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Metabolic costs of enhancing propulsion in artificially controlled live jellyfish[1] NICOLE XU, JOHN DABIRI, Stanford University — Artificial control of animal locomotion has the potential to address previously inaccessible questions about the biology of swimming organisms and animal-fluid interactions, where we are otherwise limited to observations of natural behavior. This work presents a biohybrid robot that uses a self-contained microelectronic system to induce swimming in live jellyfish. By driving body contractions at an optimal frequency range faster than observed in natural behavior, swimming speed can increase nearly threefold, with only a twofold increase in cost of transport to the animal. Robotic control was also used to characterize the metabolic response of the jellyfish to swimming in the enhanced mode, and it was determined that the animals can sustainably support the associated metabolic costs. These experimental results are consistent with an adapted hydrodynamic model developed to characterize enhanced propulsion. This capability can potentially be leveraged in applications such as ocean monitoring, and to enable further studies of swimming organisms in more user-controlled, systematic experiments.

[1]NSF GRFP

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