

How the shape of eggs can help explain the evolutionary history of birds

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Theropod Troodon clutch. Credit: Charles Deeming

The eggs of amniotes - mammals, reptiles and birds – come in a remarkable variety of shapes and sizes.

Evolutionary biologists have now addressed shape variety in [terrestrial vertebrates' eggs](#), pinpointing morphological differences between the eggs of birds and those of their extinct relatives, the theropod dinosaurs.

Researchers from the University of Lincoln, UK, examined eggshell geometry from the transition of theropods - a sub-order of the Saurischian dinosaurs - into birds, based on fossil records and studies of their living species.

The results suggest that the early birds from the Mesozoic (252 to 66 million years' ago) laid eggs that had different shapes to those of [modern birds](#). This may suggest that egg physiology and embryonic development was different in the earliest birds and so this may have implications for how some birds survived the Cretaceous-Palaeocene extinction event that wiped out the dinosaurs.

Their findings are published in the journal *Royal*

Society Open Science.

Author Dr Charles Deeming, from Lincoln's School of Life Sciences, explained: "These results indicate that egg shape can be used to distinguish between different types of egg-laying vertebrates. More importantly they suggest Mesozoic bird eggs differ significantly from modern day bird eggs, but more recently extinct Cenozoic birds do not. This suggests that the range of egg shapes in modern birds had already been attained in the Cenozoic."

The origin of the amniotic egg (an egg which can survive out of water) is one of the key adaptations underpinning vertebrates' transition from sea to land more than 300 million years ago. Modern amniotic eggs vary considerably in shape and size and it is believed this variety may reflect the different patterns of egg formation and development in these taxa.

Dr Deeming added: "From a biological perspective, it is self-evident that different egg shapes by [birds](#), both past and present, might be associated with different nesting behaviours or incubation methods. However, hardly any research has been carried out on this topic and fossil data are insufficient to draw firm conclusions. We hope that future discoveries of associated fossil eggs and skeletons will help refine the general conclusions of this work."

Dr Deeming and co-author Dr Marcello Ruta, also from the University of Lincoln, are now investigating how the highly variable amounts of yolk and albumen (egg white) in eggs of different species could be a possible determinant of bird egg shape.

More information: D. Charles Deeming and Marcello Ruta 'Egg shape changes at the theropod-bird transition, and a morphometric study of amniote eggs' *Royal Society Open Science* DOI: [10.1098/rsos.140311](https://doi.org/10.1098/rsos.140311)

Provided by University of Lincoln

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