



Department of Chemical Engineering Seminar Series

Tuesday, October 27, 2009

Presentation: 1:30 p.m., 1017 H.H. Dow

Refreshments to Follow: 3062 H.H. Dow (MSE Conference Room)

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Infection Development in the Cardiovascular System: Critical Roles for Bacterial Adhesion and Biofilm Formation

Staphylococcus aureus is a widespread human pathogen that is a common cause of blood-borne cardiovascular infections including endocarditis, wound and biomaterial-centered infections. The heavy use of antibiotics in treating staphylococcal infections has led to a rise in the number of antibiotic resistant strains and recently strains have emerged that are resistant to all known antibiotics. Therefore, novel strategies to combat staphylococcal infections are becoming increasingly important. Approaches that target virulence determinants yet to do put selective pressure on the organism to evolve are of particular interest. However, such strategies require a detailed understanding of the molecular events involved in pathogenesis.

For this microbe and others, adhesion to extracellular matrix, blood or endothelial cells, or protein-coated biomaterials is the first step toward vascular infection. Adhesion events occur under dynamic shear conditions and can eventually lead to tissue colonization, biofilm formation and metastatic seeding through the bloodstream to other sites by planktonic (suspended) cells. Once a biofilm has developed, the ability of the host's immune system to combat the infection is greatly reduced and antibiotic treatment becomes dramatically less effective. Unfortunately, the basic physical and molecular mechanisms that underlie the adhesive interactions of *S. aureus* both at surfaces and in bulk flow remain poorly understood. In addition, while it is commonly known that bacteria growing as a biofilm are phenotypically different than planktonic cells, a fundamental understanding of how the phenotypes differ in staphylococci is lacking. Therefore, the long-term goal of our research is to provide a comprehensive characterization of *S. aureus* adhesion under physiologically relevant shear conditions. In addition, we seek to understand how bacterial mode of growth (biofilm versus suspension) influences the adhesion processes.

This presentation will provide an overview of ongoing research in my laboratory including the characterization of *S. aureus* – blood cell interactions and biofilm development. Our approach uses controlled, dynamic, *in vitro* experimental systems to systematically and comprehensively examine the importance of blood components, blood flow, protein surfaces, and bacterial growth conditions in the development and spread of blood-borne infections. The understanding gained from such an approach will provide a rational basis for the design of new approaches to control and treat staphylococcal infections.

The Chemical Engineering Seminar Series is sponsored in part by the Dow Chemical Company



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