Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Navigating through complex networks by sniffing gradients: diffusiophoresis vs. chemotaxis JINZI MAC HUANG, TANVI GANDHI, ANTOINE AUBRET, DESMOND LI, SOPHIE RAMANANARIVO, MASSIMO VERGASSOLA, JEREMIE PALACCI, University of California San Diego — At the beginning of life, searching for food and evading hazards are two essential activities for microorganisms to survive, and the way they navigate is through chemotaxis. The optimal chemotaxis in complicated terrains determines the fate of living creatures, and natural selection ensures the existence of such an optimization. In our study, we investigate the navigation of inert particles in a network that has multiple junctions. In micro-networks manufactured through photolithography, a background gradient of salt is established as the signal of chemoattractant by placing a source and a sink of salt. Colloidal particles then follow this signal through diffusiophoresis and move towards the source. Through stochastic modeling, we show that particles prefer to exit each junction at the end with higher concentration gradient. This preference is further enhanced when the particle size is larger, which leads to a way to magnify small signals in a network so that the colloidal particles larger than a critical size can always move towards the source of salt through the shortest path. Ultimately, we compare the navigation schemes of inert particles and living organisms, aiming to understand biological chemotaxis and shed light on future manufacturing of navigable microswimmers.

Jinzi Mac Huang
University of California San Diego

Date submitted: 18 Jul 2019 Electronic form version 1.4