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INSIDE JEB

Newt chewing is all in the tongue

An Italian crested newt (*Triturus carnifex*). Photo credit: Daniel Schwarz.

Chewing is second nature for most of us. The only time we don't take it for granted is when our tongue gets caught up in our teeth and it gets a hard bite. According to Egon Heiss from the Friedrich-Schiller-University of Jena, Germany, the key to chewing lies in the precise coordination of the jaws with the tongue, which transfers food into place ready for mashing. And it appears that mammals and reptiles move their jaws and tongues in similar ways when chewing. But what about their close relatives, the amphibians? 'According to the textbooks, amphibians are not supposed to chew, but to swallow their prey whole', says Heiss. That was until he and Nicolai Konow noticed Italian crested newts (*Triturus carnifex*) doing something different. Instead of simply throwing food down their throats, the newts were rhythmically moving their heads, jaws and tongues prior to swallowing. Were the amphibians defying the textbooks and chewing?

Collecting Italian crested newts from a friend's pond in Lower Austria, Heiss, Konow and Daniel Schwarz quickly discovered the newts' fondness for fly larvae; 'they would do almost anything for a juicy wriggling maggot', chuckles Heiss. But to find out what was really going on inside the amphibians' mouths, the trio had to make an X-ray movie. Implanting minute metal markers in the newts' jaws and tongue, the trio fed maggots to the voracious animals while filming them with X-rays. 'However, the maggots often crawled out of the focus plane and the newts followed and captured them beyond the detector's field of view', says Heiss, recalling how the newts sometimes foiled attempts to film their unconventional chewing technique.

Reviewing the X-ray movies, the trio could clearly see the amphibians pressing their maggoty treats up against the roof of the mouth, which is lined with two rows of needle-like teeth. The amphibians then pushed the tongue forward, grinding the food against the teeth, before looping the tongue down to reposition it ready for the next pass. 'These tongue movements are similar to ours when we chew', says Heiss; but the newts were grinding their food against the teeth in the roof of their mouth with their tongue – like some species of fish. And, when the team analysed the amphibians' stomach contents, it was clear that the maggots had been lacerated by the razor-sharp teeth as they were scraped against them.

'We were surprised that it is possible to "chew" by simply rasping food against the palatal teeth', says Heiss, who is intrigued that the newt's tongue motion is so similar to our own, even though we chew with our jaws. And, he suspects that the amphibians' unique position in the tree of life could shed some light on the evolution of chewing. He says, 'We know that the evolution of the chewing mechanism in land vertebrates is tightly associated with the evolution of a movable tongue', and he suggests, 'this might point to a common ancestry of tongue motion control associated with chewing in land vertebrates'.

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