

# Jurassic saw fastest mammal evolution

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An illustration showing docodonts, now extinct mammals that saw an explosion

of skeletal and dental changes (including the special molar teeth that give them their name), in the Middle Jurassic. Credit: April Neander

Mammals were evolving up to ten times faster in the middle of the Jurassic than they were at the end of the period, coinciding with an explosion of new adaptations, new research shows.

Early [mammals](#) lived alongside the dinosaurs during the Mesozoic era (252-66 million years ago). They were once thought to be exclusively small nocturnal insect-eaters, but fossil discoveries of the past decade - particularly from China and South America - have shown that they developed diverse adaptations for feeding and locomotion, including gliding, digging, and swimming.

To find out when and how rapidly these new body shapes emerged a team led by Oxford University researchers did the first large-scale analysis of skeletal and dental changes in Mesozoic mammals. By calculating evolutionary rates across the entire Mesozoic, they show that mammals underwent a rapid 'burst' of evolutionary change that reached its peak around the middle of the Jurassic (200-145 million years ago).

The team comprised researchers from Oxford University in the UK and Macquarie University in Australia. A report of the research is published in *Current Biology*.

'What our study suggests is that mammal 'experimentation' with different body-plans and tooth types peaked in the mid-Jurassic,' said Dr Roger Close of Oxford University's Department of Earth Sciences, lead author of the report. 'This period of radical change produced characteristic body shapes that remained recognisable for tens of millions of years.'

The team recorded the number of significant changes to body plans or teeth that occurred in mammal lineages every million years. During the mid-Jurassic the frequency of such changes increased to up to 8 changes per million years per lineage, almost ten times that seen at the end of the period. This is exemplified by therian mammals, the lineage leading to [placental mammals](#) and marsupials, which were evolving 13 times faster than average in the mid-Jurassic, but which had slowed to a rate much lower than average by the later Jurassic. This 'slow-down' occurred despite the increase in the number of mammal species seen in this later period.

'We don't know what instigated this evolutionary burst. It could be due to environmental change, or perhaps mammals had acquired a 'critical mass' of 'key innovations' - such as live birth, hot bloodedness, and fur - that enabled them to thrive in different habitats and diversify ecologically,' said Dr Close. 'Once high ecological diversity had evolved, the pace of innovation slowed.'

Multituberculates, for instance, saw radical changes to their skeletons and teeth during the mid-Jurassic. However, by the end of the period they had evolved their rodent-like body shape and distinctive teeth, a form that, despite diversifying into hundreds of different species, they would generally retain until they went extinct around 130 million years later.

'This is characteristic of other 'adaptive radiation' events of this kind, such as the famous 'Cambrian explosion',' said Dr Close. 'In the Jurassic we see a profusion of weird and wonderful bodies suddenly appear and these are then 'winnowed down' so that only the most successful survive. What we may have identified in this study is mammals' own 'Cambrian explosion' moment, when evolutionary experimentation ran wild and the future shape of mammals was up for grabs.'

**More information:** A report of the research, entitled 'Evidence for a mid-Jurassic adaptive radiation in mammals', is published in *Current Biology* on 16 July 2015.

Provided by Oxford University

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