

Is it a bird? Is it a dinosaur?

Remarkable fossil finds in China seemed to have settled a long-running argument once and for all – birds really do represent the last living dinosaurs. Not so fast, says **Alan Feduccia**, maybe science is better served by going back to a 20th-century axiom – if it's got feathers and avian flight wings, it's a bird!

IN 1996, the world of palaeontology was stunned by a photograph of a Chinese fossil which was unveiled at the annual meeting of the Society of Vertebrate Paleontology in New York. It showed a small dinosaur, *Sinosauropteryx* (“Chinese dragon feather”), sporting a mane of thick filaments running from neck to tail tip. With no microscopy or scientific substantiation, the fibres were proclaimed to be protofeathers. Shortly after, the sensational specimen appeared on the front page of *The New York Times*, depicted by a pen-and-ink sketch. “Many of the experts who looked at the photographs pronounced them to be important new support for the theory that birds descended from dinosaurs,” the newspaper reported.

This discovery appeared to be the culmination of a revolution in vertebrate palaeontology which had started in the late 1960s when John Ostrom of Yale University discovered the bird-like dinosaur *Deinonychus* and revived the hypothesis that birds evolved from dinosaurs and that flight originated from the ground up, rather than from the trees down.

When Ostrom viewed the new “feathered dinosaur” in China he recalls that he “literally got weak in the knees”. But alas, even though the first scientific description of *Sinosauropteryx* appeared in 1998 in *Nature*, no evidence then or now has emerged showing that these structures are anything other than collagen fibres supporting a typical reptilian frill. The fact that the filaments are

located within a clearly demarcated body outline – indicating the fibres were not external, as they would be if they were feather-like structures – was completely ignored.

Additional fibres of varying forms and lengths classified as various stages of protofeathers have subsequently been described in myriad dinosaurs, including in a recent *Nature* paper on tyrannosaurids. Other fibres have been described in herbivorous ornithischians and pterosaurs, which have no connection with birds, but there is still little evidence to connect any of these structures with feathers.

If these descriptions were right, then feathers would be widespread among both dinosaurs and the larger group of archosaurs (terrestrial archosaurs were the dominant land vertebrates before dinosaurs).

Since 1996, many so-called “feathered dinosaurs” have been discovered in China. In 1998, *Nature* triumphantly announced “the debate is over” following a cover article describing two 125-million-year-old putative dinosaurs, *Protarchaeopteryx* and *Caudipteryx*, with true avian feathers (vol 393, p 753).

Birds as “living dinosaurs” is now a cornerstone of modern palaeontological thought. But a consensus is always in danger of turning into dogma. Indeed, given the cult-like belief in the field’s orthodoxy, it seems that every fossil pulled from the Chinese deposits is accompanied by hyperbolic pronouncements of it having filled a major evolutionary gap. Yet many of these discoveries lack normal scientific stringency, and we see a transition from normal scientific falsificationism to simply confirming what is already thought to be known.

The certainty applied to these magnificent fossils has produced some, to my mind, fantastical proposals: dinosaurs with

protofeathers, dinosaurs with bird wings and modern feathers, four-winged gliding dinosaurs, and tiny supposed theropods from the Jurassic period with avian wings.

In my opinion – admittedly a minority one, though growing in popularity – these proposals are all wrong. *Sinosauropteryx* is a standard dinosaur with no feathers, and specimens with true feathers are not dinosaurs but early birds. The tiny tree-dwellers are primitive birds, and the four-winged dinosaurs, including the famous *Microraptor*, are descended from birds, not ancestral to them.

“Science will accept the view of the dodo as a degenerate dove”

Looking back to the 19th century, one gets a distinct sense of déjà vu. In 1868, Thomas Huxley, enamoured of anatomical similarities between ground-dwelling birds and dinosaurs, proposed the “dinosaurian origin” hypothesis. This, incorrectly, viewed modern birds as evolving from flightless ratites – ostriches and the like – that evolved from dinosaurs but never went through a flight stage.

It was Huxley’s nemesis, Richard Owen, who in 1875 set the record straight on flightless birds: they were, he said, products of arrested development, or technically heterochrony – evolutionary change due to changes in the rate and timing of development. Owen predicted that “science will accept the view of the Dodo as a degenerate Dove rather than as an advanced Dinothere,” thus stating the crux of the current controversy.

Owen’s argument was later advanced by Gavin Rylands de Beer, who was a product of the remarkable zoology group formed between the first and second world wars at

PROFILE

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This fossil of a juvenile *Sinosauropteryx*, found in China, is claimed to show primitive plumage

the University of Oxford. De Beer was a successor of Owen as director of what is now the Natural History Museum in London and his work still influences how we think about the genome and evolutionary developmental biology. Less known is the mark he left on the field of bird evolution. De Beer made important contributions to the study of *Archaeopteryx*, and in 1956 showed conclusively that flightless birds descended from flying ancestors and have never re-evolved flight.

Impossible flight

History seems to repeat itself. The “feathered dinosaurs” adorning the cover of *Nature* in 1998 are not dinosaurs but flightless birds – think of them as Mesozoic kiwis. I believe that they will eventually be accepted into the Owen-de Beer model, as being derived from flying birds. No flightless bird ever gave rise to a flying one; the same is surely true in the dinosaur fossil record. But the current orthodoxy argues that birds are derived from theropods, that protofeathers provided insulation for their hot-blooded metabolism (for which no evidence exists) and that flight originated from the ground up, which is biophysically improbable.

Most disturbingly, current orthodoxy dictates that the entire suite of sophisticated avian flight architecture, including aerodynamic wings and specialised brain structures, evolved in earthbound dinosaurs in a non-flight context, a proposal that is practically non-Darwinian.

The model presented in my new book, *Riddle of the Feathered Dragons*, takes us back to the orthodoxy of most of the 20th century, when birds were seen as cousins rather than direct descendants of dinosaurs, having shared a common ancestor. In this view, birds are descended not from dinosaurs but from small tree-living archosaurs that developed feathers for flying, not insulation. Flight originated from the trees down, with small size and gravity providing the impetus, as is the case for all animals that developed flight.

My central idea, that Chinese fossils bearing modern feathers are early birds, seems new and revolutionary yet it is new only as a fresh application of de Beerian thinking to a new set of problematic fossils. Paraphrased, de Beer’s axiom still holds: if it has feathers and avian flight wings, it’s a bird! n

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