Abstract Submitted
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Relating microswimmer synthesis to hydrodynamic actuation and rheotactic tunability[1] ENKELEIDA LUSHI, Department of Mathematics, New Jersey Institute of Technology, QUENTIN BROSSEAU, Courant Institute, New York University, FLORENCIO BALBOA USABIAGA, Flatiron Institute, YANG WU, New York University, LEIF RISTROPH, Courant Institute, New York University, JUN ZHANG, MICHAEL WARD, MICHAEL J. SHELLEY, New York University — We explore the behavior of micron-scale autophoretic Janus (Au/Pt) rods, having various Au/Pt length ratios, swimming near a wall in an imposed background flow. We find that their ability to robustly orient and move upstream, i.e. to rheotax, depends strongly on the Au/Pt ratio, which is easily tunable in synthesis. Numerical simulations of swimming rods actuated by a surface slip show a similar rheotactic tunability when varying the location of the surface slip versus surface drag. Slip location determines whether swimmers are Pushers (rear-actuated), Pullers (front-actuated), or in between. Our simulations and modeling show that Pullers rheotax most robustly due to their larger tilt angle to the wall, which makes them responsive to flow gradients. Thus, rheotactic response infers the nature of difficult to measure flow-fields of an active particle, establishes its dependence on swimmer type, and shows how Janus rods can be tuned for flow responsiveness. We demonstrate the effectiveness of a simple geometric sieve for rheotactic ability.

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