Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

The multifunctional roles of Type IV pili in bacterial surface motility FAN JIN, JACINTA CONRAD, VERNITA GORDON, MAXSIM GIBIANSKY, GERARD WONG — In *Pseudomonas aeruginosa*, a commonly-studied model for biofilm formation, type IV pili mediate two different mechanisms of surface motility: a "crawling" mechanism, in which the bacterium moves parallel to the surface with high directional persistence; and a "walking" mechanism, in which a vertically-oriented bacterium moves rapidly but with low directional persistence. To characterize these mechanisms with high spatial and temporal resolution, we develop a novel tracking method called 'two focus tracking' which allows us to quantitatively estimate the tilt angle between a single bacterium and the surface. By analyzing the motion of Δ*fliM*, a flagella-deficient isogenic knockout mutant of *P. aeruginosa*, we demonstrate that a single bacterium can switch between the "walking" and "crawling" mechanisms. To elucidate the role of pili in crawling, we show that the velocity profiles of single trajectories can be decomposed into alternating "pulses" and "square waves." The direction of alternation "pulses and "square waves" are significantly correlated. We show how these observations can be explained by cooperative deployment of multiple pili.

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Date submitted: 23 Nov 2009 Electronic form version 1.4