DEPARTMENT OF MATHEMATICAL SCIENCES

Applied Math Seminar

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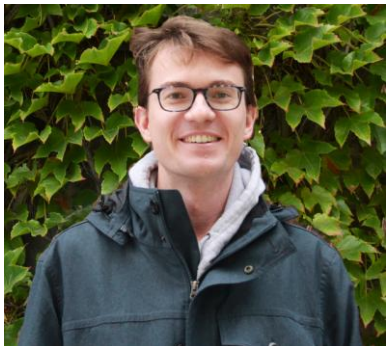

Title: Bacterial biofilms are spore Jell-O

Abstract: Bacterial biofilms are communities of polymer-encased cells that thrive in nearly every earthly environment. Within these communities, cells differentiate into heterogeneous states of gene expression, much like in multicellular organisms. It is an open question how the conditions within biofilms, such as nutrient levels and cell density, control the phenotypic states of cells and, in turn, how these diverse cells determine biofilm-level properties like 3D morphology. We ask this question in biofilms composed of *Bacillus subtilis*. Specifically, we investigate the formation of dormant spores. We find that in biofilms, sporulation starts early and sporulation progresses outward through the colony as a traveling wave. Using time-lapse imaging and an active fluid model of biofilm growth and spore formation, we show that the distribution of spores within the colony is controlled by the colony's physical expansion rate. Despite being mostly dormant spores, colonies create large 3D wrinkles. With biophysical experiments and a simple model, we show that this morphology emerges through soft matter physics: before sporulation, cells secrete extracellular matrix polymers that turn biofilms into gels. The competing effects of osmotic swelling and polymer cross-linking create strain that is relieved through wrinkling. Our results demonstrate the fundamental interplay of cell-level gene regulation and colony-scale physics in controlling the composition of cellular communities.

Thursday, September 24

1:00 – 2:00 pm

Stratton 313

WPI