Biomedical Discussion Group

In situ gelling and printable hydrogels for tissue engineering and diagnostics

Thursday November 16, 2017
1:00 –2:00 pm, Science Teaching Complex, 1019 (STC-1019)
Coffee and Cookies available - RSVP required

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Abstract: Hydrogels have been widely used in a variety of biomedical and biosensing applications due to their favourable mechanical properties (mimicking those of soft tissues in vivo while facilitating high sensor flexibility), typically low non-specific protein adsorption (minimizing inflammation in vivo and reducing sensor interference), and capacity for controlling diffusion (enabling prolonged drug release in vivo and non-covalent biomolecule immobilization on biosensors). However, the elasticity of conventional pre-formed hydrogels limits their capacity to be delivered via injection in vivo or printed in 2D or 3D geometries to develop functional sensor coatings or structured biomaterials. In this context, in situ-gelling hydrogels that can spontaneously gel following mixing of functionalized precursor polymers can substantially expand the scope of potential hydrogel applications. In this presentation, I will discuss recent work from my laboratory focused on designing and exploiting the properties of hydrazone crosslinked poly (oligoethylene glycol methacrylate) (POEGMA) hydrogels formed by simple mixing of hydrazide and aldehyde-functionalized POEGMA oligomers. The hydrazone crosslinking chemistry is kinetically independent from body chemistry and enables fast (as low as <1 s) gelation times, amenable to printing applications. In tissue engineering, these properties allow for the direct fabrication of cell-loaded nanofibrous scaffolds supporting cell propagation even after freezing and/or the alignment cell growth and differentiation along a defined axis. In biosensor applications, such hydrogels can be self-assembled or ink jet printed on cellulose-based supports to create high-resolution paper-based lateral flow bioassays for antigen detection and printed multiwell bioassay plates for high-throughput drug screening.

Biosketch: Todd Hoare received a B.Sc. (Eng.) in Engineering Chemistry from Queen's University in 2001 and a Ph.D. in Chemical Engineering from McMaster in 2006. Dr. Hoare's work has been profiled by Popular Science, Maclean's, and BBC for its potential in solving clinical challenges through innovative smart materials design. He has won an NSERC Innovation Challenge award recognizing the novelty of his research. [Full Bio]

Keywords: hydrogels, biosensors, biomaterials, tissue engineering, nano scaffolds, smart materials

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