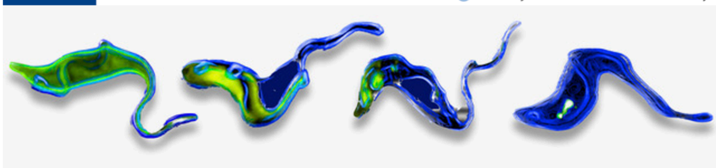

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Controlling bacterial swimming in wavy channels

The navigation of swimming microorganisms, such as bacteria, is guided by rheotaxis, their reorientation with respect to flow gradients. While recent investigations focused on the con- trol of passive particles, such as red blood cells, in spatially modulated and time-dependent flows [1–3], less is known about the behavior of swimming agents in such flows. We show that bacteria modeled by deformable microswimmers can accumulate in flows through straight microchannels either in their center or on previously unknown attractors near the channel walls. In flows through wavy microchannels, a wavy-induced swinging motion is revealed which can become resonant. As a consequence swimmers are distributed across the channel instead of accumulating at its center. We show that wavy-induced tumbling exhibits a much larger ampli- tude compared to tumbling in planar flows and is characterized by rapid, oscillatory patterns of motion along the lateral direction. Our results suggest new strategies for controlling the behav- ior of live and synthetic swimmers in microchannels. For example, the wavy channel provides a means for the separation of bacteria according to their properties, such as size or swimming speed, potentially aiding their selective elimination [4].

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