Dinosaurs of the Air: The Evolution and Loss of Flight in Dinosaurs and Birds

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Reviews

EDITED BY R. TODD ENGSTROM

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Dinosaurs of the Air: The Evolution and Loss of Flight in Dinosaurs and Birds.—Gregory S. Paul. 2002. The Johns Hopkins University Press, Baltimore and London. ix + 460 pp., ISBN 0-8018-6763-0. Hardcover, $49.95.—Among the spate of recent books on the supposed origin of birds from theropod dinosaurs is that of artist and freelance "dinosaurologist" Gregory Paul, whose past work includes the controversial *Predatory Dinosaurs of the World* (1988), which featured a good dose of "feathered, hot-blooded dinosaurs" presaging their prevalence in the popular press over the past few years. This latest and equally controversial treatise argues that certain of the birdlike theropods are actually secondarily flightless birds, possibly closer to modern birds than is *Archaeopteryx*. Paul's attempted massive documentation includes 460 pages, with six appendices and dozens of stylized "Paulian" illustrations.

Paul is a creative artist, and his illustrations of dinosaurs represent his personalized interpretation of their anatomies and lifestyles. For example, in *Predatory Dinosaurs of the World* he illustrated the giant sauropod *Mamenchisaurus* reared up on its hindlimbs, a feat almost inconceivable for that creature given its size and lack of complex epiphyses on its long bones. Although *Predatory Dinosaurs*, his first book, was published in 1988, before the discovery of so-called feathered dinosaurs, his illustrations depicted theropods from the late Triassic coelurosaur *Coelophysis* to the late Cretaceous *Velociraptor* adorned with feathers. Even in the late Triassic, the 235-my-old protodinosaur *Lagosuchus* sports feathers on the back and head. Speaking of the small-sized *Lagosuchus*, Paul notes, "This size squeeze probably marked the evolution of a fully avian–mammalian physiology" (p. 240). The implication, of course, is that all dinosaurs were fully endothermic and feathered. And, that same general theme carries over into his current magnum opus.

Not surprisingly, Paul finds no evidence for avian cranial kinesis or birdlike feathers in the skull of *Archaeopteryx*, contrary to detailed work of many careful workers, and he treats *Caudipteryx* simply as a "feathered dinosaur," despite conclusive evidence that it is a secondarily flightless bird, a Mesozoic kiwi (Jones et al. 2000). He denies the presence of featherlike appendages in the late Triassic *Longisquama* (now certain), and readily accepts evidence for a furlike pelage on pterosaurs, generally not accepted by paleontologists. He accepts the "short, fibrous material" preserved on the early Cretaceous compsognathid *Sinosauropteryx* as "another source of evidence for dinosaur feathers" (p. 66), but treats the ornithomimid dinosaurs known as "alvarezsaurids" as birds (p. 266). On page 119, there is a restoration of a lemur-like *Ornitholestes* adorned with a fuzz-like protofeather covering. Yet there is still no evidence linking the dino-fuzz preserved in Chinese Cretaceous deposits to feathers.

Birds are considered dromaeosaur derivatives, and *Archaeopteryx* is illustrated as a terrestrial creature, hyperextending its second toes. Yet *Archaeopteryx* did not have a dromaeosaur-like hypertrophied second sickle claw. If dromaeosaurs can be unequivocally identified by salient, derived features such as extremely elongate prezygapophyses and chevrons and specialized pedal digit II (Xu et al. 2003), then one must ask just how *Archaeopteryx* fits into the scheme, with typical Mesozoic "avian" teeth, no specialized digit II, and certainly no elongate prezygapophyses. How can one imagine such a creature being derived from a dromaeosaurid ancestor defined by these salient features? Yet despite a profile nearly identical in outline (including wing shape) to that of a coucal or magpie (Feduccia 2001), Paul can state,

> In *Archaeopteryx* we have a fairly intelligent, sharp-eyed dino-bird found in lagoons that lapped upon the shores of shrubby desert isles. This dino-bird had teeth somewhat like those of aquatic predators and could run, climb, fly, and perhaps swim fairly but not especially well and was a miniature dromaeosaur in the form of its body, limbs and tail… scansorial

> *Archaeopteryx* is a part-time shorebird, an occasional climbing bird, and an archosaurian "cat"… (p. 167).

