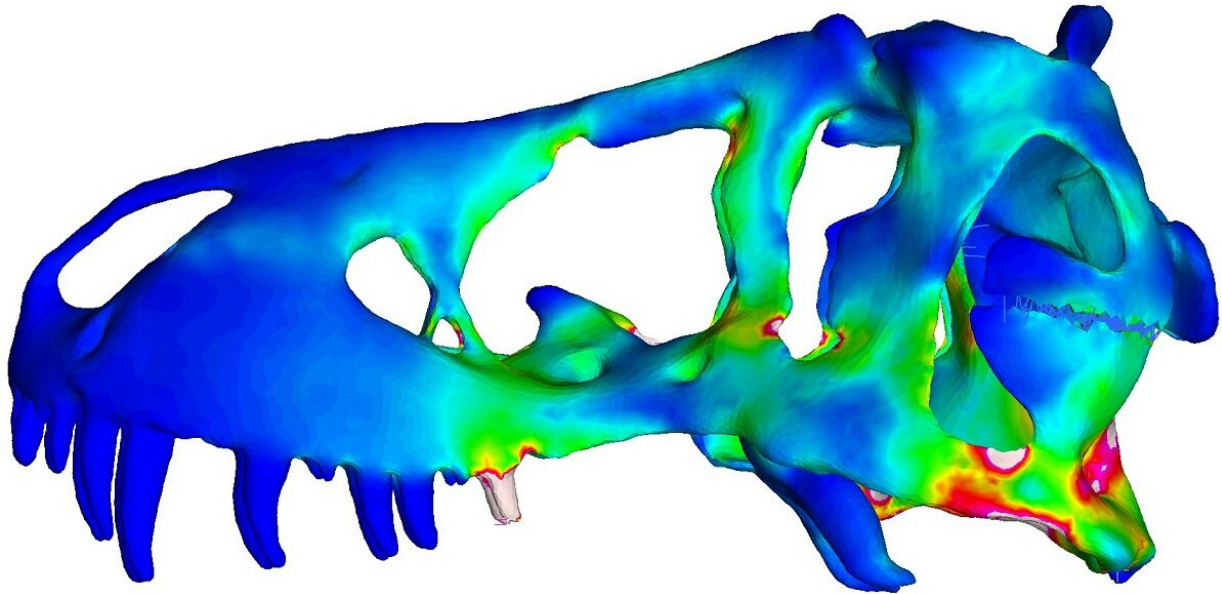


T. rex used a stiff skull to eat its prey

September 25 2019, by Eric Stann



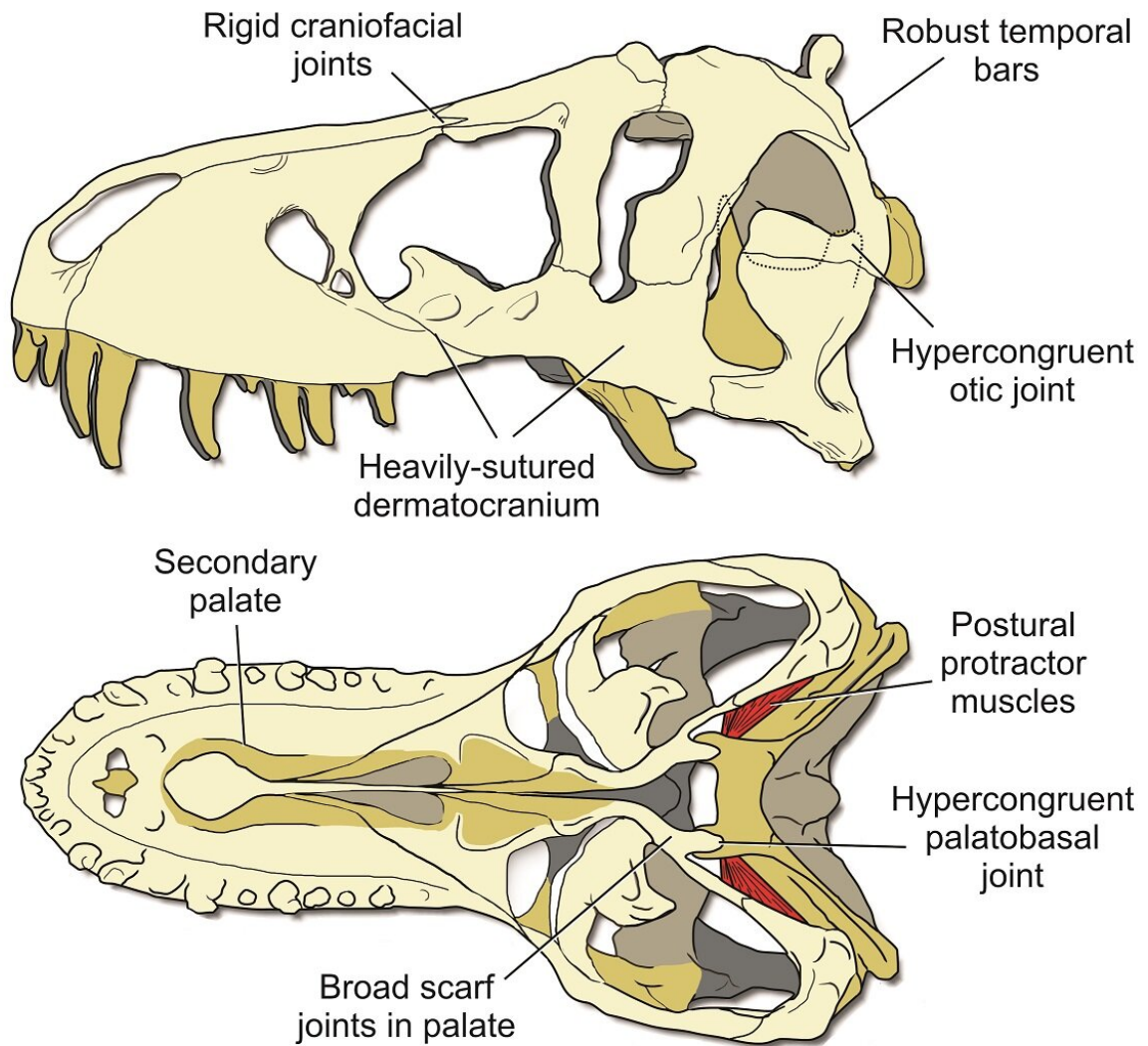
A 3D image of a Tyrannosaurus rex skull showing muscle activation. University of Missouri scientists created one of the first 3D models showing how ligaments and joints in the skull of a Tyrannosaurus rex work. Credit: University of Missouri

A Tyrannosaurus rex could bite hard enough to shatter the bones of its prey. But how it accomplished this feat without breaking its own skull bones has baffled paleontologists. That's why scientists at the University of Missouri are arguing that the T. rex's skull was stiff much like the skulls of hyenas and crocodiles, and not flexible like snakes and birds as paleontologists previously thought.

