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Development of Particulates Capable of Penetrating Physiological Barriers & the In Vitro Systems Used for their Analysis

Friday, May 1
107 Robinson
11:45am – 1:00pm

Refreshments will be served

ABSTRACT Despite the fact that nanoparticulate systems have been widely used in biomedical applications such as drug delivery over the past several decades, their implementation and success has largely been limited. Central to this obstacle are that the interactions between nanoparticles and their biological surroundings are often overlooked during the design process. Physiological barriers that are known to hinder nanoparticles transport include mucosal layers present in organs such as the lungs or cervix, tumor parenchyma (bulk), and the blood-brain barrier. The ongoing research in my group seeks to addresses these challenges in order to bridge the gaps in knowledge that restrict the success of nanoparticle therapeutics. The development of novel nanoparticle systems and/or the use of specific penetrating agents can lead to effective delivery of a therapeutic payload to a target site in the body which would otherwise not be easily reached. Thus, our research focuses on the rational design of nanoparticulates by modifying their penetration properties via surface modification or the application of nanocomposites. In particular, this currently involves three primary particular systems including (i) systemically-delivered tumor-penetrating chemotherapeutic-loaded nanoparticles used in the targeting and treatment of cancer and (ii) mucus-penetrating dry powder aerosol nanocomposite microparticles used for the treatment of pulmonary diseases such as cystic fibrosis and pulmonary hypertension, and (iii) tumor-penetrating dry powder aerosol nanocomposite microparticles used for the treatment of lung cancer. We have successfully generated and characterized the nanoparticles involved in these systems and are currently working to finalize this work through their *in vitro* characterization. Unfortunately, the *in vitro* systems used to characterize drug delivery vehicles, in particular those for aerosol lung cancer therapeutics, are not physiologically representative. As a result, we are developing *in vitro* methods involving air-grown multicellular tumor spheroids to overcome this constraint. The overarching goal of this research is to provide nanoparticle systems and tools for the development of intelligently designed therapeutics capable of targeting and penetrating physiological barriers of several types.

BIOGRAPHY Dr. Meenach is originally from Kentucky and obtained her B.S., M.S., and Ph.D. in chemical engineering from the University of Kentucky. Her doctoral research focused on the development of magnetic hydrogel nanocomposites for the treatment of cancer via hyperthermia and drug delivery. Following a postdoctoral scholar position in the College of Pharmacy at The Ohio State University, Samantha returned to Kentucky as a NIH NCI Cancer Nanotechnology (CNTC) Postdoctoral Trainee in the Colleges of Pharmacy and Engineering. There her research focused on the development of aerosol nanotherapeutics for the treatment of lung cancer. Since starting at URI in the fall of 2013, the work of the Meenach group has focused on the development of aerosol therapeutics for the treatment of pulmonary diseases as well as *in vitro* techniques for the analysis of these systems. Outside of academics, Samantha is an avid reader and loves camping and running. She resides in Richmond, Rhode Island with her husband (a drummer!) and her four crazy cats.