



College of Liberal Arts and Sciences
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Luminescent Polymer Nanoparticles for Diagnostics and Imaging

Abstract: Smartphones are now ubiquitous, and are more common than clean drinking water in some developing countries and remote communities. Where healthcare resources are limited, there is a need for diagnostic tools that are both inexpensive and readily available. Fluorescent polymer nanoparticles – termed polymer dots, or Pdots, have recently been shown to have sufficient brightness to be visible by a smartphone camera for fluorescence-based assays. In this lecture, the design and synthesis of new multifunctional Pdot probes for use in bioanalysis as diagnostic tools will be described. Pdots with near-infrared fluorescence capable of selective binding to breast cancer cells suitable for imaging in the biological transparency window (650 – 1350 nm) will be demonstrated. New Pdot technologies taking advantage of thermally activated delayed fluorescence (TADF) for time-gated imaging will also be described, allowing one to eliminate background fluorescence from biological tissues or secondary dyes. We will also show how single-chain polymer nanoparticles (SCPNS) can be used to give Pdots that can deliver a targeted drug payload with high specificity. Deep-red fluorescent polymer dots functionalized with a cell-penetrating peptide mimic will also be described, capable of entering a variety of mammalian cells with low cytotoxicity for time-gated imaging. Finally, we will demonstrate how commercial smartphones can be adapted for Pdot-based bioanalysis, with the goal of improving the accessibility of complex healthcare tools in rural and developing communities.

Bio: Zachary M. Hudson is an Associate Professor and Canada Research Chair in Sustainable Chemistry at the University of British Columbia. Zac completed his B.Sc. at Queen's University in Kingston, Ontario. He remained at Queen's to pursue a Ph.D. in Inorganic Chemistry under the supervision of Prof. Suning Wang, focusing on the development of luminescent materials for organic electronics. During his Ph.D. he also held graduate fellowships at Jilin University in China as well as Nagoya University in Japan. He then moved to the University of Bristol as a Marie Curie Postdoctoral Fellow with Prof. Ian Manners, followed by a second Postdoctoral Fellowship at the California

Nanosystems Institute at the University of California, Santa Barbara with Prof. Craig Hawker. He joined the faculty at UBC in 2015, where he holds the Canada Research Chair in Sustainable Chemistry. He leads a research program in synthetic materials chemistry, studying topics ranging from solutions for energy-efficient displays and light sources to the self-assembly of electronic materials on the nanoscale. He was the recipient of the ACS Herman Mark Young Scholar Award and Polymer International-IUPAC Award in 2022.