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Propulsive Performance Comparison of a Steady and Unsteady Self-Propelled Swimmer LYDIA RUIZ, California Institute of Technology, JOHN DABIRI, California Institute of Technology — Aquatic animals differ from typical engineering systems in their use of unsteady flow for locomotion. Researchers have long shown interest in designing devices that resemble their shape and propulsive behaviour. The purpose of this study is to make a direct, empirical comparison between biological and engineering propulsion systems. We designed an underwater vehicle that has the capability to produce either a steady or unsteady jet, akin to a squid and jellyfish, for propulsion while utilizing the same mechanical efficiency. The total efficiency is measured for both modes of propulsion. This avoids the need for direct measurement of propulsive efficiency and the associated use of quasi-steady models. Further analysis was conducted to investigate the importance of vortex ring formation during pulsation. The vehicle was attached to a force balance and the ratio of fluid overpressure to total impulse was measured as a function of dimensionless frequency during unsteady propulsion.

Lydia Trevino
California Institute of Technology

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