

ABSTRACT:

From Speckles to Spectra: Using new optical contrasts to reveal label-free biomarkers of disease in the clinic.

We're entering a new era in clinical research and care where non-invasive optical technologies make it possible to continuously monitor physiology with minimal disruption to daily life. In this talk, I will share how our lab is developing label-free biophotonic systems that unlock novel biomarkers for disease diagnosis and monitoring. I'll begin by introducing our work on speckle contrast optical spectroscopy (SCOS), an emerging technique that uses long-coherence light and 2D sensor arrays to non-invasively track microvascular blood flow. We're engineering SCOS to enable cuffless, continuous blood pressure monitoring, with the accuracy and robustness needed for both clinical and at-home settings. I will highlight our strategies for boosting SCOS sensitivity and speed and discuss our progress toward a wearable SCOS platform for the real-world. I'll then turn to our work with spatial frequency domain imaging (SFDI), which we're applying to detect and quantify skin fibrosis in systemic sclerosis (Scleroderma), a debilitating autoimmune disease with few quantitative diagnostic or prognostic tools. I will show how SFDI enables us to map sub-surface dermal remodeling over large areas, offering new metrics for disease staging and therapy monitoring. Finally, I'll describe our efforts to miniaturize this technology into a handheld clinical device, positioning it for integration into routine care and clinical trials. Finally, I will discuss my role as editor-in-chief of the new journal SPIE Biophotonics Discovery, highlighting both the opportunities and challenges, and offer perspectives on the evolving landscape of scientific publishing.

BIOGRAPHY

Darren Roblyer is a Professor of Biomedical Engineering at Boston University, where he leads a research program at the intersection of optics, engineering, and medicine. He earned his B.S. in Biomedical Engineering from Johns Hopkins University and a Ph.D. in Bioengineering from Rice University, where he trained under Rebecca Richards-Kortum. He completed postdoctoral research at the Beckman Laser Institute at UC Irvine with Bruce Tromberg, now Director of the NIH's National Institute of Biomedical Imaging and Bioengineering (NIBIB). Dr. Roblyer's research centers on translational diffuse optical imaging and spectroscopy. His lab develops wearable and remote monitoring technologies, along with advanced frequency-domain near-infrared spectroscopy systems, to enable label-free, non-invasive measurement of deep tissue metabolism and molecular composition. His interdisciplinary team works closely with clinicians to address urgent unmet needs in medicine. He is currently leading multiple clinical studies in cancer, cardiovascular disease, kidney disease, and autoimmune disorders. His contributions have been recognized with numerous honors, including the Department of Defense Era of Hope Scholar Award and the NIH Trailblazer Award. He also serves as the founding Editor-in-Chief of SPIE Biophotonics Discovery, a new journal dedicated to advancing the field of biophotonics.

DEPARTMENT OF BIOMEDICAL ENGINEERING

2025 Fall Seminar Series

Dr. Darren Roblyer
Professor of Biomedical Engineering
Boston University

THURSDAY November 20, 2025
11am-12pm
ESB 121



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For questions, please contact
Visar Ajeti at visar.ajeti@uconn.edu
or Darcy Richard at Darcy.Richard@uconn.edu