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Fluid dynamics of nutrient exchange through the branched arrays of sea fans and jellyfish oral arms LAURA MILLER, University of North Carolina at Chapel Hill — Numerous small organisms that swim, fly, smell, or feed in flows at the mesoscale, where inertial and viscous forces are balanced, rely on branched, bristled and hairy structures. Such mesoscale structures can augment particle capture and nutrient exchange by moving in a manner to transition from acting as solid surfaces to leaky/porous rakes at Reynolds numbers close to one. Although mesoscale flows have been studied in many organisms, the fluid dynamic mechanisms underlying the leaky rake to solid plate transition remain unclear. A detailed understanding of how this leaky-to-solid transition affects chemical exchange and particle capture in mesoscale filtering, where advective and diffusive transport rates are nearly balanced, also remains unavailable. In this presentation, flow visualization and computational fluid dynamics will be used to quantify the fundamental fluid dynamics of biological filtering arrays in this regime. Two types of marine invertebrates will be examined for understanding mesoscale biological filters: 1) upside-down jellyfish that use bell pulsations to filter particles within 3D bristled oral arms, and 2) sea fans that are branched into approximately 2D sheets.

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