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***Tyrannosaurus rex* grew twice as fast as previously thought** Rapid “teenage” growth came at a cost of slower locomotion later in life

A new study using highly accurate 3D laser scans of real skeletons has revealed that *T. rex* grew more quickly and became much heavier than previously estimated.

By comparing four of the most complete adult skeletons to a fairly complete juvenile specimen, an international research team - led by Professor John R. Hutchinson of The Royal Veterinary College (RVC) in England and Dr. Peter Makovicky of the Field Museum of Natural History in Chicago, USA, - concluded that the ‘king tyrant reptile’ must have grown about twice as fast as previously estimated, from 10kg hatchlings to adults of 7-9 tonnes in 16-17 years.

Commenting on the findings of the study, Professor Hutchinson said: "Previous estimates of the weight of an adult *T. rex* were developed by building scale models such as sculptures, using equations relating to body weights of other animals, or using computer modelling that estimate the “fleshy” dimensions of body parts differently."

"Our new study, using accurate and detailed three-dimensional laser scans of real skeletons, puts one of the specimens we measured at upwards of nine tonnes. We estimate that they grew as fast as 1790 kg a year during the teenage period of growth - which is more than twice the previous estimate - reaching maturity at 16-17 years old." Previous mass estimates for the largest individual ranged from 5-7 tonnes.

The study also concluded that the locomotion of this giant biped slowed as the animal grew. This is because its torso became longer and heavier while its limbs grew relatively shorter and lighter, shifting its centre of balance forward.

Professor Hutchinson added: "The total limb musculature of even an adult *T. rex* probably was relatively larger than that of a living elephant, rhinoceros, or giraffe, partly because of its giant tail and hip muscles. Yet the muscles of the lower leg were not as proportionately large as those of living birds, and those muscles seem to limit the speed at which living animals can run. Thus *T. rex* still wasn't the fleetest of land animals. Our study supports the relative consensus among scientists that peak speeds around 10-25 mph (17–40 kph) were possible for big tyrannosaurs."

"This study underscores the value of having complete specimens of different ages" adds Dr. Makovicky of the Field Museum, which houses one of the study subjects, 'Sue' - the largest and most complete *T. rex* yet found.

Dr Makovicky continued: “*T. rex* represents a biological extreme in being one of the largest bipeds that ever lived. Putting numbers on that requires access to the dimensions of whole skeletons. *T. rex* is the only giant predatory dinosaur for which you can perform a study like this.”

This study was supported by funds from the Natural Environment Research Council and the Field Museum. Access to mounted specimens and casts was granted by the Museum of the Rockies, Carnegie Museum of Natural History, Department of Geology at Leicester University and Manchester Museum. Z&F (UK), the Chicago Police Department and Loyola University Medical Center provided surface and CT scan data. Ralph Chapman, Linda Deck, and Art Andersen coordinated scan efforts and rendered the data for analysis.

The study - *A computational analysis of limb and body dimensions in Tyrannosaurus rex with implications for locomotion, ontogeny, and growth* - was published today in the open access online journal PLoS One.

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Notes for editors

- The **Royal Veterinary College** is the UK's first and largest veterinary school and a constituent College of the University of London. It also provides support for veterinary and related professions through its three referral hospitals, diagnostic services and continuing professional development courses. <http://www.rvc.ac.uk>
- Further details on the study, including images, are posted online at www.rvc.ac.uk/sml.