

Did the Real T. Rex Resemble the One in Jurassic Park?

Scientists know much more about *Tyrannosaurus rex* than they did 20 years ago.

By: Brian Switek, [National Geographic News](#)

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No dinosaur is more cherished than *Tyrannosaurus rex*. The Cretaceous king of the tyrants **epitomizes** the size, ferocity, and bizarre nature of dinosaurs that continues to enchant us. We're so smitten with *T. rex* that we are continually bringing the dinosaur back to life through art and film.

Perhaps no restoration of the great carnivore has been as influential or celebrated as the genetically engineered tyrant that terrorizes *Jurassic Park*, which is being re-released in 3D today. Revived through computerized special effects and puppetry, the film's *T. rex* is a muscular, agile predator far more imposing than the **tottering**, tail-dragging representations that had appeared on film before. And in the 20 years since *Jurassic Park* debuted, as knowledge about *T. rex* has increased, the dinosaur has become even scarier still.

"It's hard to pick a single coolest discovery about *Tyrannosaurus rex* itself over the last 20 years," says University of Maryland tyrannosaur expert Thomas R. Holtz, Jr. Paleontologists have started to understand how drastically *T. rex* changed as it grew into an adult and to make sense of the neurological "CPU [central processing unit] and sensors of the killing machine" that made *T. rex* so deadly, says Holtz.

Beware the Maw

Of all the dinosaur's traits, the **maw** of *T. rex* has probably inspired the most nightmares—and much of the cutting-edge science. The predator's deep, reinforced skull was set with an array of thick, serrated teeth that evolved to pierce and cut simultaneously.

Jurassic Park's T. rex put that impressive array of dental cutlery to work on the hapless lawyer Donald Gennaro and a fleeing *Gallimimus*, as well as a pair of raptors at the film's climax, but the predator had an even more formidable bite than the movie portrayed. Last year, researchers Karl Bates and Peter Falkingham announced that an adult *T. rex* had a bite force of almost 12,800 pounds—the most powerful estimated bite force of any **terrestrial** predator. Considering the damage a full-force *T. rex* bite would have inflicted, *Jurassic Park's* tyrannosaur looks as if it's being downright gentle with its prey.

Jurassic Park imagined how *T. rex* used its weaponry, but there is actual evidence of *T. rex* biting techniques in the fossil record. After *T. rex* made a kill or found a carcass to scavenge, it could be a delicate feeder. As Denver Fowler and colleagues presented at the annual Society of Vertebrate Paleontology meeting last fall, toothmarks on Triceratops skulls hint that *T. rex* had a step-by-step method of decapitating *Triceratops*.

Yet the destructive power of *T. rex* wasn't isolated in its jaws. The dinosaur's neck muscles played a major role in the carnivore's ability to kill and consume prey. In their 2007 study of *T. rex* feeding mechanics, Eric Snively and Anthony Russell found that the dinosaur's neck muscles were so strong that the tyrannosaur could have thrown a 110-pound chunk of meat 15 feet into the air and caught it again—a frightening ability known as "inertial feeding." Rather than shake the movie's lawyer from side to side like a dog, a real *T. rex* might have tossed Gennaro into the air with a flick of its neck, catching him as he fell back toward all those teeth.

Deadly Bite

T. rex didn't use its teeth and jaws just to pierce the flesh and crush the bones of prey. Tyrannosaurs also bit each other. Healed wounds on the skulls of tyrannosaurs—such as the teenage *T. rex* nicknamed Jane—show that these theropods tussled by biting each other on the face. (Arm wrestling wasn't an alternative, apparently, though *T. rex*'s small arms were heavily muscled and strong for their size.)

This bit of prehistoric behavior might explain why some of the largest carnivores of all time were ultimately killed by much smaller organisms. The lower jaws of many *T. rex* are **pockmarked** with smooth-sided holes. Some researchers thought that these were bite wounds from fatal attacks by rivals, but in 2009 Ewan Wolff and colleagues proposed that these injuries were created by tiny microorganisms that cause the same kind of damage in birds of prey. The protozoans infest the upper digestive tract of the birds, creating ulcers and lesions before eventually boring into the bone. The feathery raptors catch the little hitchhikers by eating infested pigeons.

Perhaps *T. rex* picked up similar microorganisms through dinosaur-to-dinosaur transmission. Face-biting would be a direct way for the harmful microorganisms to jump from one *T. rex* to another. Thanks to tooth-damaged bones, researchers also know that tyrannosaurs cannibalized each other and could have picked up parasites that way. Regardless of the pathway, it would seem that the bite of a tyrannosaur wasn't deadly just to prey, but to other tyrannosaurs, too.

Fearsome but Not Fast ... and Feathered?

Even when paleontologists downgrade the abilities of *T. rex*, the dinosaur still seems scary. One of the most famous scenes in *Jurassic Park* is the Jeep chase, with an angry *T. rex* almost making a snack of the smarmy chaos theorist Ian Malcolm. Could *T. rex* really run fast enough to keep up with a speeding car? The work of researcher John Hutchinson and colleagues suggests not.

For one thing, the movie's *T. rex* wasn't actually moving very fast. The escaping Jeep looks like it's moving 40 miles per hour or more, as Hutchinson explains on his lab's website, but the

dinosaur's movement—it always has one foot on the ground—indicates that the *T. rex* is moving only about 10-15 miles per hour. This fits what the dinosaur's skeleton suggests about its speed. By Hutchinson's calculations, *T. rex* walked about 6 miles per hour and ran about 15-25 miles per hour. A top speed of 25 miles per hour may seem meager, but the only humans able to exceed it are highly trained Olympic athletes. If you were unfortunate enough to be caught off guard by a *T. rex* out in the open, you'd stand no chance of outrunning the carnivore.

Picturing the tyrant wearing feathers—a likelihood since two other tyrannosaurs have been found with coats of dinofuzz—may change its image a bit. As researchers have filled in the deep history of the dinosaur, they have determined that the earliest Jurassic tyrannosaurs were "small, fast, and fuzzy ... not much at all like the giant *T. rex* of *Jurassic Park*," says Holtz.

But to date, *Jurassic Park's T. rex* is the best committed to film. "I think the movie pretty much nailed it," Hutchinson says, "as much as 'it' can be nailed, given the uncertainties." Holtz agrees: "The movie gave *Tyrannosaurus* a seriously high but justifiable level of awesome," he says, as the dinosaur's behaviors shown throughout the film series include "parental care, family hunting, puncture-and-pull feeding, chasing prey with a fast walk." If anything, what was on screen was "not too different from the *Tyrannosaurus* behaviors we would interpret today."

Sadly, we're never going to get to witness a living *T. rex* chase after dinosaurian prey—or even after us—to know for sure how closely *Jurassic Park's* informed speculation matches reality. The movie's intricate puppets and special effects dinosaurs may be the closest we ever come to seeing a tyrannosaur walk the Earth again. When you revisit *Jurassic Park* and watch *T. rex* howl its terrifying cry of freedom as it stomps out into the stormy night, you will be experiencing the best cinematic tribute to one of the most awesome carnivores to have ever evolved.