



The Secrets of Tyrannosaurs: Growth, Dominance, and Evolution

Venture into the Lost World...One Minute at a Time



Your source for prehistoric knowledge!

Welcome to this second edition of *The Palaeo Minute*, your one-stop dispatch from the fossil frontier. In this thunderous edition I spotlight the mascot of the newsletter delving into the life and growth of tyrannosaurs, from their evolution to their ontogeny (development). Get ready for the latest palaeobiology insights and fossil-fuelled discoveries, all packed into one mighty read.

This **edition** explores:

- **Tyrannosaurs Unleashed:** Astonishing adaptations of the ultimate predator.
- **Science Meets the Skeleton:** How new techniques are transforming our understanding of tyrannosaurid bone growth.
- **Form and Function:** What tyrannosaur growth reveal about their reign.

Did you know?

Tyrannosaurus rex wielded a bite force over three times stronger than a great white shark, more than enough to crunch through bone.

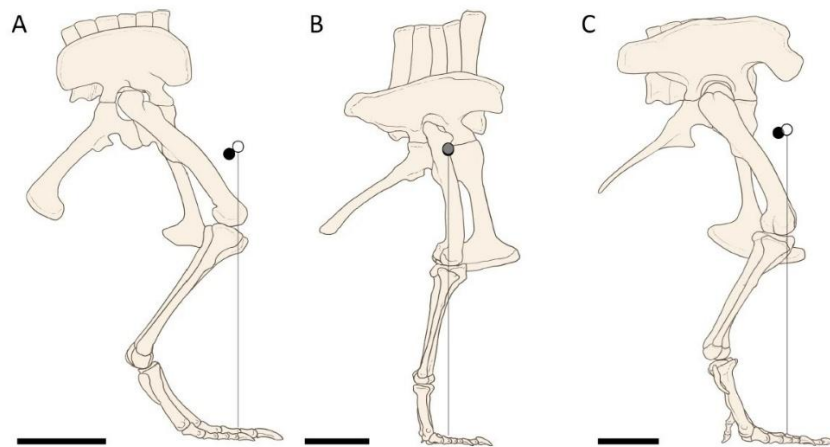
Tyrannosaurs Unleashed

Tyrannosaurs continue to capture the imagination. These colossal “tyrant lizards” ranged from twenty-six to over thirty feet in length, with [Tyrannosaurus rex](#) itself stretching beyond forty feet and weighing more than eight tonnes. Some estimates suggest individuals may have reached up to forty-nine feet long and tipped the scales at fifteen tonnes. With research suggesting *T. rex* could have been up to seventy percent bigger than the biggest known specimen ([Mallon and Hone](#), 2024).



Tyrannosaur Showdown: In 2022, Auckland Museum unveiled a fierce duo of male and female specimens of *Tyrannosaurus rex*. Image credit: [RNZ](#), 2023.

Recent research has used volumetric modelling to reassess dinosaur body mass and shape across major clades, revealing that many species were heavier than previously thought ([Dempsey et al.](#) 2025). The study found that shifts in centre of mass evolved through both convergence and divergence, driven by changes across multiple body segments.



Illustrations show standing postures and limb flexion in large theropods to align the knee and foot beneath the centre of mass. Featured taxa include **(A)** *Sinraptor*, **(B)** *Acrocanthosaurus*, and **(C)** *Tyrannosaurus*. Scale bars is 0.5 m. Image credit: [Dempsey et al. 2025](#).

This fresh perspective not only reshapes our understanding of *T. rex*, but also casts new light on its formidable relatives [Albertosaurus](#), [Gorgosaurus](#), [Daspletosaurus](#), and [Tarbosaurus](#), each one a master of its Late Cretaceous domain. *T. rex* remains, of course, the most iconic and widely recognised member of this formidable lineage.



Face to face with a legend: A *T. rex* skull cast takes centre stage at Oxford's Museum of Natural History. Image credit: James Ronan, 2019.

Key features of these dinosaurs include high, broad snouts and a square-fronted ilium. They also displayed an arctometatarsus where the central metatarsal was pinched between the surrounding toe bones, forming a semi-fused, reduced element that did not fully extend.



Meet Titus: The bone-crushing tyrant of Montana. On display at Wollaton Hall, this *Tyrannosaurus rex* brings prehistoric power straight to Britain's doorstep. Image credit: [Wikimedia](#), 2025.

Their arms were short, with phalanges reduced to just two functional fingers. But it is the sheer power of their jaws that truly defies comprehension. *Tyrannosaurus rex*, for instance, possessed a bite force strong enough to crush a modern-day car. Its serrated teeth were not only terrifying in appearance but served as highly efficient tools, evolved to slice through flesh and pulverise bone with ease.

Mounting Titus the T.rex

Conservationist Nigel Larkin prepares and mounts 'Titus' in the video link above. The *Tyrannosaurus rex* specimen made up of 15% bone material on display at Wollaton Hall.

Predators with Purpose

The fossil record reveals a wealth of palaeontological evidence about tyrannosaur life history, from predatory and cannibalistic behaviour to signs of intelligence and acute sensory abilities. Each new discovery hints at a deeper story. Many more tyrannosaur species may still lie buried, waiting to be uncovered.

To truly understand the tyrannosaurs' path to dominance, we must explore their palaeobiology and we must look beneath the surface. Recent histological studies have uncovered how these giants grew with astonishing speed, revealing bone microstructures that hold the secrets to their rise, survival, and success.

Tyrannosaurs do not just belong to the past they are icons of evolution's most dramatic tale.

