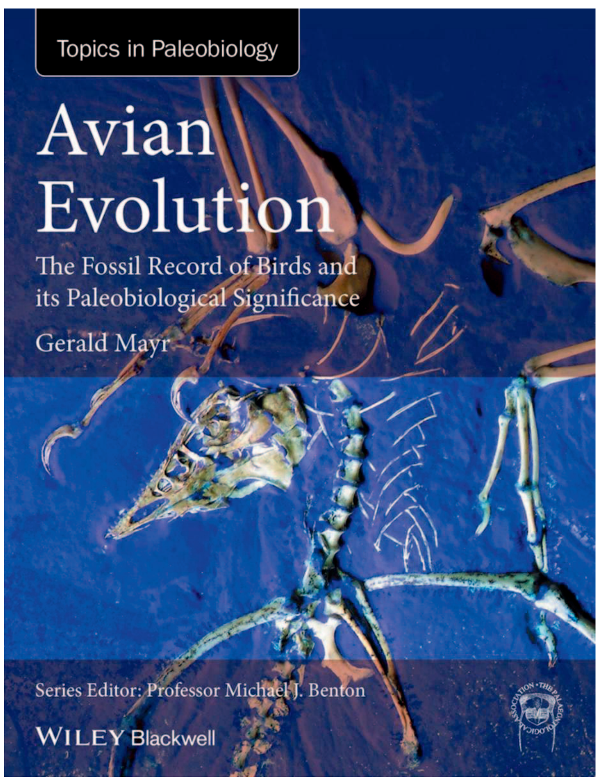
Avian Evolution: The Fossil Record of Birds and Its Paleobiological Significance by Gerald Mayr. 2017. Wiley, Chichester, UK. x + 293 pp., 16 color plates, 96 text figures. $79 (hardcover). ISBN 9781119020769.

Almost two decades have passed since the last publication of a single-volume, detailed review of avian origins and their Mesozoic–Cenozoic adaptive radiation (cf. Feduccia 1999). Since then, newly discovered fossils and novel analytical molecular techniques have significantly expanded our understanding of avian systematics and paleobiology. In *Avian Evolution*, Gerald Mayr provides a useful synthesis of recent advances in our understanding of these subjects.



Given the vagaries of the fossil record, assertions of absolute resolution of many basic questions about long-extinct forms should be regarded with caution. Surveys of bird evolution, and especially their Mesozoic Era origins and paleobiology, must be undertaken with particular objectivity. Contrary to currently popular notions that birds are merely feathered theropod dinosaurs that survived the Late Cretaceous extinction, there is a substantial and growing body of heavily peer-reviewed literature that is broadly at odds with that scenario (Feduccia 2013). Unfortunately, at the outset of *Avian Evolution*, Gerald Mayr has too frequently chosen to ignore viable alternatives to current conventional wisdom on the subject.

Avian Evolution begins with reviews of evidence bearing on the origin of feathers, avian flight, and Mesozoic avian coloration. Most all of these attributes were likely to have been influenced, to varying degrees, by the morphology and lifestyles of the immediate ancestors of the earliest birds. Mayr dutifully recounts and accepts the currently popular, cladistics-based, birds-are-dinosaurs scenario: that the earliest birds arose from an early Jurassic(?), "raptor"-like, cursorial dinosaur. However, he ignores robust, also cladistics-based, evidence that birds and theropods may have shared a common ancestor and that raptors (Maniraptora), rather than having been closely linked to avian ancestors, may have been secondarily flightless birds (Maryańska et al. 2002, James and Pourtless 2009).

Mayr's treatment of feather origins is heavily influenced by his uniform adherence to the birds-are-dinos conventional wisdom. Thus, he dutifully recounts the scenario in which feathers were likely derived from simple, filamentous integumentary appendages, such as those preserved in a variety of theropods from Chinese (Jehol fauna) Mesozoic Era sediments. But here again, Mayr has chosen to ignore substantial, peer-reviewed evidence to the contrary. Filamentous, supposed "protofeathers" in many Jehol theropods may well have been subcutaneous, collagenous connective tissue (Lingham-Soliar 2012). Furthermore, some closely related theropods from non-Jehol deposits (e.g., *Juravenator* from Solnhofen deposits) possessed fully scaled epidermal coverings with no trace of so-called protofeathers (Göhlich and Chiappe 2006). Unfortunately, there is also no discussion of another distinct possibility: If Maniraptorans were merely early flighted and secondarily flightless birds, the existence of feathers or feather antecedents in any theropods (e.g., *Sinosauropteryx*, *Tyrannosaurus*) is open to serious question.

