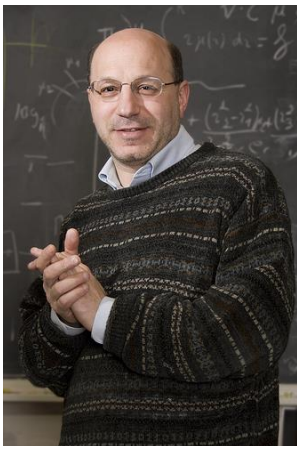
UCLA Engineering
HENRY SAMUELI SCHOOL OF ENGINEERING AND APPLIED SCIENCE

BIOENGINEERING

PRESENTS

Some Insights into the Mechanical World of Bacteria and Biofilms



WEDNESDAY, MARCH 16, 2016
12:00 PM – 1:00 PM
2101 ENGINEERING V

Howard Stone, Ph.D.

Princeton University

Professor and Chair, Department of Mechanical and Aerospace Engineering

ABSTRACT:

In this talk I describe various problems involving the intersection of fluid mechanics and bacterial biofilms. In particular, I highlight our studies of the influence of fluid motion on surface-attached bacteria and biofilms. In one example we identify and characterize upstream migration of surface-attached bacteria in a flow. In a second example we study the formation of biofilm streamers, which are filaments of biofilm extended along the central region of a channel flow; these filaments are capable of causing catastrophic disruption and clogging of industrial, environmental and medical flow systems. Third, we highlight the influence of flow on quorum sensing, which refers to bacterial communication and collective behavior regulated by secreted chemicals. Our results suggest that bacterial colonization and biofilm development under flow can lead to heterogeneous QS activation, which promotes diversity in the genetic programmes that bacteria enact. As a consequence, genetically identical bacteria exhibit remarkably different behaviours at particular regions and at particular times under flow. Finally, we provide a glimpse into single-cell imaging of living biofilms, which highlights cellular ordering that is controlled by cell-to-surface and cell-to cell adhesion.

BIOGRAPHY:

Professor Howard A. Stone received the Bachelor of Science degree in Chemical Engineering from the University of California at Davis in 1982 and the PhD in Chemical Engineering from Caltech in 1988. Following a postdoctoral year in the Department of Applied Mathematics and Theoretical Physics at the University of Cambridge, in 1989 Howard joined the faculty of the (now) School of Engineering and Applied Sciences at Harvard University, where he eventually became the Vicky Joseph Professor of Engineering and Applied Mathematics. In 1994 he received both the Joseph R. Levenson Memorial Award and the Phi Beta Kappa teaching Prize, which are the only two teaching awards given to faculty in Harvard College. In 2000 he was named a Harvard College Professor for his contributions to undergraduate education. In July 2009 Howard moved to Princeton University where he is Donald R. Dixon '69 and Elizabeth W. Dixon Professor in Mechanical and Aerospace Engineering Professor Stone's research interests are in fluid dynamics, especially as they arise in research and applications at the interface of engineering, chemistry, physics, and biology. In particular, he is well known for developing original research directions in microfluidics including studies and applications involving bubbles and droplets, red blood cells, bacteria, chemical kinetics, etc. He received the NSF Presidential Young Investigator Award, is a Fellow of the American Physical Society (APS), and is past Chair of the Division of Fluid Dynamics of the APS. For ten years he served as an Associate Editor for the Journal of Fluid Mechanics, and is currently on the editorial or advisory boards of New Journal of Physics, Physics of Fluids, Langmuir, Philosophical Transactions of the Royal Society, Soft Matter, and is co-editor the (new) Soft Matter Book Series. He is the first recipient of the G.K. Batchelor Prize in Fluid Dynamics, which was awarded in August 2008. He was elected to the National Academy of Engineering in 2009, the American Academy of Arts and Sciences in 2011 and the National Academy of Sciences in 2014.