

CBIMMS Invited Seminar
**Co-Sponsored by the Center for Biomolecular and Tissue
Engineering**

*“Biomimetic Vascular Engineering:
Using Concepts from Nature to Design New Biomaterials”*

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ABSTRACT

The abundance of complex macromolecular and supramolecular structures in Nature provides lessons in structural hierarchy and functional efficiency that are being explored and exploited in the development of novel biomimetic strategies for creating new biomaterials for cardiovascular applications. The new materials are intended to overcome the problems of current biomaterials, which suffer from surface-induced thrombosis and excessive “foreign body” wound healing. Recent advances in molecular biology, materials science, and nanoscale characterization tools have provided the scientific basis for bio-engineering macromolecular structures, not just at the level of composition, but in creating materials with structural hierarchy or supramolecular properties. Mimicking and adapting structural concepts from Nature to create new biomaterials that incorporate molecular recognition and self-assembly will be the central theme of this presentation. We have developed a biomaterial architecture using “surfactant polymers” that undergo surface and self-induced assembly on hydrophobic surfaces. Our biomimetic designs benefit from understanding the structural and functional properties of the corresponding system in Nature. One example is the external region of a cell membrane, known as the glycocalyx, which is dominated by a complex milieu of glycosylated molecules. The glycosylated molecules direct specific interactions such as cell-cell recognition, and provide an important physical basis for maximizing steric repulsion that prevents undesirable non-specific cell and molecular adhesions. Conversely, understanding the nature of a cell’s adhesive interactions with the extracellular matrix facilitates design of biomimetic materials with cell adhesion properties, which can be examined under physiologic shear conditions. Using these biomimetic concepts, we have designed and studied oligosaccharide and peptide surfactant polymers that provide suppression of non-specific protein interactions and facilitate well-controlled interactions with endothelial cells.