

## THREE-DIMENSIONAL DINOSAUR TRACK ANALYSIS: INTEGRATION OF BIOCHEMICAL AND ANALOGUE MODELLING APPLIED TO INTERPRETATION OF THE FOSSIL RECORD

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The aim of this interdisciplinary project is to develop a 3D soil model for predatory dinosaur (theropod) track formation through analysis of novel experimentally-created synthetic tracks, and to apply this new understanding to the interpretation of Cretaceous tracks to i) develop a quantitative basis for the diagnosis of ichnotaxa and ii) provide new insight into limb kinematics, ecology, environmental context, and evolution of dinosaurs. As such the project has a number of specific objectives which are to:

- use an extant avian theropod (e.g. emu or rhea) to quantify the foot movement.
- reproduce avian theropod tracks using an experimental rig comprising a reconstructed prosthetic avian theropod limb that reproduces the foot, foot movement, and loading cycle associated with a walking extant avian theropod
- engineer a prosthetic limb (based upon known skeletal evidence) of a predatory dinosaur (e.g. *Struthiomimus* sp.) that can be dynamically loaded (with the correct kinematic cycle) in the experimental rig to generate synthetic dinosaur tracks in prepared sediments
- use the prosthetic predatory dinosaur limb in the theropod experimental rig to generate track simulations under a range of loads, sediment types and moisture contents.
- characterise the 3D morphology of tracks formed under the range of experimental conditions and develop a mechanistic model for dinosaur track formation and associated deformation in the immediate subsurface sedimentary layers
- apply the results from the laboratory track simulations to analyse Cretaceous fossil dinosaur tracks, and create a more robust, quantitative taxonomic basis on which to diagnose vertebrate ichnotaxa and quantify the use of fossil tracks as indicators of dinosaur evolution, ecology, size, gait, posture, behaviour, speed, and population dynamics.

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### Relevant Publications:

**Manning, P. L.**, Payne, D., Pennicott, J and Barrett, P. 2005. Dinosaur killer claws or climbing crampons? *Biology Letters*, doi:10.1098/rsbl.2005.0.0395.

**Manning, P. L.** 2004. A new approach to the analysis and interpretation of dinosaur tracks. In McIlroy, D. (ed.) *The Application of Ichnology to Palaeoenvironmental and Stratigraphic Analysis*. Geological Society of London, Special Publications, 228, 93-123.