The color of dinosaur feathers identified

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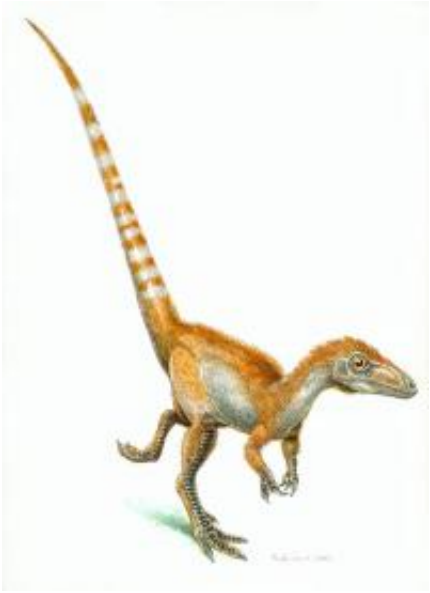

Reconstruction of a single Sinosauropteryx, sporting its orange and white striped tail. Original artwork copyright © Jim Robbins

(PhysOrg.com) -- The colour of some feathers on dinosaurs and early birds has been identified for the first time, reports a paper published in *Nature* this week.

The research found that the theropod dinosaur Sinosauropteryx had simple bristles - precursors of feathers - in alternate orange and white rings down its tail, and that the early bird Confuciusornis had patches of white, black and orange-brown colouring. Future work will allow precise mapping of colours and patterns across the whole bird.

Mike Benton, Professor of Palaeontology at the University of Bristol, said, "Our research provides extraordinary insights into the origin of feathers. In particular, it helps to resolve a long-standing debate about the original function of feathers - whether they were used for flight, insulation, or display. We now know that feathers came before wings, so feathers did not originate as flight structures.

"We therefore suggest that feathers first arose as agents for colour display and only later in their evolutionary history did they become useful for flight and insulation."

The team of palaeontologists from the University of Bristol, UK, the Institute of Vertebrate Paleontology and Paleoanthropology (IVPP) in Beijing, University College Dublin and the Open University report two kinds of melanosomes found in the feathers of numerous birds and dinosaurs from the world-famous Jehol beds of NE China.

The fossil of a small flesh-eating Chinese theropod dinosaur Sinosauropteryx, a complete specimen in the Nanjing Institute. Short, bristle-like feathers run along the midline of the head, neck, and back, and all round the tail, forming irregular stripes. Samples were taken from a 'dark' stripe near the base of the tail (marked with arrow). Only phaeomelanosomes were found in these feathers, indicating that the dark stripes were orange-brown in life. The pale stripes contain no melanosomes, so were probably white. Credits: Photo of Sinosauropteryx fossil copyright © the Nanjing Institute. Photo of phaeomelanosomes image copyright © University of Bristol.

Melanosomes are colour-bearing organelles buried within the structure of feathers and hair in modern birds and mammals, giving black, grey, and rufous tones such as orange and brown. Because melanosomes are an integral part of the tough protein structure of the feather, they survive when a feather survives, even for hundreds of millions of years.

This is the first report of melanosomes found in the feathers of dinosaurs and early birds. It is also the first report of phaeomelanosomes in fossil feathers, the organelles that provide rufous and brown colours.

These discoveries confirm the substantial body of evidence that suggests birds evolved through a long line of theropod (flesh-eating) dinosaurs. It also demonstrates that the unique assemblage of characters that make a modern bird - feathers, wings, lightweight skeleton, enhanced metabolic system, enlarged brain and visual systems - evolved step-by-step over some 50 million years of dinosaur evolution, through the Jurassic and Cretaceous periods.

"These discoveries open up a whole new area of research", said Benton, "allowing us to explore aspects of the life and behaviour of dinosaurs and early birds that lived over 100 million years ago.

"Furthermore, we now know that the simplest feathers in dinosaurs such as Sinosauropteryx were only present over limited parts of its body - for example, as a crest down the midline of the back and round the tail - and so they would have had only a limited function in thermoregulation.

"Feathers are key to the success of birds and we can now dissect their evolutionary history in detail and see how each feather type - and the fine detail of feather structure - was acquired through time. This will link with current work on how the genome controls feather development."

More information: Fucheng Zhang, Stuart L. Kearns, Patrick J. Orr, Michael J. Benton, Zhonghe Zhou, Diane Johnson, Xing Xu, and Xiaolin Wang. Fossilized melanosomes and the colour of Cretaceous dinosaurs and birds. *Nature* advanced online publication, 27 January 2010.

Provided by University of Bristol