

Early bird

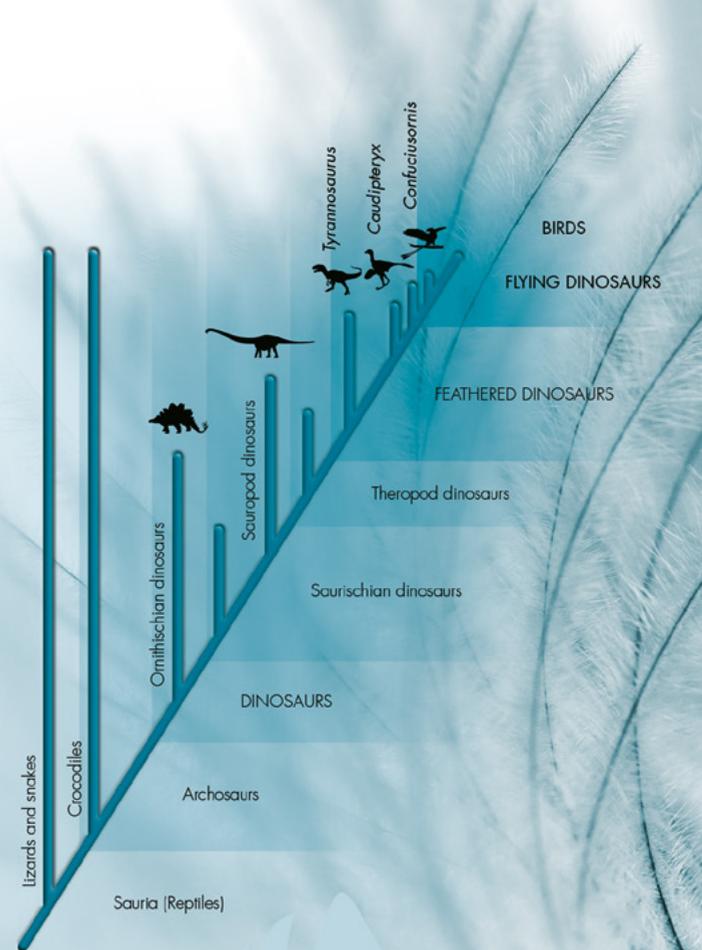
Confuciusornis was one of the first true birds. It lived about 125 million years ago, alongside feathered dinosaurs like *Caudipteryx*, in what is now China. Feathers covered its body, as in modern birds, including contour feathers and flight feathers on its forelimbs, and it had a long tail – probably, as in modern birds, for display.



Dinosaur phylogeny

This family tree (cladogram) shows how the theropods are related to other dinosaurs.

Birds are just one special group of theropods.



Key facts about 'Jane', *Tyrannosaurus rex*

- The fossil was found at Hell Creek in the arid badlands of Montana, in rocks of the Cretaceous Period that are about 66 million years old.
- At that time the local environment was a lush, warm-temperate floodplain.
- 'Jane' is a sub-adult: standing some 2.3 metres tall at the hip and 6.4 metres long, the dinosaur is about half the height and length of a full-grown *T. rex*.
- It is estimated that at the time of death 'Jane' was about 11 years old and weighed nearly 700 kilograms (an adult *T. rex* weighed 5000 kilograms).
- Its big feet and long powerful legs indicate that this type of dinosaur was built for speed and could possibly run as fast as 20-30 miles per hour.
- Typical for a tyrannosaurid dinosaur, it has tiny forelimbs; the humerus bone is only about 28 centimetres long.
- The lower jaw has many finely curved, razor-sharp teeth that were capable of tearing into flesh; it was a meat-eater.

School of Geography,
Geology and the Environment
University of Leicester
University Road
Leicester, LE1 7RH, UK
t: +44 (0)116 252 3933
e: geology@le.ac.uk
w: www.le.ac.uk/geology

 /GeologyLeics
 @GeologyLeics

17-09-14-GL

Flying dinosaurs ...and the origin of birds



Are birds really dinosaurs?

The direct kinship of birds with dinosaurs, once considered unlikely, is supported by overwhelming evidence from fossils.

It is now known that some theropod dinosaurs had feathers – previously thought to be unique to birds – millions of years before birds began to fly.

Big adult theropods, like *Tyrannosaurus*, probably did not have feathers. But some small theropods certainly did.

Fossils clearly show how feathers appeared, then evolved, on the theropod dinosaurs known as coelurosaurs.

There was a series of animals, now extinct, and feather types linking dinosaurs to true birds.

Believe it or not, many theropod dinosaur species are known to have sported feathers.

Dinosaurs with feathers

The appearance and evolution of feathers occurred in one group of dinosaurs, the theropods.

Theropod dinosaurs included the well-known giant meat eaters like *Tyrannosaurus* and *Allosaurus*, which had 'bird-like' hips, a reduced number of fingers on the hand, and a 'wishbone'.

Some smaller theropods also had feathers. These were rather simple – too flimsy for flight – more like the downy or display feathers of modern birds.

Dinosaur eggs

Like birds, all dinosaurs laid eggs. Most did so in nests, and some even looked after the hatchlings.

This clutch was laid by a giant sauropod, a type of dinosaur not closely related to theropods, or to birds.

If you look closely, you can see the porous texture of the eggshell.



Tyrannosaurus

Tyrannosaurus rex was one of the biggest carnivorous dinosaurs of all time. It was also a relative of smaller, feathered animals like *Caudipteryx*.



This specimen, found in 2001, has been nicknamed 'Jane', although it's not really possible to distinguish male and female dinosaurs from their fossilised skeletons.

'Jane' was a subadult, only half as big as a full-grown *Tyrannosaurus*.

The first birds

Fossils from China and elsewhere show that there is a well-defined evolutionary transition from small, feathered theropods to true birds.

Some small theropods that lived at the same time as *Caudipteryx* were anatomically almost indistinguishable from true birds. They had hollow bones, a wishbone, a beak without teeth and modern feathers.

A flight feather from an early true bird is exactly like a wing feather of a modern bird.

Feathered birds

Caudipteryx, a small theropod dinosaur that lived about 125 million years ago, had simple feathers. It could not fly, but used its feathers for other purposes, possibly insulation or display.

A *Caudipteryx* feather had a central rachis and side barbs, but no barbules for 'zipping up' the feather to form the closed vane needed for flight.

