DREXEL UNIVERSITY
Materials Science and Engineering
College of Engineering

Winter Seminar Series

Engineering Semiconductor Quantum Dots for Biomedical Imaging Applications

Allison Dennis, PhD
Assistant Professor, Biomedical Engineering,
Materials Science and Engineering
Boston University

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PISB 104

Fluorescence imaging has significant potential for clinical applications such as fluorescence guided surgery, but traditional fluorophores lack brightness, stability, and multiplexing capability in the near infrared (NIR), where tissue depth imaging is most effective. Quantum dots (QDs) are semiconductor nanoparticles with ideal optical properties for biomedical imaging applications, but currently lack a path towards clinical translation. In my presentation, I will outline current limitations to QD translation including in their function, toxicity, and bioaccumulation and discuss my group's efforts to tackle each of these issues. Specifically, we investigate multiplexed photoluminescence in the NIR and SWIR, the toxicity of various QD compositions, and the promise of biodegradable QDs to avoid bioaccumulation. We are concomitantly using imaging phantoms to validate QD-based dual probe-imaging for the quantification of tumor biomarkers in vivo. Our recent results demonstrate the potential for QDs to be translated for clinical imaging applications as well as the areas that still require significant materials innovation.

Professor Allison Dennis is an assistant professor in the Department of Biomedical Engineering and Division of Materials Science and Engineering at Boston University. Her research group uses materials design principles to develop semiconductor nanoparticles for specific applications in biosensing and biomedical imaging. In particular, the Dennis Lab develops antibody-free fluorescence assays for small molecule analyte detection and quantification and is developing the contrast agents and image processing tools to use NIR- and SWIR-emitting quantum dots for multiplexed tissue depth imaging. Prof. Dennis has won multiple fellowships and awards including a Full-Maintenance Fulbright Scholar Award, National Defense Science and Engineering Graduate Fellowship, Ocean Optics Young Investigator Award, and a KL2 Faculty Training Fellowship. The Dennis Lab appreciates past and current support from intramural and extramural sources including DARPA, NSF, NIH, and the BU Clinical and Translational Science Institute.