

Mechanics and Energetics of In Vivo Muscle Function

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That the energy use by skeletal muscles during movement should be linked to their mechanical functions, seems like a trivial assertion. However, demonstrating these links, particularly for terrestrial legged locomotion, has been problematic. After a brief review of my previous work on the mechanical function of muscles in flying birds, swimming scallops, and calling and jumping frogs, I will focus on recent work on legged locomotion in birds. This work uses a set of integrative techniques to examine the mechanics and energy use by the leg muscle of birds during walking and running. The mechanical function of the muscles is estimated by global studies of the limb using inverse dynamics and also by studies of individual muscles with sonomicrometry and electromyography. Muscle energy use has been estimated using blood flow measured with microspheres. Several studies have focused on the cost of swing phase, which in guinea fowl represent 25% of the total cost of locomotion. Recent work has focused on stance and the cost of force production by the ankle extensors and digital flexors.