Abstract Submitted
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Elasto-hydrodynamics of the gliding motion of myxobacteria JOEL TCHOUFAG, Departments of Chemical and Biomolecular Engineering Environmental Science, Policy, and Management, UC Berkeley, CA 94720, PUSHPITA GHOSH, TIFR Center for Interdisciplinary Sciences, Hyderabad 500075, India, CONNOR POGUE, BEIYAN NAN, Department of Biology, Texas A&M University, College Station, TX 77843, KRANTHI MANDADAPU, Department of Chemical and Biomolecular Engineering, UC Berkeley, CA 94720 — The mysterious "A-motility of myxobacteria has long been a mystery, since no appendage is involved in its motion known as gliding. Several studies in molecular microbiology have identified a number of structural features of this motion: 1) A trail of a nanometer slime film secreted underneath the bacteria 2) the shape of this rod-like bacteria, and 3) the soft substrate over which the gliding motion occurs. Using the above mentioned features, we present a mechanism for the gliding of myxobacteria. In our theory, we consider a thin slime film bounded on the top by a bacterial membrane displaying a traveling wave and on the bottom by a deformable substrate. Enforcing the lift force on the bacteria to vanish, we obtain the velocity of bacteria to be dependent on the so-called softness parameter. Using the celebrated lubrication approximation for the slime coupled to linear elastic theory for the substrate, we show that the velocity of bacteria is proportional to the shear modulus in the limit of very stiff substrates. More surprisingly, we find that the velocity is independent of substrate stiffness for softer substrates. Our results are validated with experimental measures of the gliding speed of M. xanthus cells on agar pads at various concentrations.

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