

## PALEONTOLOGY

# Pint-Sized Predator Rattles The Dinosaur Family Tree

The demise of *Tyrannosaurus rex* and most other dinosaurs some 65 million years ago may grab all the headlines. But paleontologists are equally concerned with puzzling out how these mighty beasts got their start. Who were their ancestors? Did they burst onto the scene, sweeping their older reptilian rivals before them, or take a quieter, more gradual route to world domination?

On page 206, a team working in Argentina reports the discovery of a very early dinosaur—possibly a distant ancestor of *T. rex*—that lived about 230 million years ago, during what paleontologists call the dawn of the dinosaurs. The researchers say the new finds—two specimens that together make up a nearly complete skeleton of a diminutive, 1-meter-long dinosaur—and neighboring fossils show that dinosaurs didn't outcompete other reptiles, but rather gradually replaced them as their predecessors died out for other reasons. More controversially, the team says the fossils show that one of the most well-known early dinosaurs, *Eoraptor*, long considered an ancestor of meat eaters like *T. rex*, was actually an ancestor of gigantic plant-eating dinosaurs like *Apatosaurus*.

"The new specimens are remarkable," says Sterling Nesbitt, a paleontologist at the University of Washington, Seattle. Michael Benton, a paleobiologist at the University of Bristol in the United Kingdom, adds that the fossils—which the discovery team has assigned to a new species called *Eodromaeus murphi*—are "complete enough to add substantially to our knowledge" of early dinosaur evolution.

Tracing the origins of the earliest dinosaurs has been a major challenge for paleontologists because there are no uncontested fossils from their earliest days on Earth. By the time *Eoraptor* and other undisputed early dinosaurs came on the scene about 230 million years ago, most researchers have concluded, dinosaurs had already evolved into three major lineages: ornithischians, which later gave rise to armored beasts like *Stegosaurus* and *Ankylosaurus*; sauropodomorphs, the lineage that led to giant plant eaters like *Apatosaurus* and *Brachiosaurus*; and the meat-eating theropods, such as *T. rex* and *Allosaurus*.

The team that found *Eodromaeus* was led by the same two paleontologists who discovered and described *Eoraptor* in the early

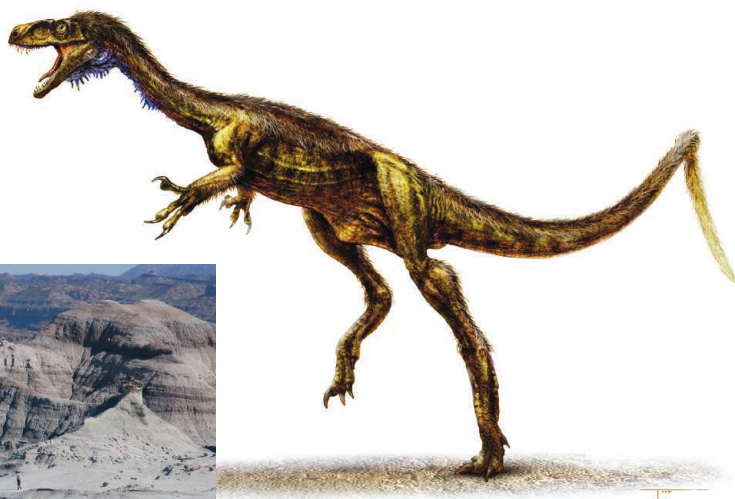


**Small daddy?** Meter-long *Eodromaeus*, found in northwestern Argentina (top), sported serrated teeth and other similarities to later theropods (bottom).

1990s: Paul Sereno of the University of Chicago in Illinois, and Ricardo Martinez of the National University of San Juan in Argentina. In 1996, a volunteer from Japan working with Martinez in the Ischigualasto Valley of northwestern Argentina, also known as the Valley of the Moon, unearthed a small vertebra on the side of a hill. When Sereno arrived a couple of months later to help excavate the fossils, he and Martinez at first identified them as *Eoraptor*.

Frustratingly, many of the fossils were embedded in a huge block of rock. "It was an extraordinarily difficult specimen to clean" and prepare for analysis, Sereno says. But once enough of the bones were visible, it became clear "that this was no *Eoraptor*."

Instead, the team concluded, the find was a new species of early theropod. Evidence included its very long, serrated teeth; long finger bones that aided in grasping prey; and pockets in its neck vertebrae for air sacs, which some researchers think helped drive air into the lungs as in today's birds, the descendants of theropod dinosaurs. "I have no doubt that this is a new taxon, a very important one from a critical time ... near the beginning of the age of dinosaurs," says Mark Norell, a paleontologist at the American Museum of Natural History in New York City. And Nesbitt says



"the authors make a pretty good case that *Eodromaeus* is a theropod."

Sereno and Martinez themselves previously identified *Eoraptor* as the earliest known theropod. But after studying their original specimens more closely and comparing them with *Eodromaeus* and other dinosaurs, they now argue that *Eoraptor* was in fact an early plant-eating sauropodomorph. "No one, even ourselves, predicted this repositioning," Sereno says.

Other researchers are cautious. "Only further research by independent teams can evaluate" this radical shakeup of the early dinosaur tree, says Max Langer, a paleontologist at the University of São Paulo in Brazil. And Langer adds that the uncertainty about where to place *Eoraptor* "emphasizes how similar [early] theropods and sauropodomorphs" were to each other, which, he says, "is expected anyway in the early radiation" of an animal group.

Dinosaur experts are happier with a broader conclusion in the *Science* paper. By 230 million years ago, the authors write, all three dinosaur lineages—ornithischians, theropods, and sauropodomorphs—had already evolved their characteristic dietary behaviors (meat eating versus plant eating) and modes of locomotion (bipedal theropods, four-footed sauropodomorphs). Yet they still made up only about 11% of all vertebrate species at Ischigualasto. Another 30 million years would pass before they became dominant—evidence, the team argues, that dinosaurs did not drive other species to extinction but rather filled ecological niches that other reptiles left empty.

"Dinosaurs had all of their most noted advances prior to their takeover," says Sereno. Benton, who has independently concluded that dinosaurs did not outcompete their rivals, says the new work confirms his own "opportunistic replacement" model for dinosaur ascendancy. "What is new is the greater precision they can bring to bear on its timing," Benton adds. —MICHAEL BALTER