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Actuated cilial layers regulate deposition of microscopic solid particles RAJAT GHOSH, Georgia Institute of Technology, GAVIN A. BUXTON, Robert Morris University, O. BERK USTA, ANNA C. BALAZS, University of Pittsburgh, ALEXANDER ALEXEEV, Georgia Institute of Technology — We use computational modeling to examine the three-dimensional interactions between oscillating, synthetic cilia and microscopic solid particles in a fluid-filled microchannel. The synthetic cilia are elastic filaments that are tethered to a substrate and are actuated by a sinusoidal force, which is applied to their free ends. The cilia are arranged in a square pattern and a neutrally buoyant particle is initially located between these filaments. Our computational studies reveal that depending on frequency of the beating cilia, the particle can be either driven downwards toward the substrate or driven upwards and expelled into the fluid above the cilial layer. This behavior mimics the performance of biological cilia used by certain marine animals to extract suspended food particles. The findings uncover a new route for controlling the deposition of microscopic particles in microfluidic devices.

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