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Microfluidic mixing using a heterogeneous array of actuated synthetic cilia[1] MATTHEW BALLARD, PUJA DE, ALEXANDER ALEXEEV, Georgia Institute of Technology — We use three-dimensional numerical simulations to examine mixing of an initially segregated viscous fluid solution in a microchannel containing a heterogeneous array of actuated synthetic cilia. We model the cilia as elastic filaments attached to the channel walls and actuated by an external periodic force. Fluid flow is modelled using a lattice Boltzmann model treating concentration as a scalar, coupled with a lattice spring model simulating the elastic cilia. To investigate the effects of the oscillating heterogeneous cilia on microfluidic mixing of fluid solutions of different diffusivity, we consider the effects of cilia relative size, elasticity, spacing, and oscillation pattern. We demonstrate that arrays of heterogeneous cilia can provide enhanced mixing over that achievable with a homogeneous array of identical cilia. Thus, our findings further the understanding of how heterogeneous arrays of active bio-mimetic structures can be used to enhance mixing in microfluidic devices.

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