might be related to lower temperatures at higher latitudes, but faunal turnover also occurs at low latitudes during the Neogene. Diversity in the late Cenozoic of East Africa is unlikely to correlate with temperature, as lower altitudes remained within crocodyliform thermal tolerance levels throughout the period. However, regional trends reveal other potential drivers. In the Turkana Basin, extinct relatives of forest-dwelling dwarf crocodiles (*Osteolaemus*) are replaced by groups with broader ecological tolerances (e.g., *Crocodylus*) during the middle Miocene. This was when continuous forest cover gave way to open savannas and grasslands. Similar taxonomic changes are not observed in the western (Gregory) branch of the African Rift Valley, where dwarf crocodile relatives and their preferred forests persisted into the Pliocene. Here, diversity changes appear to reflect changes in rainfall and aridity more than temperature. Evidence from all three continents suggests that concentrating on only one aspect of climate masks a more complex interplay between regional and global environmental change.
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Biomechanics & Functional Morphology

SHOULDER JOINT RANGE OF MOTION IN FOSSIL SYNAPSIDS AND THE ORIGINS OF MAMMALIAN LOCOMOTOR DIVERSITY

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Extant mammals are both taxonomically and ecologically diverse, having evolved a remarkable array of locomotor ecologies (e.g., swimming, digging, and flying). Evolution of the therian-type forelimb, with a highly reduced pectoral girdle and ball-and-socket shoulder joint, has been heralded as a key innovation that enabled mammals to co-opt their forelimbs for diverse functions. The acquisition of the mammal forelimb can be traced through their forerunners, the non-mammalian synapsids (NMS), but exactly how this musculoskeletal transformation proceeded and its impact on functional diversification have not be quantitatively tested.
To explore the evolution of forelimb functional diversity in synapsids, we measured shoulder joint osteological range of motion (ROM) in a range of extant amniotes (lizards, monotremes, therian mammals), and compared their patterns of joint mobility to exemplars from each of the major grades of NMS: 'pelycosaurs', basal therapsids, and non-mammalian cynodonts. Three-dimensional models of the shoulder girdles and humeri were digitally aligned in an anatomical 'neutral pose' using a semi-automated approach based on articular surface morphology. ROM was then determined for the shoulder joint using a fully automated method, where the humerus was moved in flexion-extension, adduction-abduction, and pronation-supination until bone-to-bone contact occurred. Relative degree and directionality of mobility were then compared across taxa.
We find an increase in total shoulder joint ROM through synapsid evolution, suggesting that more derived NMS could perform a wider range of limb movements. However, we also see more complex trends in directionality of shoulder mobility that may be indicators of forelimb posture. Extant lepidosaurs and monotremes had the greatest ROM in abduction-adduction, whereas therians had more ROM in flexion-extension, likely related to 'sprawling' vs. 'erect' gaits. Therapsids and cynodonts both had greatest ROM in abduction-adduction, matching previous reconstructions of these taxa as sprawling to semi-erect. However, 'pelycosaurs' had the greatest ROM in flexion-extension, despite having abducted forelimbs, suggesting they did not move their forelimbs in same manner as modern sprawling animals. Our results demonstrate the complex nature of forelimb evolution in synapsids and provide novel insights into the functional transformation and diversification of the mammalian forelimb.
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Holocene & Pleistocene Mammalian Macroecology & Faunal Studies

DETERMINING PROBABLE CAUSE OF DEATH AND CHANCE OF BONE DISEASE IN A MAMMOTH FROM SOUTHEASTERN IDAHO

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Analysis of a near-complete skeleton of a 11,700 ± 40-year-old mammoth from southeastern Idaho has the potential to show us whether Columbian and Woolly mammoth interbreeding caused introgressive hybridization and genetic diseases in their offspring: the Jeffersonian Mammoth. Understanding the circumstances surrounding this mammoth's death have raised several questions that have led us to discover that it was a juvenile (between 12–18 years old) and most likely male. In this study, CT (computerized tomography) scans, 3D modeling applications, and optical observation have revealed evidence of internal pore widening in the joints and foot