

*Stephenson School of Biomedical Engineering*  
*Seminar Series Presents*

**ENGINEERING OPTICAL IMAGING SYSTEMS FOR  
SPECIALTY MEDICAL APPLICATIONS**



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**ABSTRACT**

The use of optics in medicine is the largest single technology sector in that exists, as part of every major device company, and part of most point-of-care therapeutics. Specialized cameras and the principles of machine learning and machine vision are more and more being deployed within medicine. The advances in surgical guidance and cancer therapy are at the cutting edge of these. An example is structured light imaging for margin detection, where the principle of high spatial frequency scatter is illustrated as highlighting the contrast of tumor associated collagen structures. This example uses the principles of coded aperture imaging and postprocessing of the image to pull out unique contrast and dynamic range that is not otherwise available from simple diffuse imaging of tissue. Another example is in molecular guided surgery, where fluorescence system design is used to capture signals that are specific to the molecular tagging fluorescent molecules present in the tissue. This latter example is now widespread and growing throughout many subspecialties of surgery. Principles of time of flight imaging are also evolving and potentially allow for subsurface imaging over wide areas, to give the surgeon insight into the tissues just below the surface that they are imaging. Finally, examples of time-gated imaging are illustrated to image tissue oxygen and radiation therapy dosimetry. Taken as a whole, the design of illumination and detection allows for maximization of the signal and sensitivity to the constituents of the disease being treated.

**BIO**

Brian W. Pogue is the endowed MacLean Professor of Engineering at Dartmouth College and is an Adjunct Professor of Surgery in the Geisel School of Medicine, at Dartmouth. He is co-director of the Translational Engineering in Cancer Program at the Norris Cotton Cancer Center at the Dartmouth-Hitchcock Medical Center. His work is in the role of optics in medicine, withing biomedical engineering and medical physics, radiation therapy dosimetry, molecular guided surgery, photodynamic therapy and optically activated therapies. He has published over 400 peer-reviewed publications and is the Editor-in-Chief of the Journal of Biomedical Optics. He recently founded companies DoseOptics LLC, making the world's first camera to image radiotherapy, and Quel Imaging LLC making standards for surgical guidance. His role in innovation and translation of biomedical engineering is focused on transformational change in current paradigms.