Primate Society of Great Britain

Spring Meeting 2009

Form and Function

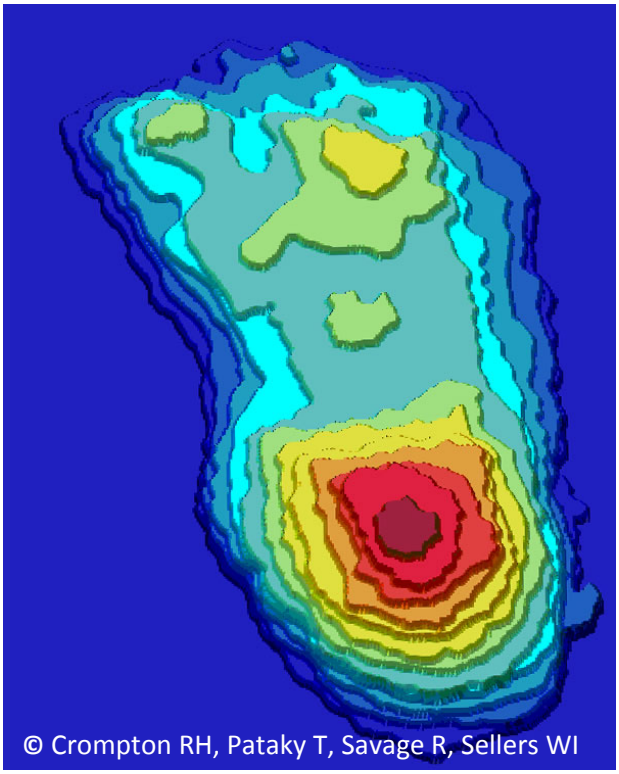
Abstracts of presentations by invited speakers

The meeting is being organised by Mandy Korstjens (Bournemouth University), Jo Setchell (University of Durham) and Bridget Waller (University of Portsmouth). They can be contacted through **registration@psgb.org.**

Biomechanical analysis of the Laetoli footprint trails

By Crompton RH, Pataky T, Savage R, Sellers WI

University of Liverpool



Abstract

The Laetoli footprint trails, dating to around 3.8 Ma and most commonly attributed to the only early hominin known from postcranial fossils in the Laetolil beds, *Australopithecus afarensis* remain our most direct evidence of the function and biomechanics of the foot in early human ancestors. Just as gait of *Au. afarensis* continues to be the subject of much debate, primarily as to whether it would have been upright ('stiff') walking or bent-hip, bent-knee ('compliant') walking, so interpretations of the footprints, most based largely on the juvenile, G-1 trackway, range from claims, as recent as 2007, that they are completely consistent with a chimpanzee-like bipedalism, (and hence compatible with a recent knucklewalking ancestry) to claims that they are completely modern in functional aspect. We report progress in biomechanical analysis of the Laetoli footprint trails based primarily on on: 1) quantitative experimental studies of human foot pressure in a variety of gaits both directly over a pressure/forceplate combination and measured under 4 mm of fine damp sand, and 2) both forwards-dynamics and finite-elements modelling of foot pressure and footprint formation.

Darwin, Time and Morphology: Constraints on Sociality in Primates and their Implications for Evolution

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Baboons and red colobus monkeys ©Amanda Korstjens

Primates are intensely social animals, and this imposes a constraint on a species' capacity to occupy different kinds of habitats since animals must be able to maintain groups of a minimum size to cope with the demands of a particular habitat. Two key constraints in this respect are time and predation risk, both of which are influenced by morphology. Time is about animals' abilities to balance their time budgets while meeting both the demands of foraging and nutrient intake and the maintenance of the social bonds that ensure group cohesion through time. When species cannot balance their time budgets, they must either evolve a new adaptive strategy or go extinct. I will consider the implications of our time budget models for species evolutionary history and extinction risk.

Form and function in the primate skeleton: guenon case studies

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Vervet monkey ©Erik Willems

Primate skeletal morphology is influenced by a wide array of factors: evolutionary history, developmental plasticity, geography, environment, social behaviour and ecology (including feeding and locomotion). These factors need to be teased apart in order to understand the relationship between form and function. In this presentation I will review some recent work on guenon craniofacial form that illustrates how multiple factors, only some of which are directly related to function, influence morphology (both size and shape). I will also use the terrestrial guenons as a case study to demonstrate how postcranial morphology in a group of closely related primates adapts in response to different locomotor and habitat pressures.

Darwin with a smile

Prof Jan A.R.A.M. van Hooff

Prof emeritus Utrecht University, The Netherlands

Bournemouth University is hosting an associated public lecture by **Prof Emeritus Jan A.R.A.M. van Hooff** from Utrecht University (early) Thursday evening. Prof van Hooff (who is the scientific father of a long list of prominent primatologists).

