

Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

A kinematic description of the trajectories of *Listeria monocytogenes* propelled by actin comet tails DHANANJAY TAMBE, VIVEK SHENOY, Brown University — The bacterial pathogen *Listeria monocytogenes* propels itself in the cytoplasm of the infected cells by forming a filamentous comet tail assembled by the polymerization of the cytoskeletal protein, actin. While a great deal is known about the molecular processes that lead to actin based movement, most macroscale aspects of motion, including the nature of the trajectories traced out by the motile bacteria are not well understood. *Listeria* moving between a glass-slide and cover slip in a *Xenopus* frog egg extract motility assay is observed to display a number of geometrically fascinating trajectories including sine curves, serpentine shapes, circles, and a variety of spirals. We have developed a dynamic model that provides a unified description of these seemingly unrelated trajectories. A key ingredient of the model is a torque (not included in any microscopic models to date) that arises from the rotation of the propulsive force about the body-axis of the bacterium. The trajectories of bacteria executing both steady and saltatory motion are found to be in excellent agreement with the predictions of our dynamic model. When the constraints that lead to planar motion are removed, our model predicts motion along regular helical trajectories, observed in recent experiments. We discover from the analysis of the trajectories of spherical beads that the comet tail revolves around the bead.

Dhananjay Tambe
Brown University

Date submitted: 03 Dec 2006

Electronic form version 1.4