Paula T. Hammond is the David H. Koch Chair Professor in Engineering and the Head of the Department of Chemical Engineering at Massachusetts Institute of Technology. She is a member of MIT’s Koch Institute for Integrative Cancer Research, the MIT Energy Initiative, and a founding member of the MIT Institute for Soldier Nanotechnology. Hammond research involves electrostatics and interactions to generate functional materials with highly controlled architecture, nanotechnology development of new biomaterials to enable drug delivery from surfaces with spatio-temporal control, novel responsive polymer architectures for targeted nanoparticle drug and gene delivery, and self-assembled materials systems for electrochemical energy devices. Hammond was elected into the National Academy of Medicine and the Class of the American Academy of Arts and Sciences, and is an Associate Editor of ACS Nano. She was the recipient of the AIChE Charles M. A. Stine Award, the Alpha Chi Sigma Award for Chemical Engineering Research, and the Department of Defense Ovarian Cancer Teal Innovator Award. She was one of the Top 100 materials scientists named by Thomson-Reuters and named a Fellow of APS, AIMBE, and ACS Polymer Division.

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**Polyelectrolyte 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 therapeutic, 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.