How Body Allometry Impacts Biomechanical Performance

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As an organism grows, its behaviors and abilities typically change because of their change in size. However, these changes are not always easily predictable because animals typically change shape as they grow (allometry) and face different pressures at different life history stages. For snakes, their simplified body form requires them to perform many different behaviors with the same muscles. For example, striking and constriction behaviors are accomplished by the same general axial musculature. These behaviors may face a biomechanical trade-off at the muscle level that likely translates to limitations in whole-body performance. Based on the fundamental limitations of skeletal muscles, we generally expect muscles to generate high forces or contract quickly, but not both. Here, using the Rosy Boa (Lichanura trivirgata), we quantified the speed and strength of predation performance by measuring striking and constriction performance during the same predation event. Our preliminary data shows that snake size played a significant role in most predation performance measures. Snake mass was positively related to peak constriction pressure, strike distance, and all measure of velocity and acceleration. However, constriction performance was not significantly related to any measure of strike performance but multiple strike variables were correlated with one another. The distance a snake had to travel toward its prey was directly related in the acceleration and velocity achieved. Therefore, snakes with greater strike distances had higher accelerations which resulted in greater overall velocities prior to making contact with prey.