The Rôle of Elastic Structures in Dinosaur Locomotion

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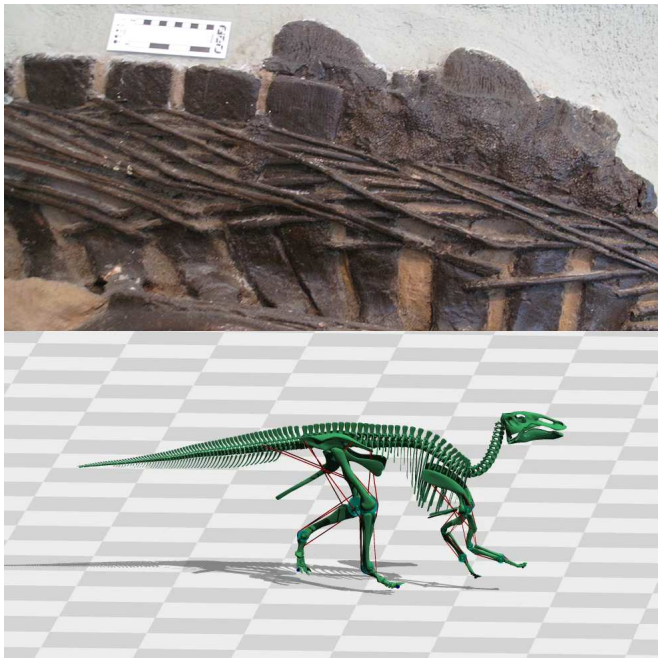
Introduction:

Dinosaurs and their modern descendants are a highly varied and successful group of animals. They managed to colonise most of the globe and achieve enormous body sizes. One particular challenge they had to overcome was that of efficient terrestrial locomotion. Dinosaurs often have complex arrangements of ossified tendons in their backs and legs and it has been suggested that these may be related to locomotor efficiency (1). The purpose of this project is to use reverse engineering and functional anatomical techniques to investigate the rôle of elastic structures in dinosaur locomotion across a range of species in terms of both economy and performance. This will help identify the key adaptations associated with bipedality and gigantism and ultimately the evolutionary success of the dinosaurs.



Top: Ossified tendons between the vertebrae in a hadrosaur. Bottom: Locomotor simulation of a hadrosaur.

Project Summary

In this project we will use innovative analytical techniques to investigate the mechanics of locomotion in a range of dinosaurs. To do this the student will use a custom, hybrid engineering approach which will combine two well established engineering techniques (finite elements and multibody dynamics) to calculate how the skeleton and the various elastic structures associated with soft tissue are loaded during locomotor performances (2, 3). This will be coupled with advanced imaging and geochemical techniques to improve the quantification of the elastic parameters associated with preserved soft tissue (4).

This project would suit students with a background in vertebrate palaeontology, zoology or anatomy. Training in the advanced techniques will be provided and there will be a requirement to travel to various museums around the world to collect morphological data from specimens in the collections. In particular, the student will be required to spend time at the Black Hills Institute of Geological Research learning excavation, preparation and imaging techniques.

References

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2. **Sellers WI**, Margetts L, Coria RA, **Manning PL**. 2013. March of the Titans: the locomotor capabilities of sauropod dinosaurs. PLoS ONE. 8:e78733.
3. **Sellers WI**, **Manning PL**, Lyson T, Stevens K, Margetts L. 2009. Virtual palaeontology: gait reconstruction of extinct vertebrates using high performance computing. Palaeontologia Electronica. 12:11A:26.
4. Anné J, Edwards NP, Wogelius RA, Tumarkin-Deratzian AR, **Sellers WI**, van Veelen A, Bergmann U, Sokaras D, Alonso-Mori R, Ignatyev K, Egerton VM, **Manning PL**. 2014. Synchrotron imaging reveals bone healing and remodelling strategies in extinct and extant vertebrates. Journal of the Royal Society, Interface / the Royal Society. 11:20140277.