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Harnessing Passive Cilia for Surface Cleaning of Microfluidic Devices ANURAG TRIPATHI, HENRY SHUM, ANNA BALAZS, University of Pittsburgh — Many biological organisms, such as mollusks and corals, utilize active cilia to prevent settlement of various fouling agents and debris on their surfaces. Inspired by these examples, we investigate if passive, non-actuated cilia can be harnessed for surface cleaning applications by utilizing oscillations in the ambient flow. By mimicking the oscillating shear flow near a ciliated wall in a channel, we show, by means of computational modeling, that the waving motion of cilia due to the oscillations in the flow can repel sticky, adhesive particles away from the surface. The results can be understood by means of a theoretical model by considering the motion of a particle penetrating an oscillating elastic layer and accounting for elastic, adhesive and hydrodynamic forces on the particle. The findings suggest a novel surface cleaning and fouling prevention mechanism for microfluidic devices dealing with transport and processing of microparticles.

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