



College of Engineering
Department of
Mechanical & Industrial Engineering

The Robert W. Courter Seminar Series

3:00-4:00pm, Friday, February 19th, 2021

ZOOM: <https://lsu.zoom.us/meeting/register/tJApd-mhqzssHNAtbx8xlujIXfCf28JLgcJB>



High resolution optical imaging and modeling of collagen architecture alterations in human diseases

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Many human diseases including all cancers, fibroses, cardiovascular disease and connective tissue disorders are characterized by alterations in the collagen organization relative to normal tissues. We have developed Second Harmonic Generation (SHG) microscope experimental and computational tools to selectively and specifically probe all levels of collagen architecture. These include machine learning analysis of collagen fiber architecture as well as computational and simulation approaches to characterize sub-resolution macromolecular structure. In both ovarian cancer and idiopathic pulmonary fibrosis, we found significant differences in collagen relative to that in normal tissues. We also describe an optical method to 3D print models of the collagen fiber architecture in these diseased tissues, where we use the corresponding SHG images as “blueprints.” These tissue-engineered scaffolds are then used to study the effects of collagen remodeling on cell-matrix interactions including migration, cytoskeletal dynamics, and other signaling pathways. Collectively we found that the diseased collagen architecture has significant effects on resulting biological response. This combination and imaging and modeling collagen alterations is a versatile approach to study biological processes in a variety of diseases at the single cell level.

* **Paul J. Campagnola** obtained his PhD in Chemistry from Yale University in 1992 after which he was a postdoctoral associate at the University of Colorado from 1992-1995. He was on the faculty in the Department of Cell Biology, Center for Cell Analysis and Modeling at the University of Connecticut Health Center from 1995-2010, having adjunct appointments in the Physics Department and Biomedical Engineering Program. In 2010 became an Associate Professor in Departments of Biomedical Engineering and Medical Physics at the University of Wisconsin-Madison and was promoted to Professor in 2013. He is currently the Tong Biomedical Engineering Department Chair and UW Kellett Faculty Fellow. He is a Fellow of the Optical Society of America and American Institute for Medical and Bioengineering. His research is focused on studying structural and functional aspects of the extracellular matrix (ECM), where we have developed optical microscopy instrumental and analysis methods to study problems in basic science as well as those with translational potential. He has over 95 peer-reviewed journal articles, several review articles and book chapters, co-edited a book “Second Harmonic Generation microscopy” and given over 100 invited talks. He serves on the editorial board for the Journal of Biomedical Optics and serves on numerous NIH and NSF review panels.