

Abstract Submitted
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Swimming against the flow - An orientational disorder to order transition¹ CHIH-KUAN TUNG, Department of Biological & Environmental Engineering, Cornell University, FLORENCIA ARDON, Department of Biomedical Sciences, Cornell University, ALYSSA G. FIORE, BEE, Cornell, LIAN HU, SUSAN S. SUAREZ, BioSci, Cornell, MINGMING WU, BEE, Cornell — Micro-organisms often need to swim against fluid flows for their survival. In native state, mammalian sperm swim against a flow to reach the egg. Using bull sperm as a model system, we studied the impact of fluid flows on sperm swimming behavior. Interestingly, we find that a directional swimming pattern emerges as the fluid flow rate exceeds a critical value. Using the average directional vector, $\langle S_x \rangle$ or $\langle S_y \rangle$ of the sperm head, as an order parameter, and fluid flow rate (along x -axis) as a control parameter, we find that $\langle S_x \rangle$ or $\langle S_y \rangle$ increases continuously with the increase of flow rate above the onset point, following a power law with an exponent close to 0.5. We will discuss the sources of this transition, and implications in both physics and biology.

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