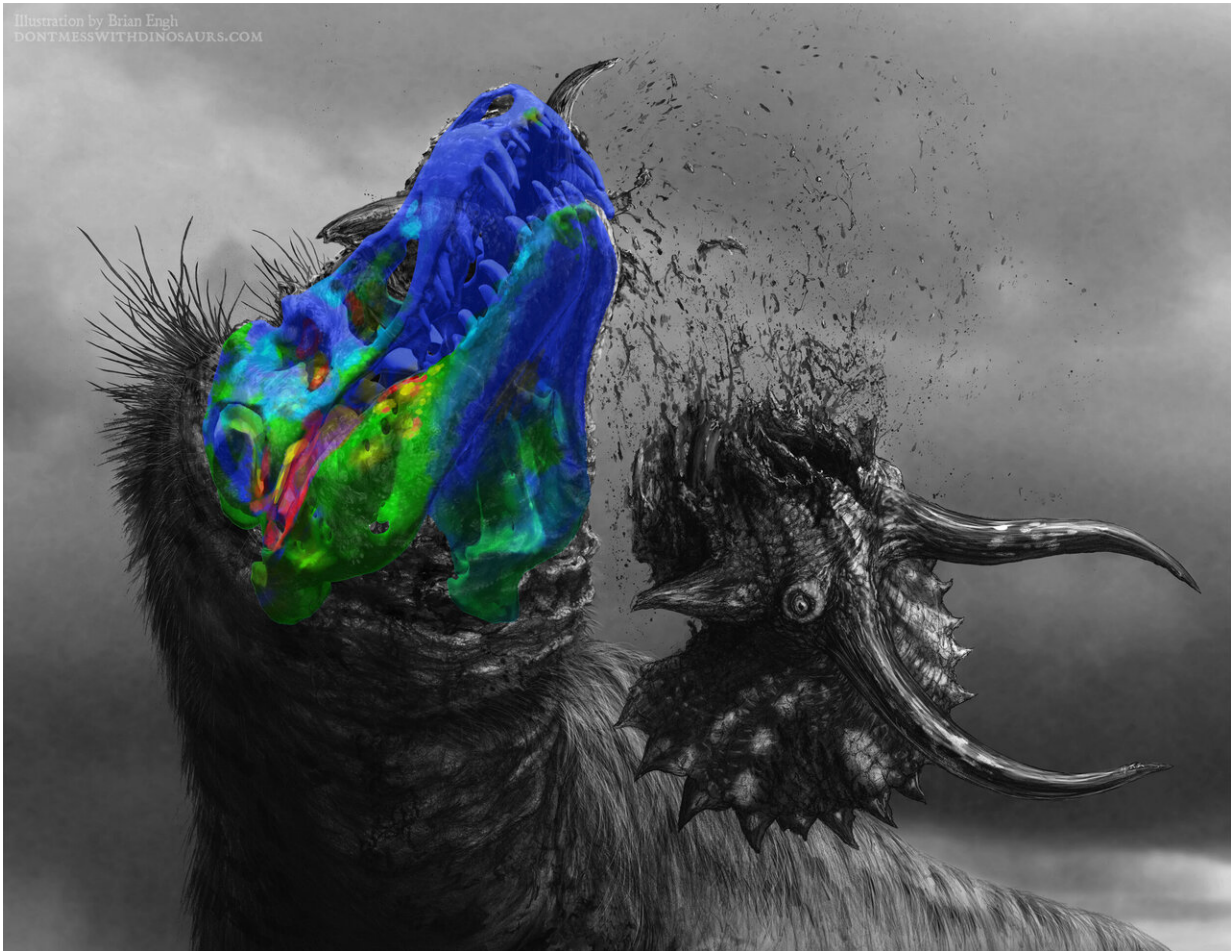
"The T. rex had a skull that's 6 feet long, 5 feet wide and 4 feet high, and bites with the force of about 6 tons," said Kaleb Sellers, a graduate student in the MU School of Medicine. "Previous researchers looked at this from a bone-only perspective without taking into account all of the connections—ligaments and cartilage—that really mediate the interactions between the bones."

Using a combination of imaging, anatomy and engineering analysis, the team observed how the roof of the mouth of the T. rex reacted to the stresses and strains from chewing by applying models of how two present day relatives of T. rex—a gecko and a parrot—chew to how the T. rex skull worked.

"Dinosaurs are like modern-day birds, crocodiles and lizards in that they inherited particular joints in their skulls from fish—ball and socket joints, much like people's hip joints—that seem to lend themselves, but not always, to movement like in snakes," said Casey Holliday, an associate professor of anatomy in the MU School of Medicine. "When you put a lot of force on things, there's a tradeoff between movement and stability. Birds and lizards have more movement but less stability. When we applied their individual movements to the T. rex [skull](#), we saw it did not like being wiggled in ways that the lizard and bird skulls do, which suggests more stiffness."



An illustration of the key features of a stiff T. rex skull. Credit: University of Missouri



An artist's rendition of the Tyrannosaurus rex with the 3D imaging showing muscle activation in its head. Credit: Brian Engh.

In addition to helping paleontologists with a detailed study of the anatomy of fossilized animals, researchers believe their findings can help advance human and animal medicine by providing better models of how joints and ligaments interact.

"In humans, this can also be applied to how people's jaws work, such as studying how the jaw joint is loaded by stresses and strains during chewing," said Ian Cost, the lead researcher on the study. Cost is an

assistant professor at Albright College and a former doctoral student in the MU School of Medicine. "In animals, understanding how those movements occur and [joints](#) are loaded will, for instance, help veterinarians better understand how to treat [exotic animals](#) such as parrots, which suffer from arthritis in their faces."

More information: Ian N. Cost et al, Palatal Biomechanics and Its Significance for Cranial Kinesis in *Tyrannosaurus rex*, *The Anatomical Record* (2019). [DOI: 10.1002/ar.24219](https://doi.org/10.1002/ar.24219)

Provided by University of Missouri

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