CENTER FOR RESEARCH IN SOFT MATTER & POLYMERS

# CRiSP SEMINAR

Monday, Oct. 28, 2019

10:00 a.m.

366 Colburn Lab

## *"Random Walks, Hydrodynamic Interactions, and Molecular Memory in Bacteria"*

Brownian motion limits the amount of control bacteria have over their movements. To improve the odds of reaching a nutrient source, bacteria have evolved an elegant intracellular signaling pathway – the chemotaxis network – and a motility apparatus – the flagellum. Together, they enable the cell to make temporal comparisons of chemical signal levels and to bias its random walk in response. To successfully migrate in a preferred direction, the bug needs a short-time memory of the current signal levels. I will present our recent discoveries with the gut-dwelling *E. coli* that demonstrate a novel function for this memory. With the aid of *in vivo* single motor biophysical assays, Förster resonance energy transfer, microfluidics, and genetic engineering, we have found that chemotactic memory induces a biphasic response to indole, an important gastrointestinal tract metabolite. When indole levels are high, *E. coli* seems to love its taste. When indole levels are low, *E. coli* would rather avoid it. I will discuss how such metabolites might influence the development of microbial niches in the gut. In contrast, our measurements of hydrodynamic interactions of individual *Helicobacter pylori* cells with no-slip boundaries together with the time reversibility of Stokes flows indicate that this memory may not be relevant for *H. pylori*-chemotaxis. How do *H. pylori* cells ever find their way?


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Dr. Pushkar Lele is an assistant professor at the Department of Chemical Engineering, Texas A&M University. He obtained his B.S. in Chemical Engineering from UDCT, Mumbai (India) and a Ph.D. in Chemical Engineering from the University of Delaware as a student in Professor Eric Furst's group. His postdoctoral training was in Biophysics in Professor Howard Berg's group at Harvard University. His work has been published in journals such as Nature Physics, Science Advances, Current Biology, and PNAS. His research is supported by multiple R01 awards (NIGMS-NIH), the High Risk High Impact Award from the Cancer Prevention Research Institute of Texas, and the DOD.

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