They took T. Rex's temperature and...

Here's what scientists at UCLA learnt. **Carolyn Y. Johnson** has the story

The last vestiges of warmth drained out of a *Tyrannosaurus rex's* body around 66 million years ago, but scientists just used chemistry to take the long-extinct dinosaur's temperature — 97°Fahrenheit, give or take a few.

The new finding securely situates the king of the dinosaurs among the warm-blooded animals, confirming previous years of research.

T. rex ran hot, but not too hot, according to the study, published in *Science Advances*. The reading places it somewhere on the body-temperature spectrum near large mammals like Indian elephants (97°Fahrenheit) or humans (98°Fahrenheit) or flightless birds like ostriches (101 to 103°Fahrenheit) — but nowhere near the heat of say a chicken (105 to 107 degrees).

"That is absolutely spectacular," said Jasmina Wiemann, a molecular palaeobiologist at Johns Hopkins, US, who was not involved in the study.

Up until the early 2000s, dinosaurs were thought to be rather reptilian and therefore probably cold-blooded, Wiemann said. That began to change as multiple lines of evidence from geochemistry studies and CT scans of fossils showed they were warm-blooded. Wiemann had previously found that *T. rex* had a fast metabolism, but she said the new study did an "exquisite" job of zeroing in on a precise body temperature.

To take the body temperature of a long extinct, school-bus-size predator, scientists at UCLA used a clever geochemistry technique on fossilised teeth (in pic), including two from Thomas, a famous *T. rex* in the collection of the National History Museum of Los Angeles County, US.



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The team first used a dental drill to sample the tough outer enamel from the teeth, and then took advantage of a remarkable fact: the chemical bonds within minerals can tell their own stories. "Basically, at the point a mineral forms there are elements of its chemistry that are kind of frozen in time," said Robert Eagle, a geobiologist and one of the leaders of the study.

Eagle and his colleagues analysed the bonds between two isotopes; heavier versions of both carbon and oxygen. Those bonds acted like a thermometer: the more bonds present, the lower the body temperature.

For a gut check, they also compared the *T. rex* teeth to those of ancient crocodilians excavated from the same site Hell Creek Formation in Montana. *T. rex* measured 97°Fahrenheit; the crocodilians ran much cooler at, on average, 88°Fahrenheit.

Being warm-blooded is associated with a more active lifestyle and means the "tyrant lizard" could live in a broad range of environments. The researchers calculated that at least from a temperature tolerance point of view, *T. rex* could have roamed over most of the North American continent, from Alaska to Mexico.

"All of these habitats would have been viable from a physiological perspective," Wiemann said. "It really reshapes our way of asking questions of habitat preference."

Stephen Brusatte, a palaeontologist at the University of Edinburgh in the UK, pointed out in an email that the body temperature reading opens up a whole new set of questions about how this celebrity dinosaur operated.

One possibility is that *T. rex* was warm-blooded the way humans are, with a constant and hot body temperature regulated by an internal furnace, Brusatte said. Another possibility is that *T. rex* was more like a giant, terrifying insulated coffee cup that takes forever to cool down.

With a body as massive as *T. rex's*, its large size might have insulated it and held the heat inside "without the sophisticated internal chemical reactions that power warm-bloodedness in us and other mammals and birds", Brusatte said.

Eagle said his team is now working on a different chemical approach that could illuminate what these animals ate. They are hanging on to Thomas' teeth for future research.

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