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Pili-driven surface motility of Myxococcus xanthus MAXSIM GIBIANSKY, UCLA Bioengineering, WEI HU, UCLA School of Dentistry, KUN ZHAO, UCLA Bioengineering, HONGWEI PAN, WENYUAN SHI, UCLA School of Dentistry, KARIN DAHMEN, UIUC Physics, GERARD WONG, UCLA Bioengineering — Myxococcus xanthus is a common, rod-shaped soil-dwelling bacterium with complex motility characteristics. In groups, M. xanthus bacteria can move via social "S" motility, in which the Type IV Pili (TFP) attach to secreted exopolysaccharides (EPS). We examine this motility mechanism using high-framerate video acquisition, taking data on individual bacteria at 400 frames per second; using particle tracking algorithms, we algorithmically reconstruct the bacterial trajectories. The motion of a single bacterium as it is pulled by its TFP through the EPS layer on the surface is not smooth, but instead displays distinct plateaus and slips, with a wide range of plateau and slip lengths. The distribution of slips exhibits power law scaling, consistent with a crackling noise model; crackling noise has previously been used to model nonbiological systems such as earthquake dynamics and Barkhausen noise. We show quantitative agreement between mean field friction models and observed bacterial dynamics. We demonstrate that the crackling noise behavior of M. xanthus is strongly dependent on the presence of EPS, but is unaffected by the chemotactic behavior of the bacterium; we also demonstrate velocity coupling between pairs of bacteria in the early stages of social motility.

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