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Simulation of micro-organisms swimming near ciliated surfaces HENRY SHUM, ANURAG TRIPATHI, Department of Chemical and Petroleum Engineering, University of Pittsburgh, JULIA YEOMANS, Rudolf Peierls Centre for Theoretical Physics, University of Oxford, ANNA BALAZS, Department of Chemical and Petroleum Engineering, University of Pittsburgh — Ciliated tissues can be found lining the respiratory tract and Fallopian tubes in mammals. The main function of the cilia is to sweep objects such as the ovum, dirt or bacteria in a directed manner. The self-cleaning action of these tissues would be a desirable property for surfaces that are continually submerged and prone to biofouling. We therefore investigate the effect of artificially driven cilia on swimming organisms. In this study we use a 3-D immersed boundary approach, with the fluid flow solved by the lattice Boltzmann method and the immersed objects modeled as elastic structures. Two types of objects are considered: (i) cilia, which are driven by an external field, and (ii) bacteria, which are self-motile and propelled by a rotating helical flagellum. Placing a bacterial cell in the vicinity of a surface covered by an array of actuated cilia yields a rich system to explore. Of particular interest is the possibility of guiding the motion of bacteria towards, along or away from the ciliated surface.

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