

# Evolution of dinosaur body size through different developmental mechanisms

February 23 2023

---



Broken shin bone of a carnivorous dinosaur, showing rings like the rings of a tree. These closely spaced rings were formed annually and indicate a slow-growing, long-lived animal. Credit: Michael D. D'Emic

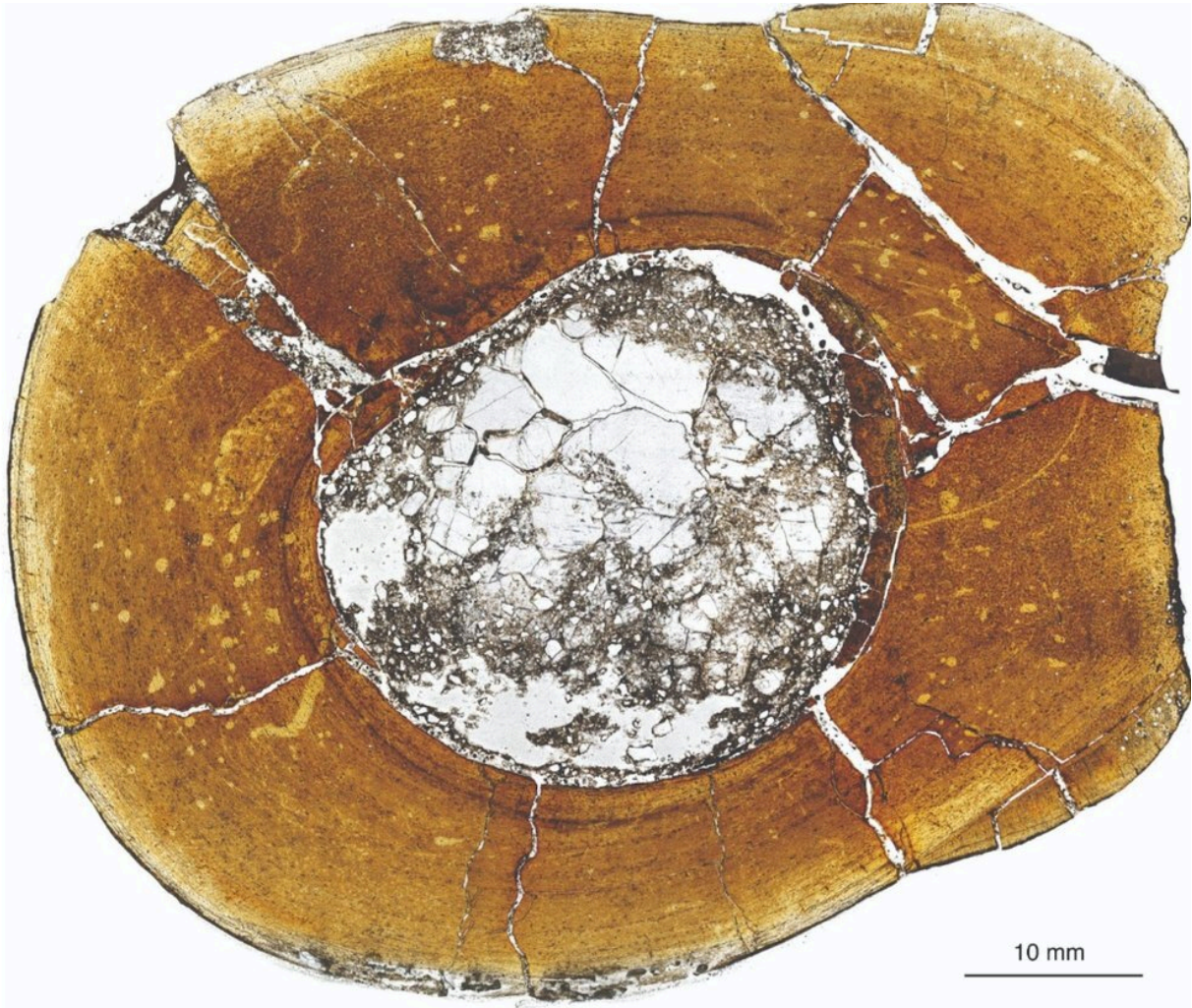
The meat-eating dinosaurs known as theropods that roamed the ancient Earth ranged in size from the bus-sized *T. rex* to the smaller, dog-sized

*Velociraptor*. Scientists puzzling over how such wildly different dinosaur sizes evolved recently found—to their surprise— that smaller and larger theropod dinosaurs like these didn't necessarily get that way merely by growing slower or faster.

