Northeastern University
College of Engineering

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Distinguished Seminar Speaker

Life in a tight spot: Spying on bacteria in complex spaces

Prof. Sujit Datta

Prof. of Chem. Engineering, BioE, & Biophysics| California Institute of Technology| Pasadena, CA

Abstract: Bacteria are arguably the simplest form of life; and yet, as multi-cellular collectives, they perform complex functions critical to environment, food, health, and industry. What principles govern how complex behaviors emerge in bacterial collectives? And how can we harness them to control bacterial behavior? In this talk, I will describe my group's work addressing this question using tools from soft matter engineering, 3D imaging, and biophysical modeling. We have developed the ability to (i) directly visualize bacteria from the scale of a single cell to that of an entire multi-cellular collective, (ii) 3D-print precisely structured collectives, and (iii) model their large -scale motion and growth in complex environments. I will describe how, using this approach, we are developing new ways to predict and control how bacterial collectives — and potentially other forms of "active matter" — spread large distances, adapt shape to resist perturbations, and self-regulate growth to access more space by processing chemical information in their local environments.

Biography: Sujit Datta is Professor of Chemical Engineering, Bioengineering, and Biophysics at Caltech. Prior, he was at Princeton University, where he started his faculty career in 2017 and was promoted to Associate Professor of Chemical and Biological Engineering in 2022.

Sujit earned a BA in Mathematics and Physics and an MS in Physics in 2008 from the University of Pennsylvania, and then a PhD in Physics in 2013 from Harvard, where he studied fluid dynamics and instabilities in soft and disordered media with Dave Weitz. His postdoctoral training was in Chemical Engineering at Caltech, where he studied the biophysics of the gut with Rustem Ismagilov.

The Datta Lab studies the dynamics, self-organization, and applications of complex, soft (“squishy”), and living systems, with a focus on complex fluids, gels, and bacterial communities/active matter, motivated by challenges in biotechnology, energy, environment, and medicine. Their work integrates microscopy, microfluidics, materials science, and biophysical characterization with theoretical & computational modeling, applying ideas from fluid and solid mechanics, colloidal science, polymer physics, statistical mechanics, and network science. Altogether, this research program has revealed and shed new light on the fascinating behaviors manifested by complex fluids and bacterial populations in complex environments, guiding the development of new approaches to environmental remediation, energy production, agriculture, water security, and biotechnology.

Sujit’s scholarship has been recognized by awards from a broad range of different communities, reflecting its multidisciplinary nature, including through the AIChE Allan P. Colburn and 35 Under 35 Awards, three awards from the APS (Early Career Award in Biological Physics, Andreas Acrivos Award in Fluid Dynamics, and Apker Award), Pew Biomedical Scholar Award, Society of Rheology Arthur Metzner Award, ACS Unilever Award, Camille Dreyfus Teacher-Scholar Award, NSF CAREER Award, and multiple commendations for teaching. In addition to leading professional activities for a number of scientific societies and agencies, Sujit serves on the editorial boards of Annual Reviews of Condensed Matter Physics and the Journal of Non-Newtonian Fluid Mechanics.

Department of Chemical Engineering
201Cullinane Hall
Northeastern University
360 Huntington Avenue
Boston, MA 02115