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HIP STRUCTURE AND LOCOMOTION IN AMBULATORY AND CURSORIAL CARNIVORES REINVESTIGATED

Joshua G. Thweatt (Undergraduate)

Ashley S. Hammond (Graduate)

(Carol Ward, PhD)
Department of Pathology and Anatomical Sciences

Understanding how the femoral head articulates with the acetabulum of the pelvis should allow one to infer the pattern of hip mobility in living and fossil species. In 1977, Jenkins and Camazine analyzed cineradiographic films of carnivores (cat, dog, raccoon) during locomotion. They hypothesized that raccoons, which climb trees as well as walk terrestrially, would have hip joints adapted for greater abduction, where as the nearly strictly terrestrial dogs would have more adducted hips, and cats would be intermediate. Inferences made in this study have been used extensively to infer locomotor behavior and evolution in primates, although they were not tested thoroughly due to methodological limitations at the time.

We tested the hypothesis that ambulatory carnivores (raccoons; Procyonidae) would have shallower acetabulae, lower greater trochanters, higher femoral neck-shaft angle and higher position of the fovea capitis than terrestrial ones (dogs; Canidae), and that cats (Felidae) would be intermediate. We used 3D polygonal models created from laser scan data of raccoons, felids and canids. We quantified morphology by fitting spheres, vectors and measuring articular surface areas using automated features in the CAD software package Polyworks.

Our results show differences between terrestrial canids and more ambulatory species. The articular surface distribution was a poor discriminator between groups, except for the posterosuperior quadrant. Femoral geometry, such as neckshaft angle, did not match our predictions but acetabular depth measures clearly matched our predictions for the locomotor groups. These results have implications for inferring joint mobility from bony anatomy in all mammals, including humans.