However, Paul's main theme is "Were some dinosaurs also neoflightless birds?" (chapter 11), and he argues that dromaeosaurs, troodonts, oviraptorosaurs, therizinosaurs, and ornithomimids all have characters expected in neoflightless birds. His arguments, however, are narrative and he rejects cladistics as a methodology. "Cladistics will be a useful but limited tool for further investigating the neoflightless dinosaur hypothesis" (p. 254), and "The limits of cladistic methodology mean that no matter what the results of contemporary cladistic analyses or investigations of flight heritage are, in the end, only an improved set of transitional fossils will reveal the actual situation" (p. 255). Paul summarizes, "Protarchaeopteryx, dromaeosaurs, troodonts, caudipterygians, oviraptosaurs, and therizinosaurs provide telling evidence of having descended from fliers more advanced than *Archaeopteryx*" (p. 257).

Much of the remainder of the book is dedicated to phylogenies, the Mesozoic, extinctions, and the Cenozoic. That discussion is followed by a series of appendices with character lists and other associated information on anatomy, locomotion, etc. The discussion is full of convoluted statements that are difficult to grasp, such as "the global archosaur fauna was not healthy," and "A nonlinear, chaotic response to these environmental perturbations may have exaggerated what should have been survivable events…" (p. 301). In the discussion on the Cenozoic, Paul states that "The skull of *Diatryma* appears similar to that of the terror bird *Phorusrhacos*… but is even more similar to the shoebill stork… and that of the possibly herbivorous dromornithid *Bullockornis*…" (p. 308). First, the skulls of those birds are totally and dramatically dissimilar, and second, does this mean that the shoebill (*Balaeniceps*) is extinct? Such statements do not lend much confidence to Paul's anatomical comparisons of archosaurs and theories of origins based on paleontological morphology.

Despite its faults and the perception of a Disney-like fantasia produced by his freelance creative artwork, Paul's thesis, that certain birdlike terrestrial dinosaurs may be secondarily flightless birds deserves attention, and recent analyses provide evidence that *Caudipteryx* and oviraptosaurids may well be birds (Jones et al. 2000, Maryanska et al. 2002). Too, S. Czerkas (2002) has theorized that all the Dromaeosauridae may be a lineage of secondarily flightless birds, but derived from a predinosaur, a basal archosaur, not part of the theropod assemblage. In addition, the recently described four-winged dinosaur from China (Xu et al. 2003) appears to be much more birdlike than dromaeosaurlike, and its supposedly diagnostic dromaeosaur tail (also like that of a ramphorhynchoid pterosaur) and claws bear little close resemblance to those of the typical dromaeosaurs such as *Deinonychus* and *Velociraptor*. Are these early Cretaceous Chinese fossils actually remnants of the early avian radiation, which also produced secondarily flightless forms such as *Caudipteryx*? We must keep an open mind to bizarre possibilities, and certainly Paul's book will encourage all interested in this topic to begin thinking out of the box.—Alan Feduccia, *Department of Biology, University of North Carolina, Chapel Hill, North Carolina 27599-3280, USA. E-mail: feduccia@bio.unc.edu*

Literature Cited

Czerkas, S. A., D. Zhang, J. Li, and Y. Li. 2002. Flying dromaeosaurs. Dinosaur Museum Journal 1:97–126.

Feduccia, A. 2001. The problem of bird origins and early avian evolution. Journal für Ornithologie 142:139–147.

Jones, T. D., J. O. Farlow, J. A. Ruben, D. M. Henderson, and W. J. Hillenius. 2000. Cursoriality in bipedal archosaurs. Nature 406: 716–718.

Maryanska, T., H. Osmolska, AND M. Wolsan. 2002. Avialan status for Oviraptorosauria. Acta Palaeontologica Polonica 47:97–116.

Paul, G. 1988. Predatory Dinosaurs of the World. Simon and Schuster, New York.

Xu, X., Z. Zhou, X. Wang, X. Kuang, F. Zhang, and X. Du. 2003. Four-winged dinosaurs from China. Nature 421:335–340.

The Auk 120(3):917–919, 2003

The Lost World of the Moa: Prehistoric Life of New Zealand.—T. H. Worthy and R. N. Holdaway. 2002. Indiana University Press, Bloomington and Indianapolis, Indiana. xxxiii + 718 pp, 145 figures, 97 black and white photographs, 61 tables, 4 appendices, bibliography, index. ISBN 0-253-34034-9. Cloth, $89.95.— The study of New Zealand's ancient birdlife got an early start when Sir Richard Owen announced in 1840 that the islands were once inhabited by giant wingless birds—the moa. Bones of elephant birds from Madagascar were not reported in the literature for another 11 years, and in Hawaii the first fossil bird was described 103 years later, for comparison. Owen requested more bones to examine from New Zealand, and New Zealanders quickly obliged, eventually