Abstract Submitted
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Running and tumbling with E. coli in polymeric solutions[1] ALISON PATTESON, Department of Mechanical Engineering, SEAS, University of Pennsylvania, ARVIND GOPINATH, Department of Physics and Astronomy, Haverford College, PAULO ARRATIA, Department of Mechanical Engineering, SEAS, University of Pennsylvania — Bacteria commonly utilize a run-and-tumble swimming behavior to navigate through complex environments such as mucus in the lungs or digestive system. This swimming behavior has been extensively studied in water-like fluids; yet, investigations on the role of particles or polymers in the ambient fluid on the run-and-tumble behavior are limited. Here, we experimentally investigate the swimming dynamics of E. coli in polymeric solutions. We find that small amounts of polymer drastically change the run-and-tumble behavior of E. coli cells, significantly enhancing translational diffusion and reducing rotational diffusion. The average cell velocity increases with polymer concentration (and viscosity) and the mean run times are enhanced. By varying polymer molecular weight and visualizing interactions between single E. coli and fluorescently-stained DNA-polymer molecules, we show that enhanced translation is a result of two mechanisms: (1) suppression of cell wobbling due to elasticity and (2) enhancement of run times due to viscosity. Our results show that the transport of chemotactic cells can be independently modified by viscosity and elasticity.

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Alison Patteson
Univ of Pennsylvania

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