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Sperm Motility in Flow JEFFREY GUASTO, GABRIEL JUAREZ, ROMAN STOCKER, MIT — A wide variety of plants and animals reproduce sexually by releasing motile sperm that seek out a conspecific egg, for example in the reproductive tract for mammals or in the water column for externally fertilizing organisms. Sperm are aided in their quest by chemical cues, but must also contend with hydrodynamic forces, resulting from laminar flows in reproductive tracts or turbulence in aquatic habitats. To understand how velocity gradients affect motility, we subjected swimming sperm to a range of highly-controlled straining flows using a cross-flow microfluidic device. The motion of the cell body and flagellum were captured through high-speed video microscopy. The effects of flow on swimming are twofold. For moderate velocity gradients, flow simply advects and reorients cells, quenching their ability to cross streamlines. For high velocity gradients, fluid stresses hinder the internal bending of the flagellum, directly inhibiting motility. The transition between the two regimes is governed by the Sperm number, which compares the external viscous stresses with the internal elastic stresses. Ultimately, unraveling the role of flow in sperm motility will lead to a better understanding of population dynamics among aquatic organisms and infertility problems in humans.

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