



Department of  
Biomedical Engineering  
UNIVERSITY OF WISCONSIN-MADISON

## Spring 2019 Seminar Series

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# Unraveling Tissue Morpho-Functional Metabolic Secrets Using Label-Free Two-Photon Imaging

**Irene Georgakoudi, Ph.D.**  
**Professor of Biomedical Engineering**  
**Tufts University**



Cellular metabolism is essential for tissue function; conversely, metabolic dysfunction is associated with numerous afflictions, including cancer, obesity, cardiovascular and neurodegenerative diseases. Current techniques used widely in the lab and the clinic to assess metabolic state or either highly invasive or lack the resolution to monitor changes that occur at the cellular or subcellular level. Label-free, non-linear microscopic imaging approaches are well suited to fill this gap, and help us to assess essential metabolic function processes non-destructively, without interfering with the specimen, with high spatial resolution, and dynamically over time. I will present an overview of studies that we have been pursuing in my group that aim to exploit endogenous sources of optical contrast to yield quantitative metrics of metabolic function and organization. Specifically, I will demonstrate the use of two-photon excited fluorescence images acquired based on the detection of an endogenous signal from NADH and FAD to acquire detailed information regarding redox state and mitochondrial fragmentation. I will also discuss the combined use of such optical metabolic readout changes to gain insights regarding alterations in the specific metabolic pathways that led to them, including glycolysis, glutaminolysis, uncoupling, fatty acid oxidation and synthesis. Finally, I will illustrate how such information can be used to assess adipose tissue function and to identify pre-cancerous lesions.

*Irene Georgakoudi has been working on the use of lasers for therapeutic and diagnostic applications since her undergraduate years. She started as a physicist at Dartmouth College and continued her graduate studies in Biophysics at the University of Rochester. Her interests in spectroscopy and spectroscopic imaging using endogenous sources of contrast were founded during her postdoctoral years at the MIT Spectroscopy Lab. After working on the development of fluorescence-based in vivo flow cytometry while an Instructor at the Wellman Laboratories for Photomedicine at Massachusetts General Hospital/Harvard Medical School, she moved to Tufts in 2004. She is the author of several patents on the development and use of spectroscopy and imaging to characterize tissues or to detect specific populations of cells and has published numerous peer-reviewed manuscripts, review articles and book chapters in these topics. She is the recipient of a Claflin Distinguished Scholar, an NSF Career, and an American Cancer Society Research Scholar award. She has served on the Board of Directors of the Optical Society of America and is the Director of the Tufts Advanced Microscopic Imaging Center (TAMIC).*



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12 PM in Tong Auditorium (1003 Engineering Centers)