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Microfluidic Mixing and Confined Flows with Biomimetic Cilia Arrays A.R. SHIELDS, B.L. FISER, Department of Physics and Astronomy, University of North Carolina at Chapel Hill, B.A. EVANS, Department of Physics, Elon University, R. SUPERFINE, Department of Physics and Astronomy, University of North Carolina at Chapel Hill — We present results on fluidic mixing produced by the collective beating of arrays of biomimetic cilia. Our artificial cilia are arrays of free-standing microstructures, at the scale of biological cilia, which we actuate with permanent magnets to mimic their biological counterparts. The presence of mixing in biological ciliated systems has been a subject of recent speculation, with possible implications for a variety of biochemical processes. We have observed that biomimetic cilia actuation induces fluid mixing within the cilia layer that can be characterized as an enhanced diffusivity. Due to the similarity in size and hydrodynamic regime between our system and biology, our results provide the first experimental suggestion of mixing in ciliated systems. In addition, we have mapped three-dimensional flows in confined fluidic cells that recreate the flows observed in the embryonic node, where cilia-driven fluid transport determines vertebrate left/right body asymmetry.

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