UNIVERSITY OF ALBERTA
FACULTY OF MEDICINE & DENTISTRY

BME Dissertation Seminar

Department of Biomedical Engineering

Date : Tuesday, Aug 8, 2017
Time : 12 noon
Venue: Room 1075 Research Transition Facility

"Title: Human Plasma Adsorption to Biomaterials: Fundamental Level Chemical Modifications and Their Effects on Biocompatibility"

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Chair: Dr. UNSWORTH, Larry

Abstract:

The non-specific adsorption of proteins to biomaterials is a process that begins instantly upon implantation and results in the formation of a protein-rich layer coating the biomaterial surface. The consequences of this complex phenomenon are far-reaching and may affect both the biomaterial performance and the health of the host. Though this phenomenon has been studied for 50 years, our understanding is far from complete. The difficulty lies in the myriad of biomaterials designed for various applications along with the complexity of the adsorption event given the hundreds of proteins found in blood, their complex structure-function relationships and their potential interactions with one another.

Studies of protein adsorption to biomaterials with well characterized chemical modifications can be used to elucidate how molecular level modifications may impact protein adsorption. To this end, platelet poor human plasma was exposed to a variety of biomaterials, each with specific variations in their chemistry, and the composition of the adsorbed protein corona was evaluated using the highly sensitive and specific Western blotting method. Among the tested biomaterials were conventional thermogelling polymer hydrogels, bioactive glasses and polymer nanoparticles. Additionally, a novel suite of self-assembling protein biopolymer nanoparticles were developed to systematically examine the effects of chain length, guest amino acid chemistry and particle size on plasma protein adsorption as well as macrophage viability and phagocytosis.

The studies reported herein revealed the safety or potential for deleterious host response for a variety of biomaterials and demonstrated the utility of short, marginally soluble protein biopolymers as biocompatible nanoscale delivery vehicles. Detailed analysis indicated that certain chemical modifications led to significant variations in immune, phagocytic and clotting responses. Taken together, these works reveal methods by which to modulate host response and contribute to the development of a generalized model of biomaterial-protein adsorption.

All are welcome