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Limb Bone Scaling: Afrotherian Allometry

Christine Gardner

Faculty Mentor: Matthew Bonnan
Biology

Afrotheria is a diverse placental mammal clade including both large (elephants) and tiny (golden moles) taxa, making them of significance to paleontologists and biologists. Scaling is how animal anatomy changes with increasing size. Allometry, which complements scaling, is the study of correlations between form and size. Because long bones play such an important role in support and locomotion, significant changes in their shape and dimension express variations in limb use. Furthermore, how their shapes change with overall body size can reveal weight-support strategies. Therefore, scaling and allometric trends were analyzed in two long bones, the humerus and femur, to test for significant differences in limb dimensions and shape in relation to size. I used traditional linear statistics as well as a geometric morphometrics approach, Thin-Plate Splines (TPS), to test for shape variation. I predicted that the limb bones would scale with positive allometry: they would become more robust as body size increases. The linear data suggest that the dimensional changes are elastic and agree with my initial predictions. This indicates the long bones of larger Afrotherians are thicker and more robust than those of small taxa. Results from the TPS shape analysis show that most shape differences occur in the humerus, probably due to difference in forelimb use, such as burrowing. In the femur, however, variation in shape is extremely limited, probably because most mammals are hindlimb-driven. Overall, the analyses suggest that, whereas femur shape is more conservative for locomotion purposes, forelimb shape is more affected by non-locomotor behaviors.