In a new paper published in *Science*, "Developmental strategies underlying gigantism and miniaturization in non-avian theropod dinosaurs," researchers including Ohio University professor Patrick O'Connor and Ph.D. student Riley Sombathy discovered through examining the bones of dinosaurs that there was no relationship between growth rate and body size.

"Most animals are thought to evolve to be larger by growing faster than their ancestors, but this study shows that it's just as likely that bigger and smaller animals grew for longer or shorter periods of time during growth spurts," said Michael D. D'Emic, a paleontologist at Adelphi University and lead author of the study.

The bones of many animals, including dinosaurs, slowed or paused growth every year, leaving marks like [tree rings](#) that indicate the animal's age and can be used to estimate the rate of growth. "Rings like these are called cortical growth marks," said D'Emic. "Widely spaced rings indicate faster growth and narrowly spaced rings tell us that an animal was growing more slowly."



Microscopic view of a carnivorous dinosaur's shin bone, showing growth rings that get more closely spaced towards the outside of the bone, indicating that this individual reached adulthood. Credit: Michael D. D'Emic

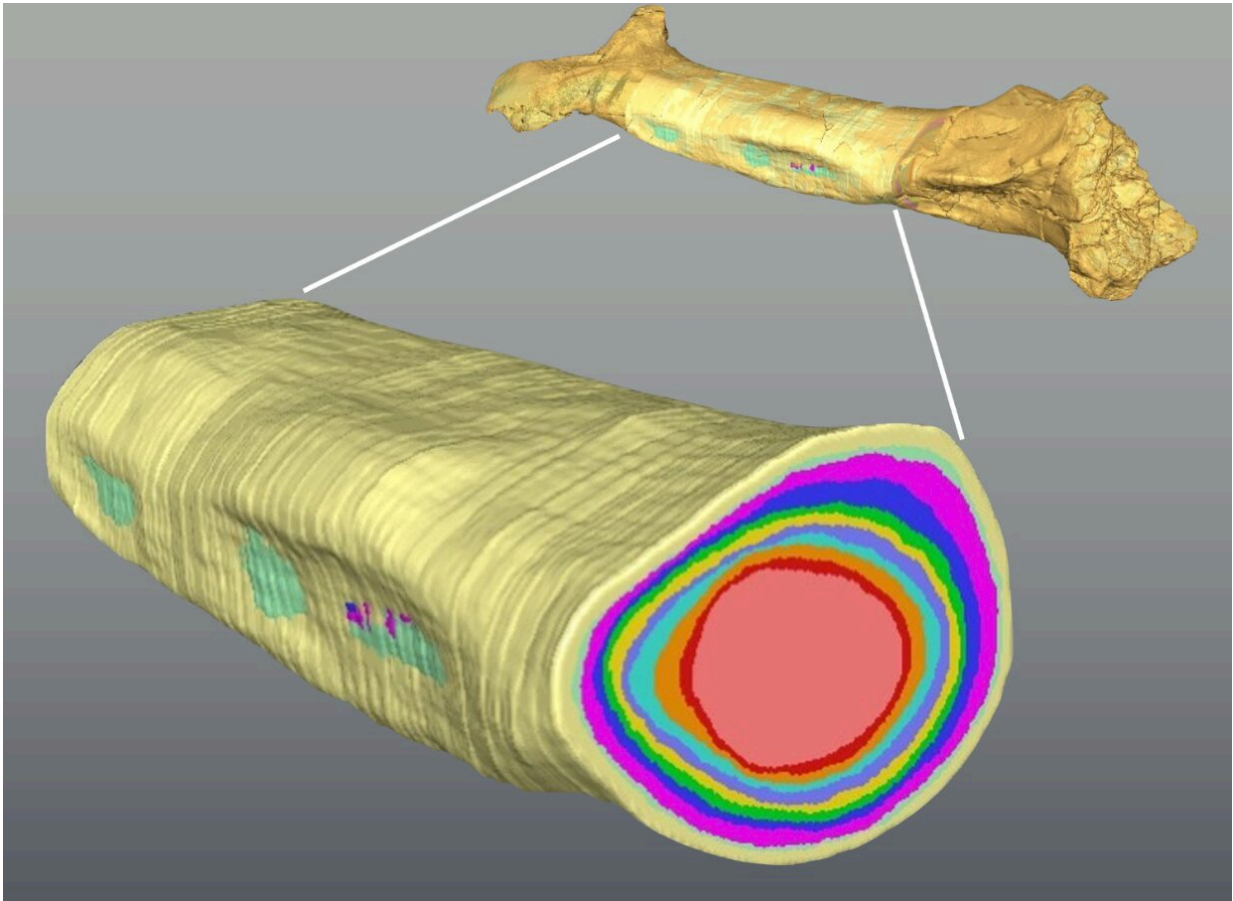
D'Emic, O'Connor, Sombathy and a team of international researchers measured about 500 such growth rings in about 80 different theropod bones, the two-legged, mostly meat-eating species of dinosaurs closely related to birds.

