The Mathematical Laws of Morphology and Biomechanics

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Mechanics of Multi-articular Muscles

The geometry of the musculoskeletal system, such as moment arms and linkages, determines the link between muscular functions and external mechanical results. The musculoskeletal system of snakes is extremely complex, with several muscles which span dozens of vertebrae, and this span correlates with habitat: burrowing and aquatic species showing short spans while arboreal species show longer spans. Similar multi-articular spans are present in the prehensile tails of primates, the necks of birds, and our own digits. However, the mechanics of these multi-articular spans remains unclear, either relative to mono-articular configurations or compared to greater or lesser spans. This talk will examine the consequences of multiarticular morphology and how it is implemented in snakes, using a combination of mathematical modeling, physical models, contrast-enhanced CT scans, and muscle ultrastructure.