

‘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.