"We found that there was no relationship between growth rate and size,"



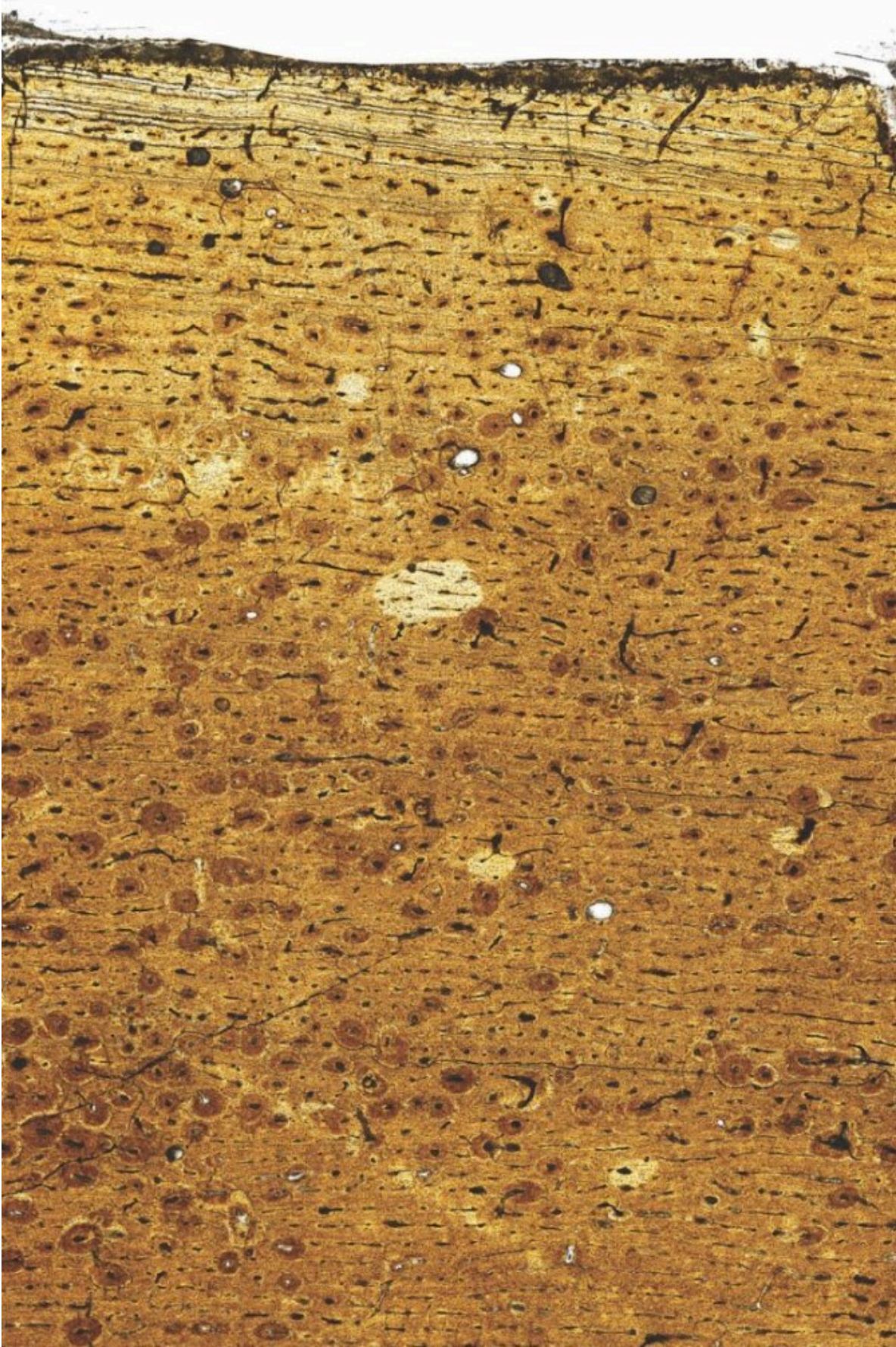
said D'Emic. "Some gigantic dinosaurs grew very slowly, slower than alligators do today. And some smaller dinosaurs grew very fast, as fast as mammals that are alive today." This made sense to co-author Thomas Pascucci, whose graduate thesis contributed to the project: "Extinct animals like dinosaurs inspire awe because of how different they seem from our [modern world](#), but they were animals that grew under similar constraints and [environmental factors](#) as those that exist today."

