Archaeopteryx and the dinosaur-bird family tree

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The first fossil skeleton specimen of Archaeopteryx was uncovered in 1861 and is looked after at the Natural History Museum. It shows a creature with both bird and dinosaur features.

The magpie-sized Archaeopteryx had bird and dinosaur features and helped show that birds evolved from dinosaurs. However, recent research in the journal Nature questions its position in the dinosaur-bird family tree.

Scientists know birds evolved from dinosaurs because many fossils have been found of ancient animals with both bird and dinosaur features, including the famous Archaeopteryx that lived 147 million years ago.

Archaeopteryx had a feathered tail and wings with a flight feather arrangement just like modern birds. But it also had a long bony tail, teeth , and 3 fingers ending in claws, like dinosaurs.

The first Archaeopteryx skeleton fossil was uncovered in 1861 in Solnhofen, Germany, and is looked after at the Natural History Museum. It provided the first evidence that helped demonstrate that modern birds descended from small meat-eating dinosaurs.

Along with researchers from all over the world, Museum scientists have studied the specimen ever since, and they have been able to reveal that it had hearing like an emu and a brain like a chicken.

Still a bird?

No other fossils of bird-like creatures older than Archaeopteryx were known at the time, or for most of the time since this early discovery. So it became established as the earliest known bird. But is this still so?

Since the discovery of Archaeopteryx, many more fossils with combined dinosaur and bird features have been uncovered, especially in the last 10 years (with only 9 other Archaeopteryx finds over the last 150 years).

In June, scientists revealed a new species from China that they say shows Archaeopteryx was not a bird at all.

Xing Xu from the Institute of Vertebrate Paleontology and Paleoanthropology, in Beijing, and colleagues, identified the feathered and chicken-sized Xiaotingia zhengi. It was very similar to Archaeopteryx, sharing features such as long and robust forelimbs, which the team says puts them together in the dinosaur group rather than with birds.

Dr. Paul Barrett, Museum dinosaur expert says, "The June research shows just how fine the line between birds and non-avian dinosaurs really is."

Species that have a mixture of features, and are hard to place in one group or another, are known as transitional forms, sometimes incorrectly called a ‘missing link’. Their fossils provide a record of significant steps in the evolution of new features.

Although Archaeopteryx and X. zhengi had some bird-like features, the researchers say they had more features that put them in the group Deinonychosauria, which includes Microraptor and Velociraptor, rather than in the bird group Avialae.

So, does the whole bird family tree need re-arranging?

Not according to Barrett. "Xiaotingia does not necessitate a major re-writing of early bird evolution, but shows that the evolution of many of the detailed anatomical features that changed during the origin of birds may have been slightly more complex than previously thought."

Painting of how Archaeopteryx may have looked 147 million years ago.
Credit: John Sibbick / Natural History Museum

Dr. Angela Milner, Museum dinosaur expert comments. "This recent research in no way diminishes the scientific and historical importance of Archaeopteryx.

"Thomas Henry Huxley [pioneering biologist and educator] pointed out in 1868 that it was the first fossil to provide a snapshot of evolution in action between two major groups, dinosaurs and birds, and a clear demonstration that birds are the descendents of small meat-eating dinosaurs.

Another bird-like branch?

If Archaeopteryx is not a direct ancestor of birds, why does it have bird-like features and where does it sit in relation to the transition of dinosaurs to birds?

Archaeopteryx could be on another branch of the dinosaur family tree with bird-like feathers and skeletal features evolving in another closely related dinosaur group, suggests Barrett.

"Maybe Archaeopteryx wasn't on the direct ancestral line to birds, but was part of an early experimentation in how to build a bird-like body."

Overall bird origin picture

The overall picture of birds descending from meat-eating dinosaurs is firmly established. Now scientists need to rearrange the details of the early stages in the bird evolutionary tree.

Barrett adds, "As the authors of the June paper note, the evidence

suggesting that Archaeopteryx is not a bird is fairly equivocal and new analyses or new animals could very easily change this picture.

"In reality what we now have are a set of animals incredibly close to bird origin – unsurprisingly these are very similar to each other, to birds and to other small meat-eating dinosaurs. As they are so similar, it becomes exceptionally difficult to disentangle their relationships accurately."

Milner concludes, "The fact that Archaeopteryx may represent one of many early flying experiments rather than being the direct ancestor of modern birds is no surprise at all.

"It is only now that Archaeopteryx can be assessed in the context of all the recent discoveries in China which provide so much more information."

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