

automatic, threshold-based mesh extraction of the sample's surface (e.g., epidermis), which, without coating, frequently has similar gray values in μ CT-scans as internal anatomical structures. We expect that this methodological advancement consequently will be instrumental for a number of biological disciplines that depend on accurate morphological data of internal as well as external structures.

Seismic Signaling: Morphological Adaptations to the Hind Limb in Three Species of African Mole-rats (Bathyergidae)

Sahd L¹, Bennett NC², Kotzé SH³; ¹Department of Biomedical Sciences, Faculty of Medicine and Health Sciences, Stellenbosch University, Cape Town, South Africa, ²Department of Zoology and Entomology, Mammal Research Institute, University of Pretoria, Pretoria, South Africa, ³Department of Biomedical Sciences, Faculty of Medicine and Health Sciences, Stellenbosch University, Cape Town, South Africa (17521777@sun.ac.za)

Seismic signaling using hind foot drumming plays a crucial role during communication in several species of African mole-rats (Bathyergidae). These signals are produced by striking the ground repeatedly at rapid speeds with alternating hind limbs using flexion and extension of the hip and knee. This study aimed to determine if the hind limb osteology and musculature differed between drumming and non-drumming species of Bathyergidae. Both left and right formalin fixed hind limbs N=48 (n=16 of each species) of two drumming species, *Georchus capensis* and *Bathyergus suillus* and one non-drumming species, *Cryptomys hottentotus natalensis* were dissected to determine the origin and insertion of muscles. After dissection, all soft tissue was removed by maceration. The bones of the hind limb and pelvis were photographed and exact origins and insertions were mapped onto the images. The ilial shaft, distal femoral shaft and the tibia were more robust in the drumming species (*G.capensis* and *B. suillus*) compared to *C. h. natalensis*. The origins and insertions of all three species were similar except for the *m. gracilis*. In both drumming species the *m. gracilis* was a large single muscle; in contrast in *C. h. natalensis* an additional caudal part of the *m. gracilis* was observed. In all three species, the *m. tensor fasciae latae* was absent. It is unlikely that the *m. gracilis* plays a role in hind foot drumming as the singularity or doubling of this muscle has been reported in numerous non-drumming rodents. The ilium, femoral shaft and tibia are the main origin and insertion sites respectively of several muscles that act during flexion and extension of the hip and knee. Therefore, the more robust nature of these bones in the drumming species could be caused by the additional muscular force exerted during rapid flexion and extension of the hip and knee during drumming.

Cranial Diversity and Evolution in Shieldtail Snakes (Serpentes: Uropeltidae)

Sampaio FL¹, Day JJ², Olori JC³, Gower DJ⁴; ¹Department of Life Sciences, The Natural History Museum, London, UK, ²Department of Genetics, Evolution and Environment, University College London, UK, ³Department of Biological Sciences, State University of New York at Oswego, Oswego, USA, ⁴Department of Life Sciences, The Natural History Museum, London, UK (f.sampaio@nhm.ac.uk)

As with other aspects of the biology of fossorial taxa, the diversity and diversification of cranial morphology of head-first burrowing vertebrates is relatively understudied. Shieldtails (Serpentes: Uropeltidae) are a family of small fossorial snakes, endemic to Sri Lanka and peninsular India. There are eight genera and 55 species currently recognized. This is a poorly understood group, partly due to their secretive habits and confusing taxonomic history. Although uropeltids seem to exhibit high levels of morphological diversity and have some highly distinct phenotypic features, their morphology has not been studied using a quantitative approach. Combining 3D-geometric morphometrics (from microCT-data) with a new, dated multigene phylogeny, we determined phylomorphospace occupation of skull shape, and investigated patterns of morphological diversification across time and space. We assessed the degree to which skull shape is influenced by variables such as body size, geography and phylogeny, and tested hypotheses including i) that rates of lineage diversification are correlated with morphological diversification, and ii) that patterns of diversification are similar in mainland and island lineages. Uropeltid crania vary in features including snout shape and elongation of the occipital region, which might be indicative of differing burrowing styles. Analysis of phylomorphospace reveals convergence of head shape between some Indian *Uropeltis* and Sri Lankan *Rhinophis*, so that head shape variation is not only partitioned phylogenetically, but that behavioral and/or ecological factors likely also influence morphology in the group.

Think Big, Evolutionary Allometry as a Major Factor in Rates, Trajectories and Scaling of Morphological Evolution of the Primate Brain Shape

Sansalone G¹, Ledogar J², Ledogar S³, Profico A⁴, Raia P⁵, Mitchell RD⁶, Wroe S⁷, Allen K⁸; ¹University of New England, Armidale, Australia, ²Duke University, ³University of New England, ⁴Sapienza Università di Roma, ⁵Università Federico II di Napoli, ⁶University of New England, ⁷University of New England, ⁸Washington University in St. Louis (gsansalone@uniroma3.it)

Primates constitute one of the most successful and diverse mammalian clades. One key factor in their diversification is the evolution of their peculiar brain morphology. However, the evolutionary and developmental processes determining the relevant shape changes in the primate brain remain largely unknown. In this study, we used 3D-geometric morphometrics, phylogenetic comparative methods and Bookstein's novel concept of scaling in shape variation to understand the factors influencing rates, trajectories and scaling of brain shape in a sample of 146 species including members from each major primate clade (excluding *Homo*). We found that only Hominoidea and Cercopithecoidea showed a significant evolutionary allometry after controlling for phylogeny, whereas Strepsirrhini, Colobinae and Platyrrhini did not. However, Hominoidea and Cercopithecoidea both showed markedly high rates of morphological evolution, whereas Strepsirrhini and Platyrrhini display a significant slowdown. As a consequence, Hominoidea and Cercopithecoidea have different trajectories and magnitudes of shape changes when compared to the remaining clades. Apes, lesser apes and cercopithecids tend to have an overall globular brain shape with more developed frontal lobes. Furthermore, there is a large-scale effect (global pattern of variation) of size on brain