

Pinnation and Predation – Predicting the Effects of Muscle Architecture in an Ecological Context

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Physiology students generally hear much about muscle at the cellular level, but little about the quantitative influence of muscle architecture on the generation and transmission of force. In this exercise, students dissect crab claws and estimate force output by 1) measuring claw in-levers and out-levers; 2) measuring muscle lines of action to isolate appropriate force vectors; 3) and developing models to simplify calculations of anatomical and physiological muscle cross-sectional area. Students evaluate the effect of muscle pinnation by measuring angle of muscle fiber insertion and comparing predicted force generation of a pinnate to parallel fibered muscle. Finally, students consider muscle architecture in an ecological context – force generation by crab predators compared to shell strength in bivalve prey. This exercise combines detailed anatomy and simple quantitative modeling in a clear ecological context.

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