‘Mix and match’: local delivery of protein-based biologics using responsive microgels

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Abstract

Protein-based biologics, particularly antibodies, are of growing interest owing to their specificity and therapeutic efficacy, especially for many conditions that traditionally have been difficult to treat (*e.g.*, metastatic cancer, misregulated wound healing). The use of multiple therapeutics, combination therapies, that target different aspects of disease mechanisms can be particularly effective; however, such therapies have a significant risk of systemic toxicity owing to the high total doses that must be used. Responsive hydrogels offer a facile platform for the local, controlled release of these large, hydrophilic proteins for the design of personalized combination therapies while minimizing adverse side effects. Specifically, in this talk, I report the development of mixed populations of hydrogel microparticles, or microgels, for achieving tunable and tailorable release profiles of antibodies *in vitro* and *in vivo*. Microgels of uniform size and relevance for local injection were created using microfluidic devices. To achieve tunable and on-demand release profiles, microgels that respond to either internal (*i.e.*, reducing microenvironments) or external (*i.e.*, light) cues were designed. Modular building blocks, multifunctional polymers with a variety of chemical handles, were used to create mixed populations of microgels that localize to desired tissues and release multiple therapeutics across a range of time scales.

Biography

Professor April M. Kloxin, Ph.D., is Centennial Development Professor of Chemical and Biomolecular Engineering at the University of Delaware (UD) and a member of the Breast Cancer Research Program at the Helen F. Graham Cancer Center and Research Institute. She obtained her B.S. (Summa Cum Laude) and M.S. in Chemical Engineering from North Carolina State University and Ph.D. in Chemical Engineering from the University of Colorado, Boulder, as a NASA Graduate Student Research Program Fellow. She trained as a Howard Hughes Medical Institute postdoctoral research associate at the University of Colorado before joining the faculty at UD in 2011. Her group aims to create unique materials with multiscale property control for addressing outstanding problems in human health. Her research currently focuses on the design of responsive biomaterials with multiscale properties and development of controlled, dynamic models of disease and regeneration. Her honors include a NIH Director’s New Innovator Award, ACS PMSE Arthur K. Doolittle Award, Susan G. Komen Foundation Career Catalyst Research award, NSF CAREER award, and a Pew Scholars in Biomedical Sciences award.