Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

The swimming behavior of flagellated bacteria in viscous and viscoelastic media[1] ZIJIE QU, Brown University, RENE HENDERIKX, Eindhoven University of Technology, KENNETH BREUER, Brown University — The motility of bacteria E.coli in viscous and viscoelastic fluids has been widely studied although full understanding remains elusive. The swimming mode of wild-type E.coli is well-described by a run-and-tumble sequence in which periods of straight swimming at a constant speed are randomly interrupted by a tumble, defined as a sudden change of direction with a very low speed. Using a tracking microscope, we follow cells for extended periods of time and find that the swimming behavior can be more complex, and can include a wider variety of behaviors including a "slow random walk" in which the cells move at relatively low speed without the characteristic run. Significant variation between individual cells is observed, and furthermore, a single cell can change its motility during the course of a tracking event. Changing the viscosity and viscoelasticy of the swimming media also has profound effects on the average swimming speed and run-tumble nature of the cell motility, including changing the distribution, duration of tumbling and slow random walk events. The reasons for these changes are explained using a Purcell-style resistive force model for the cell and flagellar behavior as well as model for the changes in flagellar bundling in different fluid viscosities.

[1]National Science Foundation

Zijie Qu
Brown University

Date submitted: 26 Jul 2016 Electronic form version 1.4