**The 2018 John D. Ferry Lectures**

**in Physical Chemistry**



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Monday, January 29, 2018

4:00 pm - 1610 E. Hall, Engineering

Reception to follow in atrium outside seminar hall

***Nanolayered Drug Release Systems for Regenerative Medicine and Targeted Nanotherapies***

Alternating electrostatic assembly is a tool that makes it possible to create ultrathin film coatings that contain highly controlled quantities of one or more therapeutic molecules within a singular construct. These release systems greatly exceed the usual ranges of traditional degradable polymers, ranging from 10 to as high as 40 wt% drug loading within the film. The nature of the layering process enables the incorporation of different drugs within different regions of the thin film architecture; the result is an ability to uniquely tailor both the independent release profiles of each herapeutic, and the order of release of these molecules to the targeted region of the body. We demonstrate the use of this approach to release or present signaling molecules such as growth factors and siRNA and DNA to regulate genes to facilitate tissue regeneration in-situ, address soft tissue wound healing, deliver vaccines from microneedle surfaces, or administer targeted nanotherapies that are highly synergistic for cancer treatments. New developments in targeted cancer therapies for ovarian, lung and brain cancers will be addressed. Translation of these concepts to nanomaterials design for the penetration of difficult physiological barriers, including cartilage penetration for osteoarthritis, will be described.

Tuesday, January 30, 2018

11:00 am - Room 1315 Chemistry

***Attochemistry***

***Functionalizable Polypeptides and Polymeric siRNA Smart Delivery***

The controlled polymerization of N-carboxyanhydride monomers provides a means of generating synthetic polypeptides; however, until recently, only native amino acids were incorporated along the backbone. Our lab introduced an alkyne functionalized monomer, propargyl-L-glutamate, that enables the use of click chemistry post-polymerization, thus allowing the generation of a broad range of different functional side groups. Poly(propargyl-L-glutamate) (PPLG), and similar polypeptides subsequently introduced, has enabled a broad range of new approaches to designing artificial polypeptide systems with properties that engage or mimic biology. On the other hand, interesting new biological macromolecules can be engineered from nucleic acids. Newer synthetic methods in our laboratory include the use of rolling circle transcription to create periodic-shRNA (pshRNA) consisting of hundreds of repeat units that spontaneously assemble into RNAi microsponges. We have found that these polymeric forms of siRNA can yield activation of immunological pathways that facilitate further tumor cell death, while also inducing knockdown of targeted genes. Applications of these systems toward active or responsive drug delivery applications will be discussed.