Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Geometric effects induce anomalous size-dependent bacterial transport in structured environments POOJA CHOPRA, APS, DAVID A. QUINT, Lawrence Livermore National Laboratory, AJAY GOPINATHAN, BIN LIU, University of California, Merced — Variations of transport efficiency in structured environments between distinct individuals in a bacterial community is both hard to study and poorly understood. Here, we demonstrate the sensitive size-dependence of bacterial swimming in a micropillar array by using a tracking microscope to follow individual cells over extended durations. Using a non-tumbling E. coli strain, we show that long-term transport switches from a trapping dominated state for shorter cells to a much more dispersive state for longer cells above a critical bacterial size set by the pillar array geometry. Using a combination of experiments and modeling, we show that this anomalous size-dependence arises from an enhancement of the escape rate from trapping for longer cells caused by nearby pillars. Our results show that geometric effects can lead to bacterial size being a sensitive tuning knob for bacterial transport in structured environments. Our results therefore have implications for the morphological adaptation of bacteria to structured habitats and can provide insights into the design of metamaterials for controlling the transport of bacteria at the single-cell level.

Pooja Chopra
University of California, Merced

Date submitted: 10 Aug 2020 Electronic form version 1.4