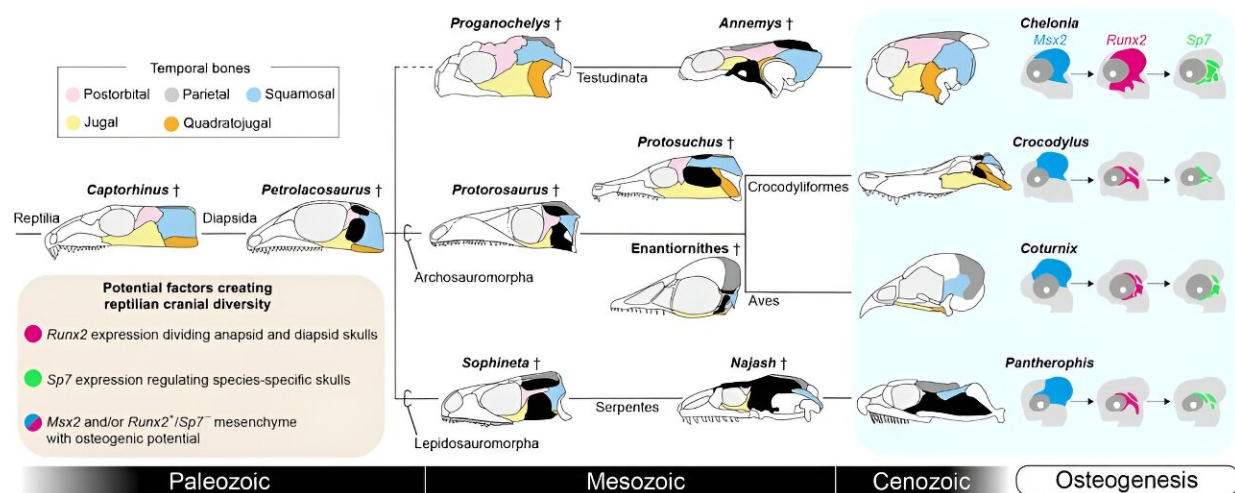


# Researchers identify molecular basis for morphological diversity of amniote skull

December 12 2023



Simplified phylogeny of the clade Reptilia including fossil (†) and living species. Living species are highlighted by a light blue background. The five temporal dermal bones are shown in distinct colors. Expression domains of Msx2 (blue), Runx2 (magenta), and Sp7 (green) are shown on the embryonic head illustrations of each extant species. Credit: Dr. Masayoshi Tokita

A research group led by Associate Professor Masayoshi Tokita explored the molecular basis generating the diversity of amniote skull morphology, using embryos of several amniote species as materials.

Their study suggests that the diversity of amniote skull morphology may be brought about by spatiotemporal differences in the expression of

three osteogenic genes, *Msx2*, *Runx2*, and *Sp7*.

The finding provides a basis for understanding how skull morphology has diversified in amniotes, the first vertebrate lineage to fully move to land, including humans. Furthermore, the findings may provide hints for the development of treatments for congenital diseases that cause abnormalities in human skull morphology. The findings of this research are [reported](#) in *Science Advances*.

Amniote skulls have an opening(s) surrounded by bones behind the orbit (temporal [region](#)), called the temporal fenestration(s). Amniote skulls are categorized into three conditions: anapsid, synapsid, and diapsid, depending on the number of temporal arches that border the ventral side of the temporal fenestrations.

In this study, the expression patterns of the osteogenic genes *Msx2*, *Runx2*, and *Sp7* were examined during embryonic skull formation of six reptilian species (three turtle species, two snake species, and one crocodile species), two [avian species](#), and two [mammalian species](#). In the temporal region of reptilian and avian embryos, *Msx2* was widely expressed.

The expression domain of *Runx2* was widespread in the temporal region of turtle embryos, whereas in non-turtle reptiles and birds, it was restricted to the region excluding the domain where the temporal fenestrations later appeared

In the temporal region of reptilian and avian embryos, *Sp7* was regionally expressed in the area where the bones are later formed. Its expression pattern varied among species. In the temporal region of mammalian embryos, *Msx2*, *Runx2*, and *Sp7* were regionally expressed in the domain where the bones were formed.

This study suggests that the diversity of amniote [skull morphology](#) may be brought about by spatiotemporal differences in the expression patterns of Msx2, Runx2, and Sp7.

**More information:** Hiromu Sato et al, Turtle skull development unveils a molecular basis for amniote cranial diversity, *Science Advances* (2023). [DOI: 10.1126/sciadv.adi6765](https://doi.org/10.1126/sciadv.adi6765)

Provided by Toho University

Citation: Researchers identify molecular basis for morphological diversity of amniote skull (2023, December 12) retrieved 28 April 2024 from <https://phys.org/news/2023-12-molecular-basis-morphological-diversity-amniote.html>

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