DFD10-2010-020031

Abstract for an Invited Paper
for the DFD10 Meeting of
the American Physical Society

Jet propulsion in animals: theoretical innovation and biological constraints[1]

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Jet propulsion is arguably the oldest and simplest form of animal locomotion, and simple hydrodynamic theory highlights the many possible ways in which animals might maximize speed and minimize metabolic cost while using jet propulsion to travel from one point to another. However, environmental and physiological reality constrains the potential for hydrodynamic innovation. We explore two heuristic examples: Antarctic scallops, in which ecological release from predation apparently constrains the evolution of improved locomotory capacity, and squids, in which the fundamental limitations of muscular contraction constrain the hydrodynamic efficiency of locomotion for all but a small range of sizes. Even simple forms of locomotion can be complex in a biological context.

[1]In collaboration with Luke Miller and Danna Staaf.