Wright Brothers Upstaged! Dinos Invented Biplanes

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The evolution of airplanes from the Wright Brothers' first biplanes to monoplanes was an inadvertent replay of the much earlier evolution of dinosaur flight, say two dino flight experts.

According to paleontologist Sankar Chatterjee and retired aeronautical engineer R.J. Templin, a small early Chinese dinosaur called Microraptor gui used a two-level, biplane wing configuration to fly from tree to tree in the early Cretaceous.

Among the evidence for the early biplane is that Microraptor had unmistakable flight feathers on its hind limbs as well as on its wings, says Chatterjee, a distinguished professor at Texas Tech University in Lubbock. The Chinese paleontologists who first reconstructed Microraptor had guessed that its four wings were used in tandem, similar to those of dragonfly.

Chatterjee presented the new biplane flight findings Sunday, 16 October, at the Annual Meeting of the Geological Society of America in Salt Lake City.

"The most unusual thing is that they have flight feathers not only on the hand section, but also on foot," said Chatterjee. Flight feathers differ noticeably from other feathers in that they are asymmetrical with interlocking barbules to keep their shape. The leading edge of each long feather was narrower than the trailing edge, which helped streamline the body in flight. The hooked, interlocking barbs gave strength and

flexibility to the feather and prevented air from passing through it in flight.

Some present-day birds, especially raptors as well as the earliest Jurassic bird Archaeopteryx, also have (or had) feathers on their legs, Chatterjee says. But these are not flight feathers and appear adapted to streamline the legs during catching and carrying prey so they don't interfere with flight.

Another key element to discovering Microraptor's flight secrets was setting some realistic limitations on how the dinosaur could move its hindlimbs – something that was initially overlooked by Chinese researchers who found the fossil. Chatterjee and Templin studied its anatomy and found that like any dinosaurs, Microraptor held their hindlimbs in erect, vertical plane, permitting forward and backward motion.

"The problem we faced is that the legs of Microraptor, like on any dinosaur, could not be splayed sideways," as the Chinese paleontologists assumed. That means Microraptor could not have extended its rear limbs to form a wing directly behind the front wing. More likely, and more aerodynamically stable, would have been a rear wing that was held lower than the front wing – what from the side would look like a staggered biplane configuration, Chatterjee explains.

Chatterjee and Templin fed Microraptor's flight data into a computer simulation that they have previously used to successfully analyze the flying abilities of pterosaurs and Archaeopteryx. Based on the aeronautical analysis, it appears that Microraptor flights looked rather like those seen today among some "monoplane" forest birds -- something called undulating phugoid gliding, Chatterjee said. In other words, Microraptor launched from a high branch and dove off, falling head-first until it reached a speed that created lift on its wings. With that lift the

feathered dino then swooped upwards and landed in the branches of another tree without having to flap its wings and expend muscular energy.

"The biplane wing configuration was probably a very first experiment in nature," says Chatterjee of the early flying technique, which was also used by another feathered dinosaur from China, Pedopenna, he said. Archaeopteryx achieved fully powered flight with monoplane configuration, as its wing became even larger than those of Microraptor, but foot feathers were lost.

"It is intriguing to contemplate that perhaps avian flight, like aircraft evolution, went through a biplane stage before the monoplane was introduced, said Chatterjee. "It seems likely that Microraptor invented the biplane 125 million years before the Wright 1903 Flyer."

The discovery of Microraptor and other small, exquisitely preserved feathered dinosaurs from China also helps to settle a century-old controversy over whether avian flight began in trees (trees-down theory) or on the ground (ground-up theory). These fossils show various transitional stages–from wingless, tree-dwelling theropod dinosaurs to fully winged, active flyers, Chatterjee said.

The central theme of the trees-down theory is that gravity was the source of energy: a small climbing dinosaur first parachuted down, then began to stay aloft longer by gliding, and finally acquired powered flight. As those abilities developed, feathers became larger and more specialized, providing greater lift and thrust. The Chinese feathered dinosaurs show these transitional stages of flight.

In contrast, the ground-up theory has a theropod struggling toward flight directly from the ground, against gravity, without any gliding stage. Such long feathers around the feet would make it hard for Microraptor to run

on the ground, says Chatterjee, supporting the idea that it was a tree dweller, thus reinforcing the trees-down theory.