Were dinosaurs destined to be big? Testing Cope's rule

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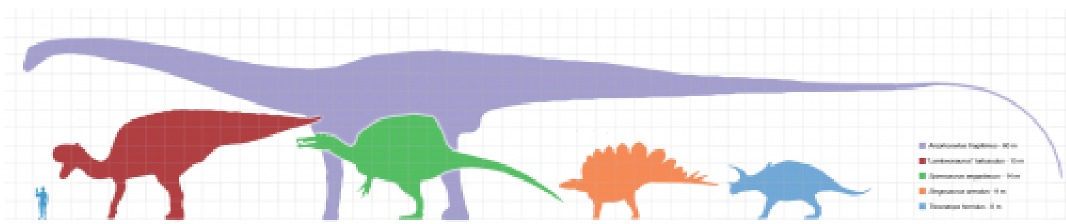

A stylized scale of relative dinosaur sizes. Image by Matt Martyniuk, from Wikimedia Commons.

In the evolutionary long run, small critters tend to evolve into bigger beasts—at least according to the idea attributed to paleontologist Edward Cope, now known as Cope's Rule. Using the latest advanced statistical modeling methods, a new test of this rule as it applies dinosaurs shows that Cope was right—sometimes.

"For a long time, dinosaurs were thought to be the example of Cope's Rule," says Gene Hunt, curator in the Department of Paleobiology at the National Museum of Natural History (NMNH) in Washington, D.C. Other groups, particularly mammals, also provide plenty of classic examples of the rule, Hunt says.

To see if Cope's rule really applies to dinosaurs, Hunt and colleagues Richard FitzJohn of the University of British Columbia and Matthew Carrano of the NMNH used dinosaur thigh bones (aka femurs) as proxies for animal size. They then used that femur data in their statistical model to look for two things: directional trends in size over time and whether there were any detectable upper limits for body size.

"What we did then was explore how constant a rule is this Cope's Rule trend within dinosaurs," said Hunt. They looked across the "family tree" of dinosaurs and found that some groups, or clades, of dinosaurs do indeed trend larger over time, following Cope's Rule. Ceratopsids and hadrosaurs, for instance, show more increases in size than decreases over time, according to Hunt. Although birds evolved from theropod dinosaurs, the team excluded them from the study because of the evolutionary pressure birds faced to lighten up and get smaller so they could fly better.

As for the upper limits to size, the results were sometimes yes, sometimes no. The four-legged sauropods (i.e., long-necked, small-headed herbivores) and ornithopod (i.e., iguanodons, ceratopsids) clades showed no indication of upper limits to how large they could evolve. And indeed, these groups contain the largest land animals that ever lived.

Theropods, which include the famous Tyrannosaurus rex, on the other hand, did show what appears to be an upper limit on body size. This may not be particularly surprising, says Hunt, because theropods were bipedal, and there are physical limits to how massive you can get while still being able to move around on two legs.

Hunt, FitzJohn, and Carrano will be presenting the results of their study on the afternoon of Sunday, Nov. 4, at the annual meeting of The Geological Society of America in Charlotte, North Carolina, USA.

As for why Cope's Rule works at all, that is not very well understood, says Hunt. "It does happen sometimes, but not always," he added. The traditional idea that somehow "bigger is better" because a bigger animal is less likely to be preyed upon is naïve, Hunt says. After all, even the biggest animals start out small enough to be preyed upon and spend a long, vulnerable, time getting gigantic.

More information: Testing Cope's Rule and the Existence of an Upper Bound for Body Size in Non-Avian Dinosaurs, gsa.confex.com/gsa/2012AM/webp … ram/Paper211594.html

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