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"Revealing the True Colors of Cancer with Label-Free Simultaneous Multimodal Nonlinear Optical Imaging" Dr. Stephen Boppart, Ph.D.

Stephen Boppart is a Professor and Grainger Distinguished Chair in Engineering at the University of Illinois Urbana-Champaign in the Departments of Electrical and Computer Engineering, Bioengineering, and the Carle Illinois College of Medicine. His Biophotonics Imaging Laboratory develops novel optical biomedical imaging technologies and translates these into clinical applications. Prof. Boppart received his Ph.D. in Medical and Electrical Engineering from MIT, his M.D. from Harvard Medical School, and specialty training in Internal Medicine. Prof. Boppart is a Fellow of AAAS, IEEE, Optica, SPIE, AIMBE, BMES, and IAMBE, has co-founded five start-up companies, and is an elected member of the National Academy of Inventors. Prof. Boppart is concurrently serving as Director of the university's Interdisciplinary Health Sciences Institute, the GSK Center for Optical Molecular Imaging, and the national NIH/NIBIB P41 Center for Label-free Imaging and Multiscale Biophotonics (CLIMB).

Innovations in biomedical imaging have historically led to new discoveries in the life sciences and new detection and diagnostic technologies in medicine and surgery. Label-free intraoperative and intravital optical imaging, and imaging of fresh, unstained, resected tissue specimens, offer a wealth of new biomarkers for assessing the tumor microenvironment and diagnosing disease. Using nonlinear optics to generate new excitation wavelengths and manipulate the light stimulus in new ways, Simultaneous Label-free Auto-fluorescence Multi-harmonic (SLAM) microscopy can achieve fast and simultaneous visualization to reveal the rich intrinsic molecular and metabolic features within tissues. In addition, quantitative machine/deep learning analyses of these multi-dimensional datasets can be used to identify more selective clinical biomarkers for cancer. In particular, tumor-associated extracellular vesicles (EVs) were segmented using fully convolutional networks and analyzed via their optical signatures and spatial distributions. With new ARPA-H support for Precision Surgical Interventions, the integration and clinical demonstration of label-free optical coherence tomography and these nonlinear imaging techniques suggests the broad potential of these imaging technologies for real-time intraoperative surgical guidance and decision-making, and for the slide-free histopathological assessment of living biopsy specimens.

DATE: February 27, 2025 at 3:30 p.m.

LOCATION: 302 Bioengineering Building, Medical University of South Carolina
(Zoom link available for all locations.)

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