Fattysaurus or thinnysaurus? How dinosaurs measure up with laser imaging

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(PhysOrg.com) -- University of Manchester scientists are using laser imaging to investigate how fat - or fit - T. rex and his fellow dinosaurs were.
Karl Bates and his colleagues in the palaeontology and biomechanics research group have reconstructed the bodies of five dinosaurs, two T. rex (Stan at the Manchester Museum and the Museum of the Rockies cast MOR555), an Acrocanthosaurus atokensis, a Strutiomimum sedens and an Edmontosaurus annectens.

The team, whose findings are published in the Public Library of Science journal *PLoS ONE* today (19th February 2009), found that the smaller Museum of the Rockies T. rex could have weighed anywhere between 5.5 and 7 tonnes, while the larger specimen (Stan) might have weighed as much as 8 tonnes.

Acrocanthosaurus atokensis was a large predatory dinosaur that looked like T. rex but with large spines on its back and roamed the earth much earlier in the mid Cretaceous period, around 110M years ago. The team suggest Acrocanthosaurus probably weighed in at a similar mass to MOR555 and other medium sized adult T. rex at about 6 tonnes.

The Strutiomimum sedens, whose name means “ostrich mimic”, lived alongside T. rex in the late Cretaceous period and probably weighed somewhere between 0.4 - 0.6 tonnes

The reconstruction of Edmontosaurus annectens, a plant-eating

hadrosaur was based on a juvenile specimen, but still weighed in at between 0.8 - 0.95 tonnes. As adults, some hadrosaurs grew as big as T. Rex, again living in the late Cretaceous period.

The team used laser scanning (LiDAR) and computer modelling methods to create a range of 3D models of the specimens, attempting to reconstruct their body sizes and shape as in life. The laser scanner images the full mounted skeleton, resulting in a detailed 3D model in which each bone retains its spatial position and articulation. This provides a high resolution skeletal framework around which the body cavity and internal organs such as stomach, lungs and air sacs can be reconstructed. This has allowed calculation of body segment masses, centres of mass and moments of inertia for each animal - all the information that is needed to analyse body movements.

Having created their 'best-guess' reconstruction of each animal, they then varied the volumes of body segments and respiratory organs to find the maximum plausible range of mass for the animals. Even scientists cannot be sure exactly how fat or thin animals like T. rex were in life, and the team were interested in exactly how broad the range of possible values were for body mass. They believe that the lower weight estimates are most likely to be correct as there is no good reason for the dinosaurs to weigh more than they need to as this would affect their speed, energy use and demands on the respiratory system.

The team also measured the body mass of an ostrich, as an existing subject that would show how accurate their technique was, and found the results to be correct.

They will now use the results to further investigate the locomotion of dinosaurs, specifically how they ran.

Karl said: "Our technique allows people to see and decide for themselves

how fat or thin the dinosaurs might have been in life. You can see the skeleton with a belly. Anyone from a five-year-old to a Professor can see it and say, 'I think this reconstruction is too fat or too thin'.

He added: "This study will help us in our research on how dinosaurs ran in 3-D rather than 2-D as in previous studies.

"Reconstructing more dinosaurs in such detail will allow us to examine changes in body mass and particularly centre of mass as they evolved. As we know, dinosaurs evolved into birds. As they did so, the centre of mass moved forward and different walking styles evolved. Although the dinosaurs we have reconstructed are not very close relatives of the birds, we can nevertheless see a small forwards movement in the position of the centre of mass from Acrocanthosaurus atokensis to the T. rex, which lies closer to modern birds on the evolutionary lines."

More information: The paper 'Estimating Mass Properties of Dinosaurs Using Laser Imaging and 3D Computer Modelling' in *PLoS ONE* is available at dx.plos.org/10.1371/journal.pone.0004532

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