According to O'Connor, this study opens the door to future investigations of how animals regulate their growth. "Alteration of different growth control mechanisms, at molecular or genetic levels, likely accounts for the range of developmental strategies our team observed in theropod dinosaurs. Future studies of living organisms provide an opportunity to elucidate mechanisms related to the evolution of body size in vertebrates more generally."



3D model generated from a CT scan of a carnivorous dinosaur's shin bone, showing the annually formed growth rings. Credit: Michael D. D'Emic



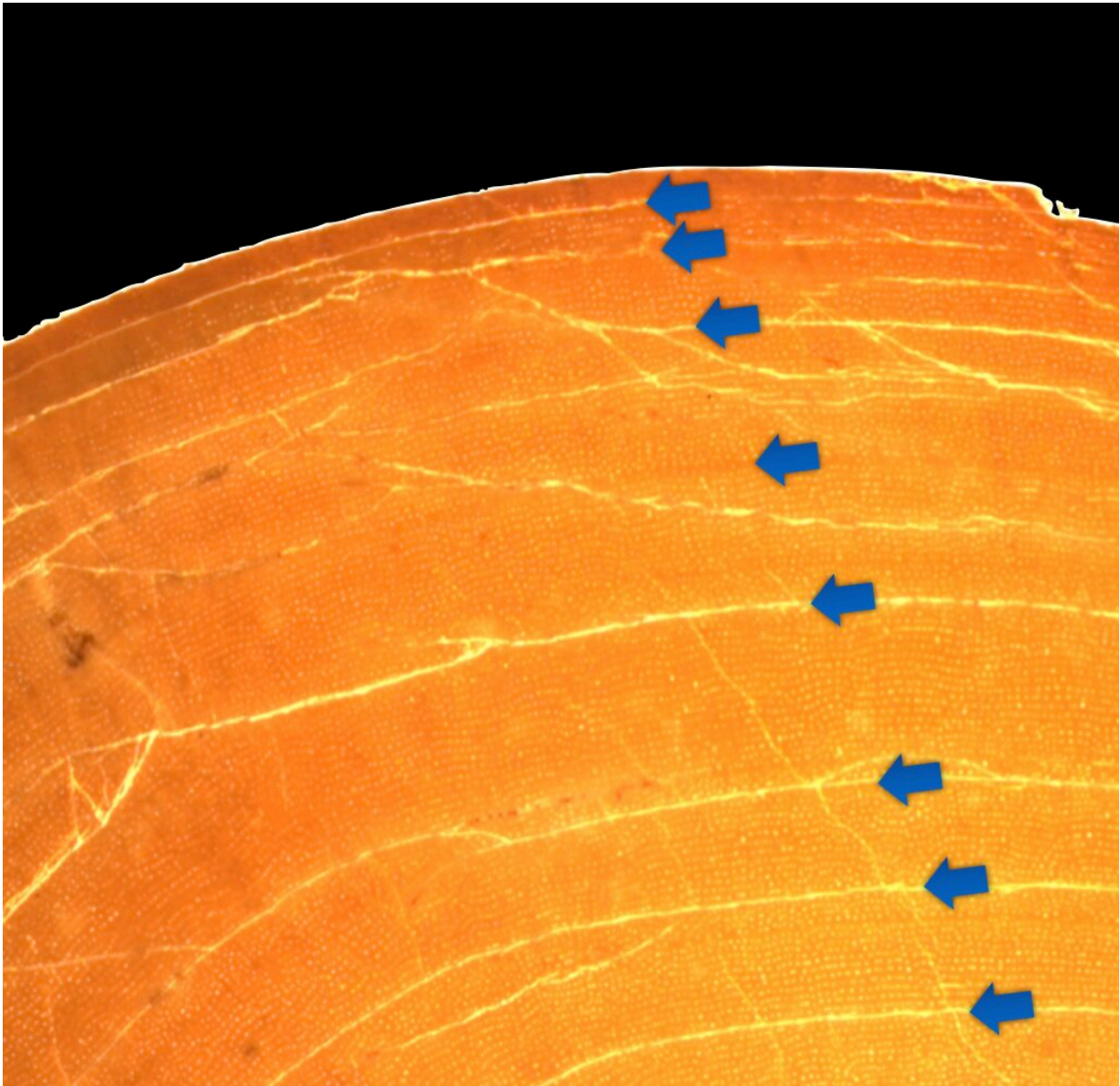


Zoomed-in microscopic view of a carnivorous dinosaur's shin bone, showing growth rings that get more closely spaced towards the outside of the bone, indicating that this individual reached adulthood. Credit: Michael D. D'Emic

Sombathy hopes to take up some of those investigations, adding "One of the things that interests me most about the results is the apparent decoupling between growth rate and body size. My Ph.D. dissertation will investigate the impacts of [growth rate](#) and [body size](#) on bone shape and function."

"This has really important implications because changes in rate versus timing can correlate to many other things, like how many or how large your offspring are, how long you live, or how susceptible to predators you are," D'Emic added. "Hopefully this research spurs investigations into other groups, both alive and extinct, to see what developmental mechanisms are most important in other types of animals."





Zoomed-in microscopic view of a carnivorous dinosaur's shin bone, showing growth rings that get more closely spaced towards the outside of the bone, indicating that this individual reached adulthood. Credit: Michael D. D'Emic

**More information:** Michael D. D'Emic, Developmental strategies underlying gigantism and miniaturization in non-avian theropod



dinosaurs, *Science* (2023). DOI: [10.1126/science.adc8714](https://doi.org/10.1126/science.adc8714).  
[www.science.org/doi/10.1126/science.adc8714](https://www.science.org/doi/10.1126/science.adc8714)

Provided by Ohio University

Citation: Evolution of dinosaur body size through different developmental mechanisms (2023, February 23) retrieved 11 May 2024 from <https://phys.org/news/2023-02-evolution-dinosaur-body-size-developmental.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.