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Mechanical and scaling considerations for efficient jellyfish swimming ALEXANDER HOOVER, Tulane University, LAURA MILLER, BOYCE GRIFFITH, University of North Carolina at Chapel Hill — With a fossil record dating over half a billion years, jellyfish represent one of the earliest examples of how multicellular organisms first organized into moving systems. Lacking an agonist-antagonist muscle pairing, jellyfish swim via a process of elastic deformation and recoil. Jellyfish propulsion is generated via the coordinated contraction of its elastic bell by its coronal swimming muscles and a complementary re-expansion that is passively driven by stored elastic energy. Recent studies have found jellyfish to be one of the most efficient swimmers due to its low energy expenditure in their forward movement. Using an immersed boundary framework, we will further examine the efficiency of jellyfish swimming by incorporating material models that are informed by the musculature present in jellyfish into a model of the elastic jellyfish bell in three dimensions. The fully-coupled fluid structure interaction problem is solved using an adaptive and parallelized version of the immersed boundary method (IBAMR). This model is then used to explore how variability in the mechanical properties of the bell affect the work done by the bell as well as the cost of transport related to jellyfish locomotion. We then examine how the efficiency of this system is affected by the Reynolds number.

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