

Workshop on Bacterial-Material Interactions and Communication

Department of Polymer Science and Engineering, UMass Amherst May 16, 2019

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Moderator: Mark Tuominen, Co-PI (Physics); Speaker: Sloan Siegrist, Co-PI (Microbiology)

Objective: This workshop will identify needs and opportunities in the field of bacteria-material communication. The workshop will address applications where bacteria-material interactions can be manipulated towards a productive goal, such as waste remediation, energy production, and the production of specialty compounds.

Background: Supported by a \$1M grant from the National Science Foundation, a team at UMass led by Maria Santore in the Polymer Science and Engineering Department, is working to control bacteria-surface interactions and response, to enable the ultimate creation of bacteria-integrated devices. Ongoing studies probe and manipulate the signaling communication between cells, bacterial communities, and microelectronics.

Areas to be advanced in this workshop include:

Surface coatings for bacterial control

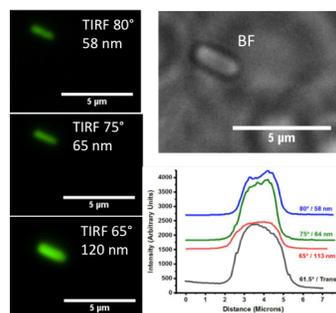
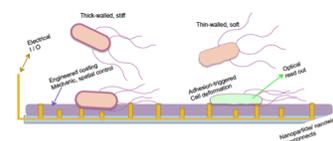
- identifying the initial mechanical and electrical signals that enable bacteria to distinguish a surface
- determining how bacteria sense the mechanical character of their environment
- probing how chemical and mechanical surface interactions couple to elicit bacterial response at an interface
- designing coatings that manipulate bacteria by mechanical means

Signal transmission / transduction in bacterial cells and communities

- determining how weak electrical signals elicit changes and response in bacterial cells
- identifying how electrical signals couple with mechanical signals in producing a cellular response
- determining how electrical and mechanical surface signals are transmitted between cells

New tools and methods

- microscopy and scattering methods to probe the cells and the buried interface between adherent bacteria and a material
- advanced scanning microscopy methods to probe the micro- and nano-mechanical properties of interacting bacteria
- organisms with engineered cell walls and controlled stiffnesses
- reporter organisms and single-cell bacterial readouts



Invited Speakers Include:

Joel Kralj, U. Colorado "The Electrophysiology of Bacteria"

Amy Heintz, Batelle "Exchange Across the Abiotic-Biotic Interface:

Applications in Health, Environment, Infrastructure and National Security"

Karine Gibbs, Molecular and Cellular Biology, Harvard "Surface-

surfing with a few million friends: how identity information influences bacterial collective motility"

John Katsaras, Oak Ridge National Lab "Neutron Scattering from Bacteria"

Denis Bendejacq, Solvay, "TBD"

With additional Round Table participants from E-Ink, Army Futures Command, UMass