LETTER

# Distorted *Microraptor* specimen is not ideal for understanding the origin of avian flight

The hypothesis that birds are theropod dinosaurs is supported by anatomical and molecular similarities, shared growth dynamics and physiology, and fossil theropods covered in feathers. A recent paper by Alexander et al. (1) and an associated commentary by Ruben (2) attempted to understand one of the greatest remaining riddles of avian evolution: the origin of flight itself.

Alexander et al. (1) examined the aerodynamic capabilities of *Microraptor*, a Cretaceous dromaeosaurid (avian sister taxon), by subjecting a reconstructed model to glide tests (1). They concluded that *Microraptor* was an arboreal glider that used all limbs as a single airfoil. We applaud the empirical approach of the study by Alexander et al. (1) and agree that *Microraptor* was capable of gliding. We disagree, however, with their anatomical reconstruction of *Microraptor* and, most importantly, with the assumption that any discovery about the habits of a single dromaeosaurid may solve the riddle of the origin of avian flight.

Alexander et al. (1) reconstructed *Microraptor* as a sprawling animal, with femora oriented at 140° to one another, a pelvic anatomy unlike that of other dromaeosaurids. The authors claimed that "new anatomical information," gleaned from "examination of new material," supported their reconstruction (1). However, this is simply asserted, with no description or illustration of this new material. Similarly, the authors argued that the lack of a supracetabular crest and an antitrochanter in *Microraptor* and other dromaeosaurids allows for a greater range of motion in the hind limb (1). This is incorrect: dromaeosaurids actually have enlarged antitrochanters, which limit femoral abduction (3), and although the supracetabular crest is reduced, it is still present (3). Finally, one author (J.B.) examined the cast pelvis used by Alexander et al. (1) and found that it, like all known *Microraptor* specimens, was crushed flat. With this in mind, it is important that the recent discovery of a 3D pelvis of a close relative, *Hesperonychus* (4), seems to allow only minor lateral splaying of the hind limbs.

We disagree with Ruben (2) on his presumption that different postural reconstructions of *Microraptor* "imply profoundly different scenarios for the origin of flight" (2). The implicit assumption is that this single species can be analyzed biomechanically, and whatever configuration glides best when launched from a catapult is the probable anatomy of the ancestor of birds. There is a clear fallacy in this reasoning: *Microraptor* itself cannot be an ancestor of birds, because it lived after birds had originated. It could only help understand avian flight if it retained the gliding abilities of that ancestor, which is not at all certain (5). There are nearly 40 known dromaeosaurid and troodontid dinosaurs—the closest relatives to birds. These animals exhibit a wide range in morphology, body size, integumentary covering, limb proportions, and inferred habitat. Fixation on a single derived dromaeosaurid species is not the path to understanding the origins of avian flight. We do commend Ruben (2), however, on acknowledging that an arboreal theropod dinosaur may have given rise to birds, which departs from his previous criticism of the dinosaur–bird hypothesis and is in line with the robustly supported theory that birds are living theropods.

***Jason Brougham*[a,1] *and Stephen L. Brusatte*[b]**
[a]*Department of Exhibition and* [b]*Division of Paleontology, American Museum of Natural History, New York, NY 10024*

1. Alexander DE, Gong E, Martin LD, Burnham DA, Falk AR (2010) Model tests of gliding with different hindwing configurations in the four-winged dromaeosaurid *Microraptor gui*. *Proc Natl Acad Sci USA* 107:2972–2976.
2. Ruben J (2010) Paleobiology and the origins of avian flight. *Proc Natl Acad Sci USA* 107: 2733–2734.
3. Norell MA, Makovicky PJ (1997) Important features of the dromaeosaur skeleton: Information from a new specimen. *Am Mus Novit* 3215:1–28.
4. Longrich NR, Currie PJ (2009) A microraptorine (Dinosauria-Dromaeosauridae) from the Late Cretaceous of North America. *Proc Natl Acad Sci USA* 106:5002–5007.
5. Hwang SH, et al. (2002) New specimens of *Microraptor zhaoianus* (Theropoda: Dromaeosauridae) from northeastern China. *Am Mus Novit* 3381:1–44.

Author contributions: J.B. and S.L.B. wrote the paper.

The authors declare no conflict of interest.

[1]To whom correspondence should be addressed. E-mail: jaseb@amnh.org.