

Feathers too weak for early bird flight

May 13 2010



Life reconstruction of the earliest fossil bird, Archaeopteryx. Credit: Artwork by Todd Marshall

(PhysOrg.com) -- The evolution of flight took longer than previously thought with the ancestors of modern birds “rubbish” at flying, if they flew at all, according to a Manchester scientist.

Archaeopteryx, the theropod dinosaur believed to be the earliest bird, was discovered 150 years ago but debates about how flight evolved still persist. The two theories are that flight evolved in running bipeds through a series of short jumps or that Archaeopteryx leapt from tree to tree using its wings as a balancing mechanism.

Dr Robert Nudds at The University of Manchester is carrying out a

series of biomechanical investigations to shed light on the subject with his colleague Dr Gareth Dyke at University College Dublin.

For their latest paper Dr Nudds and Dr Dyke applied a novel biomechanical analysis to the flight feathers of the early birds Archaeopteryx and Confuciusornis to find out if they were strong enough to allow flight.

They found that the dinosaur feathers' much thinner central stem (rachis) must have been solid or they would have broken under the lift forces generated during flight or by gusts of wind. This solid structure is very different to modern birds, whose rachises are broader, hollow straws. If the dinosaurs' feathers had had hollow rachises, they would not have been able to fly at all.

"These are surprising results," says Dr Nudds, whose findings are published in *Science* today (13th May 2010).

"I thought the feathers would be strong enough with a hollow rachis to fly but they weren't. Even with a solid rachis, they were not very good. These dinosaurs were rubbish at flying.

"This pushes the origin of flapping flight to after Archaeopteryx and Confuciusornis. It must have come much later."

It is impossible to tell from fossils whether the rachises were solid or hollow. However Dr Nudds, at Manchester's Faculty of Life Sciences, believes the dinosaurs' feathers were solid and therefore they could fly, but very poorly.

"The fossilsof Confuciusornis and Archaeopteryx suggest flight and at this stage it would be a brave person to say they couldn't fly" he says.

“However their feathers must have been very different to modern birds and they were poor fliers. I believe the feathers were originally for insulation or display purposes then they found that by elongating them they had a parachuting surface, then a gliding surface.

“Archeopteryx and Confuciusornis are still at a very early stage in the evolution of flight.”

Dr Nudds’ and Dr Dykes’ work builds on their previous paper, in the journal *Evolution*, which investigated how the movement of feathered dinosaur forelimbs evolved into flapping flight. Again they found the flight was a consequence of gradual changes in wing shape and movement - a long, slow evolution.

Dr Nudds adds: “Our analysis also shows that Confuciusornis, which is younger by 25 million years, was worse at flying than Archaeopteryx. This raises the further question of lineage - did the dinosaur-bird line branch off, giving rise to flying and flightless birds?”

He and Dr Dyke plan to analyse other fossilized feathers to find out when flapping flight evolved. However such specimens are rare.

“I don’t mind,” says Dr Nudds. “It makes it more exciting and all the more intriguing.”

More information: Science: <http://www.sciencemag.org>

Provided by University of Manchester

Citation: Feathers too weak for early bird flight (2010, May 13) retrieved 27 April 2024 from <https://phys.org/news/2010-05-feathers-weak-early-bird-flight.html>

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