How to eat a *Triceratops*

***Tyrannosaurus* tore the head off armoured prey to reach the tender neck meat.**

Matt Kaplan

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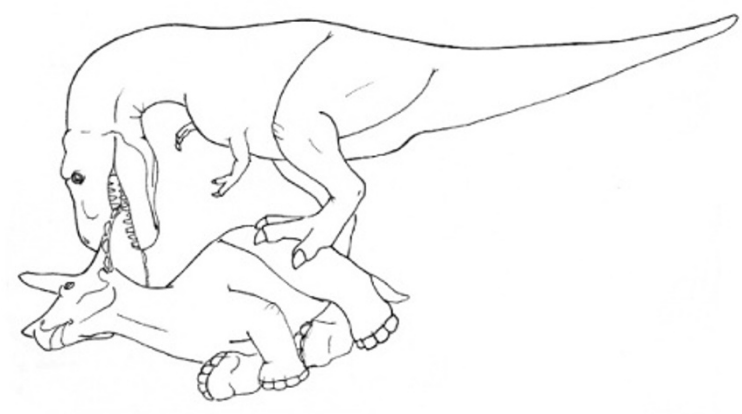

Step one: get a good grip on the neck frill.

Nate Carroll

Theirs was the immortal battle: a fierce tyrant battling a defender armed with three lethal horns and protected by a bony frill around its neck. Yet the violent fight between *Tyrannosaurus* and *Triceratops* is hardly the stuff of Hollywood hype. *Tyrannosaurus* bite marks are well known on the fossil bones of *Triceratops* but, so far, such fossils have always been studied in an isolated manner.

In a departure from this precedent, work presented last week at the Society of Vertebrate Paleontology's annual meeting in Raleigh, North Carolina, reports on an examination of numerous bite-scarred *Triceratops* bones and a theory of how *Tyrannosaurus* fed.

Denver Fowler at the Museum of the Rockies in Bozeman, Montana, and his colleagues studied numerous *Triceratops* specimens from Montana's Hell Creek Formation to identify how many had the characteristic tooth marks of *Tyrannosaurus* on them. They found 18, most of which were skulls. When they looked closer, they noted something important: none of the bones showed any signs of healing, indicating that the bites were inflicted on dead animals that were in the process of being eaten.

As Fowler and his colleagues examined the various types of bite mark on the skulls, they were intrigued by the extensive puncture and pull marks on the neck frills on some of the specimens. At first, this seemed to

make no sense. “The frill would have been mostly bone and keratin,” says Fowler. “Not much to eat there.” The pulling action and the presence of deep parallel grooves led the team to realise that these marks were probably not indicative of actual eating, but repositioning of the prey. The scientists suggest that the frills were in the way of *Tyrannosaurus* as it was trying to get at the nutrient-rich neck muscles.

“It's gruesome, but the easiest way to do this was to pull the head off,” explains Fowler with a grin. The researchers found further evidence to support this idea when they examined the *Triceratops* occipital condyles — the ball-socket head–neck joint — and found tooth marks there too. Such marks could only have been made if the animal had been decapitated.

Bites and nibbles

“Innovative and thorough, this work really shows the value of incomplete specimens and large samples for interpreting palaeobiology,” says palaeontologist Andrew Farke at the Raymond M. Alf Museum of Paleontology in Claremont, California.

It also shows that *Tyrannosaurus* also had a daintier side. Fowler and his team found precise, even delicate, bites along the front of several *Triceratops* skulls, and suggest that these are nibbles on the tender meat found on the face.

The discoveries led Fowler and his colleagues to question whether the feeding behaviour of *Tyrannosaurus* changed substantially as the animals grew. The team proposes that, with their particularly thick teeth, adult tyrannosaurids would have been well-suited to tearing apart something as tough as a *Triceratops*, whereas younger individuals may have had to rely on different feeding strategies to prevent them from damaging their teeth.

There is also the question of how the creatures might have evolved over time. “It is going to be interesting to see if similar patterns of prey processing occurred earlier in time,” says Farke. “I really wonder what the smaller tyrannosaurs that lived millions of years before *T. rex* were doing.”

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