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Directed Fluid Transport and Mixing with Biomimetic Cilia Arrays A.R. SHIELDS, Universitiy of North Carolina - Chapel Hill, B.A. EVANS, Elon University, B.L. CARSTENS, M.R. FALVO, S. WASHBURN, R. SUPERFINE, University of North Carolina - Chapel Hill — We present results on the long-range, directed fluid transport and fluidic mixing produced by the collective beating of arrays of biomimetic cilia. These artificial cilia are arrays of free-standing nanorods roughly the size of biological cilia, which we fabricate from a polymer-magnetic nanoparticle composite material and actuate with permanent magnets to mimic biological cilia. Biological cilia have evolved to produce microscale fluid transport and are increasingly being recognized as critical components in a wide range of biological systems. However, despite much effort cilia generated fluid flows remain an area of active study. In the last decade, cilia-driven fluid flow in the embryonic node of vertebrates has been implicated as the initial left-right symmetry breaking event in these embryos. With silia we generate directional fluid transport by mimicking the tilted conical beating of these nodal cilia. By seeding fluorescent microparticles into the fluid we have noted the existence of two distinct flow regimes. The fluid flow is directional and coherent above the cilia tips, while between the cilia tips and the floor particle motion is complicated and suggestive of chaotic advection.

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