

Height or flight? Fossil answers some questions about evolution of flight in dinosaurs, raises others

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A dinosaur fossil unearthed in the Gobi Desert of Mongolia shows that miniaturization, a hallmark of bird origins and a necessary precursor of flight, occurred progressively in primitive dinosaurs. Credit: F. Ippolito, American Museum of Natural History

Paleontologists have long theorized that miniaturization was one of the last stages in the long series of changes required in order for dinosaurs to make the evolutionary “leap” to take flight and so become what we call birds. New evidence from a tiny Mongolian dinosaur, however, may leave some current theories about the evolution of flight up in the air.

A team of researchers including Dr. Julia Clarke, assistant professor of

paleontology at North Carolina State University with a joint appointment at the North Carolina Museum of Natural Sciences, studied the new dinosaur species *Mahakala omnogovae* and its relationships to other small meat-eating dinosaurs including birds.

They found that small size was held in common among early species within the two dinosaurian lineages most closely related to birds and was evolved well before the ability to fly. Further, the dinosaurs within each lineage did not get uniformly smaller as time went on; in fact, in some lineages dinosaurs' size increased by a factor of three.

Their results are published in the Sept. 7 edition of the journal *Science*.

What we know as extant or modern-day birds trace their lineage back to membership in a clade, or group of dinosaurian species that share many similar physical traits, known as Paraves.

Within Paraves are two other branches besides that leading to birds. The new study indicates that while the species on the bird branch stayed small, the two other branches showed pronounced trends toward increases in size over time. One of these secondarily large groups includes Velociraptor, familiar to fans of the Jurassic Park movies.

The *Mahakala* specimen measures approximately 70 centimeters (28 inches) long and the researchers believe the fossil is from a young adult of the species, not a juvenile. Other characteristics identify *Mahakala* as a member of Dromaeosauridae, a group that also contains larger species such as Velociraptor.

“This specimen shows that dinosaurs evolved small size earlier than we previously thought,” Clarke says. “And even more interesting is the fact that in a couple of these lineages closely most related to birds, dinosaurs didn’t stay small – they got much larger. So we now see some competing

trends within very closely related groups over the same time interval in the Cretaceous period.”

If miniaturization of dinosaurs occurred well before the origin of flight, then this raises other questions about the ways that paleontologists have traditionally explained trends in the early history of birds.

“We had closely linked smaller size in dinosaurs including birds to flight, changes in growth strategy and metabolism: They got progressively smaller, grew faster, and flew,” Clarke adds. “Now we see that small size occurs well before many other innovations in locomotion and growth strategy. It forces us to look at the ways we were explaining trends within this part of Dinosauria, and to question our previous assumptions about causal factors in, and timing of, the acquisition of attributes seen in living birds.”

Source: North Carolina State University

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