The birds-are-dinos scenario also heavily influences Mayr's treatment of other aspects of early avian paleobiology. "Plausibility" is attributed to the wing-assisted, inclined running ("WAIR") hypothesis for the origin of avian powered flight: Supposedly pre-avian theropods quickly flapped their wings-to-be to assist uphill running, and this eventually resulted in the development of feathered, powerful forelimbs capable of sustaining powered flight, from the ground upward. However, as Mayr mentions, the WAIR scenario would have necessitated the presence of a substantial forelimb skeleto-muscular apparatus (i.e. enlarged pectoral muscle mass and a bird-like supracoracoideus), both of which were absent in theropod dinosaurs. In addition, early birds and/or near-bird ancestors (e.g., *Archaeopteryx*, microraptors) were likely to have possessed a set of fully developed hindlimb flight feathers—a condition unlikely to be compatible with adept cursoriality.

In the context of powered avian flight's origin in cursorial ancestors, Mayr leaves the impression that the abundant Early Cretaceous jeholornithid *Confuciusornis* was incapable of sustained flapping flight and was arboreal to only "a certain extent." Nevertheless, *Confuciusornis* (like *Archaeopteryx*) possessed a suite of attributes consistent with its having been primarily a tree-dweller and capable of flapping flight. These included (but were not limited to) a reversed hallux, markedly recurved hindlimb claws, and the presence of a stout furcala and, especially, fully developed, asymmetric flight feathers (Olson 2000).

Avian Evolution contains more useful accounts of enantiornithine and neornithine history. Mayr ably reviews enantiornithines as surprisingly diverse, fully volant, cosmopolitan, small- to medium-sized Mesozoic Era birds. There is also a brief discussion of possible factors involved in enantiornithine disappearance at or near the K–T boundary. However, although Mayr describes parameters of modern avian reproduction and endothermy, there is no attempt to decipher the metabolic status of either enantiornithines or early neornithines and evaluate its potential impact on extinction patterns. Moreover, he seems to conflate thermoregulation (of which all amniotes are capable) with endothermy in extant birds and mammals.

The review of neornithine history begins with a fairly detailed account of the evolution of paleognathous birds. This includes an informative section on early Tertiary flightless birds of Europe as well as a fairly comprehensive discussion of the failure of vicariance biogeography to account for the distribution and complexity of extant ratites. Curiously, in later sections of the book, Mayr presents a general discussion of avian flightlessness and of the cosmopolitan occurrence of myriad secondarily flightless forms unrelated to paleognathous taxa.

Mayr, whose expertise centers on Cenozoic neognathines, presents a fairly comprehensive history of the Galloanserinae. There is a good account of transitions and biogeography from early Cenozoic omnivorous galliforms to modern seed-eating phasianids. He also discusses the likely filter-feeding diets of the early Anatinae and their subsequent cosmopolitan adaptive radiation. In this context, at least a brief, updated discussion of the comparative morphology of filter feeding in anatids and flamingos would have been welcome.

Neoaves receive extensive coverage, including fairly detailed, up-to-date reviews of fossil evidence for the evolution of virtually every group of these taxa. Here, Mayr presents a particularly informative discussion of the apparently close relationship of early passerines and parrots and provides a reasonable scenario for the antiquity, and subsequent loss (in passerines), of the zygodactyl foot.

Notwithstanding its "received wisdom" treatment of avian origins, *Avian Evolution* provides an invaluable review of Cenozoic bird evolution and is an essential reference to recent primary literature on the subject. Moreover, the large number and consistently superior quality of the illustrations (including, especially, a series of color plates of fossils from Eocene Messel and other Paleogene deposits) add considerably to the book's value.

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