Science Meets the Skeleton

Advances in palaeontology and histological analysis are lifting the veil on tyrannosaur biology. One area that has drawn attention is growth, just how rapidly did a *Tyrannosaurus rex* reach its towering adult proportions?

In 2004, Jack Horner and colleagues investigated this question by analysing histological samples (fossil growth rings). Samples taken from seven tyrannosaur specimens housed at the Museum of the Rockies in Montana.



Legends Immortalised: The bronze cast of *Tyrannosaurus rex* (MOR 555) stands guard at the Museum of the Rockies. Image credit: [The Museum of the Rockies](#), 2025.

Much like examining the life rings of a tree, dinosaur bones can provide palaeontologists with insight into their bone growth and mature rate. Their research offered a rare glimpse into the growth dynamics of these prehistoric giants.

Transverse thin sections were prepared from the tibia, femur, fibula, and additional long bones to investigate growth dynamics ([Horner and Padian, 2004](#)). Specimen lengths were measured or estimated, and lines of arrested growth (LAGs) were identified in the preserved cortex.

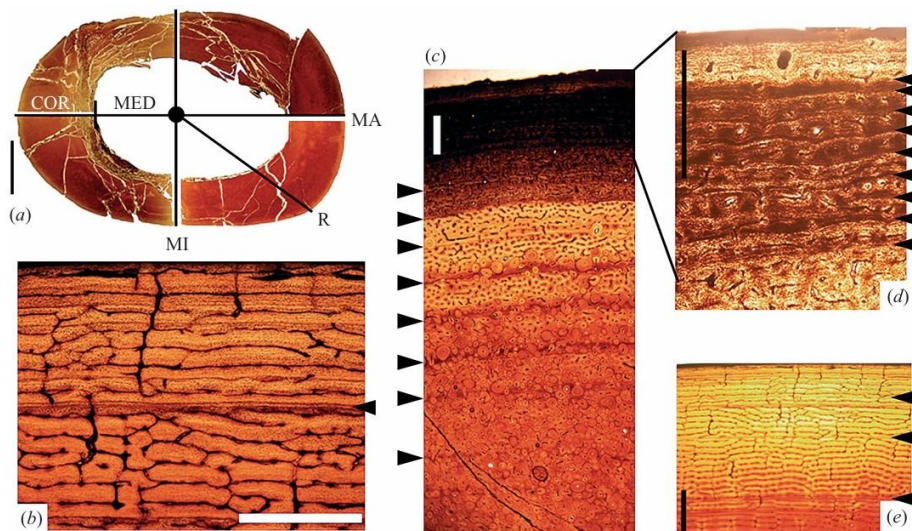
These LAGs were counted and measured, including the distances between them. Observations were conducted using a petrographic microscope and digitally recorded with a Nikon DS-L1 camera.

Fast-Track to Gianthood

Compared to modern megafauna, tyrannosaurs matured rapidly with an accelerated sprint to adulthood.

Additional analysis was undertaken to assess the extent of bone growth lost due to erosion and remodelling. The results revealed all sampled specimens exhibited **lines of arrested growth (LAGs)** that extended continuously through both the inner and outer cortical regions. These LAGs were consistently fine, each no wider than the surrounding vascular canals.

Laminae thickness averaged 0.17 mm across all specimens, though localized variations ranged from 0.13 mm to 0.15 mm. Comparable thicknesses have been documented in *Troodon*, deer, and moa specimens housed in the collections of the Museum of the Rockies.



Bone histology samples from *Tyrannosaurus rex*. Transverse thin sections of limb bones reveal varying growth patterns. Image credit: [Horner and Padian, 2004](#).

Of the seven tyrannosaur specimens analysed, three had ceased active growth two to three years prior to death, yet still showed cortical bone expansion at an annual rate of 0.5%–0.7%. The remaining four were still growing, though narrowing LAG spacing suggests they were nearing skeletal maturity and would reach full adult size within one to three years

Evidence from the femora and tibiae suggests *Tyrannosaurus rex* typically reached full adult size at approximately 16 ± 3 years of age. However, due to small sample size, this estimate may not encompass the full spectrum of individual variation in growth trajectories or the timing of skeletal maturity.

When compared to living megafauna, such as the African elephant, tyrannosaurs exhibited a slightly accelerated growth rate, reaching adult size rapidly relative to their total lifespan. This pattern underscores the intense, fast-paced development that characterised their journey to adulthood. As their bones rocketed toward adulthood, so too did their bite evolve into one of nature's most destructive forces.

Form and Function

In summary, tyrannosaur growth rates reveal how these predators stormed their ecosystems with speed and strength. Engineered for dominance, their bodies surged toward adult size in mere decades, every adaptation a weapon in the evolutionary arms race.

Next up: **Montana's fossil treasures!**

These apex predators carried a legacy of lethal design, a blueprint written in bone. Today, their fossils still speak of battles fought, prey claimed, and mysteries yet to surface. And those mysteries? They are waiting to be discovered beneath the rock.

I hope you have enjoyed exploring the life history of tyrannosaurids in this edition. As *The Palaeo Minute* evolves I want to thank every reader who has walked beside me through fossil beds and forgotten worlds. The support, curiosity, and shared wonder have meant the world.



You can follow *The Palaeo Minute* on X and Instagram for fossils, facts, and behind-the-scenes glimpses into palaeontology in action.

Don't miss the next edition of *The Palaeo Minute*, where I dig into fossil fieldwork and dinosaur biodiversity in Montana's legendary Judith River Formation!

Thanks for journeying through the Mesozoic with me!



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References

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