2006 William G. Lowrie Lecturer

Alice P. Gast
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Alice P. Gast is the Robert T. Haslam Professor of Chemical Engineering and the Vice President for Research and Associate Provost at Massachusetts Institute of Technology. Prior to moving to MIT in 2001, she spent sixteen years as a professor of chemical engineering at Stanford University and at the Stanford Synchrotron Radiation Laboratory. In her research she studies surface and interfacial phenomena, in particular the behavior of complex fluids. Some of her areas of research include colloidal aggregation and ordering, protein lipid interactions and enzymes reactions at surfaces. In 1997 she co-authored the sixth edition of "Physical Chemistry of Surfaces." with Arthur Adamson.

Professor Gast received her BS in Chemical Engineering from the University of Southern California. After earning her Ph.D. in Chemical Engineering from Princeton University, Gast spent a postdoctoral year on a NATO fellowship at the École Supérieure de Physique et de Chimie Industrielles in Paris. She returned there for a sabbatical as a Guggenheim Fellow. She was a 1999 Alexander von Humboldt Fellow at the Technical University in Garching, Germany. She received the National Academy of Sciences Award for Initiative in Research, and the Colburn Award of the American Institute of Chemical Engineers. She was elected to the National Academy of Engineering in 2001 and to the American Academy of Arts and Sciences in 2002. She has served on numerous advisory committees including the NRC Board on Chemical Science and Technology, Board of Directors of the American Association for the Advancement of Science, and the Homeland Security Science and Technology Advisory Committee.

WILLIAM G. LOWRIE LECTURES

OSU Department of Chemical and Biomolecular Engineering
Lecturer: Dr. Alice P. Gast

Lecture I: April 27, 2006
Room 207, Koffolt Lab, 11:30 AM

LECTURE I: Proteins and Enzymes at Membrane Interfaces

Organization in colloidal, macromolecular and biological systems is driven by intermolecular interactions that can be mediated by the solution conditions. An understanding of the intermolecular forces governing protein assembly on and within model membranes will help elucidate the physical processes governing cell membranes. The ordering of proteins in two-dimensions is of particular interest as a fundamental model of phase transitions and self-assembly. It is also a phenomenon found in nature on the surface of some bacteria and phages.

We are studying the structure, morphology and dynamics of two-dimensional streptavidin crystals bound to lipid membranes. We show how changing the solution composition can alter the crystal structure and morphology. Producing these crystals on the surface of vesicles mimics the protein coats on cell surfaces. We see the influence of an ordered layer of proteins on the mechanical properties, permeability and shape of vesicles.

There are other situations where surface-associated proteins alter the local membrane composition. Membrane phase separations create domains, known as lipid rafts, that alter the membrane properties such as fluidity and local curvature. Transitions like these on cell surfaces can be caused by enzymes that react with lipids and cause phase separation. We will describe our investigation of these phase transitions on model supported lipid bilayers and vesicle membranes.

EVERYONE IS WELCOME TO ATTEND THE LECTURES

Lecture II: April 28, 2006
Room 330, Koffolt Lab, 11:30 AM

LECTURE II: Chemical Engineering: Evolution and Innovation

Chemical engineering has been a versatile discipline that has prepared its graduates for a wide variety of careers. Our core values in fundamental physics, chemistry and mathematics have served us well for decades. The recent surge in activity in interdisciplinary work has been very beneficial to chemical engineers who have excelled in many broad fields of research.

In this seminar I will present my views of the opportunities and challenges facing chemical engineering departments in the coming decades. I will discuss the need to balance a strong core discipline while embracing interdisciplinary activities. I will describe some developments in the chemical engineering research that can aid us in evolving our curriculum. I will also mention the growing context of the global workplace and the need to offer international opportunities to our students.