This year we commemorate the genius who gave us an explanatory model for the phenomenon of evolution. He was also one of the first to make scientifically reliable observations about animal behaviour; see his third famous book: “The Expression of the Emotions in Man and Animals”. Darwin regarded, contrary to what many were willing to accept, also the mind as a product of evolution. And yes, he found evidence that there is evolutionary continuity in the behavioural expression of mental states, especially in primate facial expressions. A century later new approaches have revived the interest in our expressive behaviour. They even reveal the evolutionary origins of such “unique” human attributes as our ‘laughter’ and ‘sense of humour’. A good reason to look at this with a smile

Linking morphology, behaviour and ecology: how reliable are inferences from fragmentary hominin remains?

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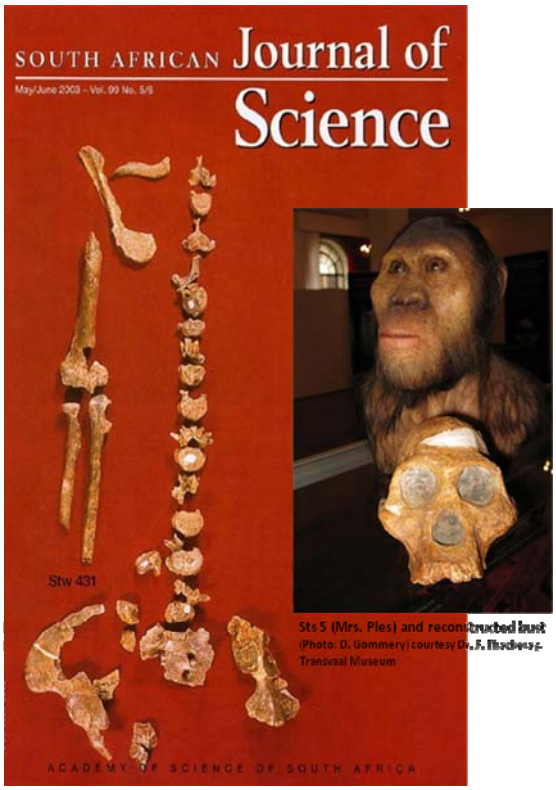

The late Miocene to early Pleistocene is one of the most exciting periods in hominin evolution, as it marks the key innovations in hominin morphology and behaviour, largely triggered by environmental changes. Elucidating these changes, processes and underlying causes is however fraught with problems, not least because of the sparse and fragmentary nature of the fossil record itself. Where sufficient material is available, phylogenetic and developmental constraints on morphology may mask behavioural changes already established ("form follows function"). Evolutionary anthropologists have therefore relied on broad comparative analyses of extant (and some extinct) taxa to infer evolutionary changes in morphology and behavior, or they have used modern analogues to deduce the behaviour of extinct species. In the case of hominins, chimpanzees are commonly used as such modern analogues given their close genetic relationship with modern humans. Whether chimpanzees are indeed suited for functional and behavioural inferences has been called into question however. Over the last few years it has become increasingly evident that early hominins may have been more comparable to gorillas in dietary adaptations and habitat exploitation, and may have differed from both chimpanzees and gorillas in positional behavior. Here we review the evidence and present a new analytical approach, which throws further light on the locomotor behavior of *A. anamensis* and *A. afarensis.*

This work is funded by The Leverhulme Trust and the Natural Environment Research Council.

Applying numbers to the three Fs: form, function, and phylogeny

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Blue monkey ©Amanda Korstjens

Throughout the history of evolutionary thought, there has been an uncomfortable tension in morphology between those intent on exploring function and those with an interest in phylogeny. To many, the relationship between form and function is self-evident, and the relationship between form and phylogeny is obvious and tractable, but that between function and phylogeny is a philosophical nightmare. While some maintain that phylogeneticists should concentrate only on non-functional traits (however they may be defined), others argue that phylogeny can only be inferred from functional characteristics, as they are under the strictest control of natural selection. Even less straightforward is how quantitative traits should be treated, as most phylogeny reconstruction computer programs require that data be coded into discrete states for input, and the translation of quantitative data into codes is tantamount to violence in the eyes of many.

To explore these issues, a large dataset of cercopithecine primate postcranial measurements was analysed using a number of techniques, reflecting a wide range of approaches to the problem of function and phylogeny. The data demonstrate a number of issues, including sensitivity to dominant locomotor pattern, the effect of allometry on attempts to scale data to body size, and the relationship of functional features to phylogenetic relationships, which highlight the opportunities and difficulties in inferring function and phylogeny from form. While it may not be possible to 'solve' the function/phylogeny conundrum, this example demonstrates the utility of some approaches to the problem, and the failure of others.