

PHYSICAL MATHEMATICS SEMINAR

Adapting to life in diffusive gradients

ALEXANDER PETROFF

Clark University

ABSTRACT:

For billions of years, waterlogged sediment has hosted microbial ecosystems. Over the eons, microbes have evolved diverse strategies to mitigate the physical stresses imposed by the slow diffusion of nutrients and the difficulties of navigating a heterogeneous environment. Here we consider two such strategies. In the first example, the most powerful swimmer of the bacterial world stirs its chemical environment to overcome diffusion limitation. In the second case, multicellular bacteria navigate the labyrinthine pore space by aligning their locomotion with the geomagnetic field. In both cases, we show how the efficacy of these strategies can be quantitatively understood using simple physical reasoning. We argue that natural selection has acted to tune dimensionless combinations of the cells' physiological parameters (e.g., swimming speed, size, and magnetic moment) and the environmental parameters (e.g., viscosity, pore geometry, and diffusion coefficients of metabolites).

TUESDAY, APRIL 11, 2023

2:30 PM – 3:30 PM

Building 2, Room 449

<http://math.mit.edu/seminars/pms/>