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Lessons learned from the jellyfish: Fluid transport at intermediate Reynolds numbers JANNA NAWROTH, JOHN DABIRI, Caltech — Biologically inspired hydrodynamic propulsion and maneuvering strategies promise the advancement of medical implants and novel robotic tools. We have chosen juvenile jellyfish as a model system for investigating fluid dynamics and morphological properties underlying fluid transport by an elastic system at intermediate Reynolds numbers. Recently we have described how natural variations in viscous forces are balanced by changes in jellyfish body shape (phenotypic plasticity), to the effect of facilitating efficient body-fluid interaction. Complementing these studies in our live model organisms, we are also engaged in engineering a synthetic jellyfish, that is, a rhythmically actuated elastomer capable of generating efficient feeding and propulsion currents. The main challenges here are (1) to derive a body shape and deformation suitable for effective fluid transport under physiological fluid conditions, (2) to understand the mechanical properties of actuator and elastomer to derive a design capable of the desired deformation, (3) to establish adequate 3D kinematics of power and recovery stroke, and (4) to evaluate the performance of the design.

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