

Abstract Submitted
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Viscoelasticity promotes collective swimming of sperm¹ CHIH-KUAN TUNG, Dept of Physics, North Carolina A&T State Univ, BENEDICT B. HARVEY, 1, ALYSSA G. FIORE, 2, FLORENCIA ARDON, 1, SUSAN S. SUAREZ, 1 Dept of Biomed Sci, Cornell Univ, MINGMING WU, 2 Dept of Biol & Environ Eng, Cornell Univ — From flocking birds to swarming insects, interactions of organisms large and small lead to the emergence of collective dynamics. Here, we report striking collective swimming of bovine sperm, with sperm orienting in the same direction within each cluster, enabled by the viscoelasticity of the fluid. A long-chain polyacrylamide solution was used as a model viscoelastic fluid such that its rheology can be fine-tuned to mimic that of bovine cervical mucus. In viscoelastic fluid, sperm formed dynamic clusters, and the cluster size increased with elasticity of the polyacrylamide solution. In contrast, sperm swam randomly and individually in Newtonian fluids of similar viscosity. Analysis of the fluid motion surrounding individual swimming sperm indicated that sperm-fluid interaction is facilitated by the elastic component of the fluid. We note that almost all biological fluids (e.g. mucus and blood) are viscoelastic in nature, this finding highlights the importance of fluid elasticity in biological function. We will discuss what the orientation fluctuation within a cluster reveals about the interaction strength.

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