SPECIAL SEMINAR

Optical Molecular Imaging Technologies for Surgery & Radiation Therapy Guidance

Brian Pogue, PhD
Professor, Engineering, Physics & Astronomy, and Surgery
Dartmouth College, Hanover, NH
Hosted by: Ryerson University (Dr. Alexandre Douplik) and Techna (Dr. David Jaffray)

December 21, 2015
4:00 pm - 5:00 pm
Princess Margaret Cancer Centre, 610 University Avenue room 1B-615 (Red Room)

ASTRACT

Molecular guidance of cancer therapy could provide more specificity and higher likelihood of success in therapeutic outcomes, yet is largely undeveloped beyond PET fluorodeoxyglucose imaging. In this talk, methods and unique imaging systems being developed to advance molecular guidance towards metabolic and immunologic targeting are discussed. The imaging is compared to the contrast possible with conventional structural x-ray and MRI based approaches. One of the largest areas of R&D is for molecular probes that target cancer cell immune expression, however these often suffer of non-specific uptake issues from tumor enhanced permeability & retention. The use of ratiometric approaches to imaging receptor binding are demonstrated in lymph nodes and resected breast cancer tissue. In radiation oncology, radiation dose imaging has been shown to be possible from gamma-ray and electron interactions emitting Cherenkov light, and this is a unique way to verify dosimetry in radiation therapy. The major potential benefit of Cerenkov imaging is that it is a way to image beams in real time. As such, it is feasible to image treatment beams in water tanks dynamically, and create composite visualizations of the treatment plans. This imaging can be used to verify new treatment plans prior to application to patients, or to quickly verify new machines, or testing in situations where access is limited. In human imaging studies, two clinical trials have been completed to image surface emissions in real time during therapy. In the first case, whole breast irradiation was followed for fractionated therapy in 12 patients. Finally, molecular imaging using the radiotherapy-induced Cerenkov as an internal tissue excitation system is shown, allowing high–resolution sensing of metabolites. This is demonstrated in tissue phantoms as well as mouse studies, sensing molecular oxygen in lymph nodes in vivo. The extension of this to molecular guidance of radiation therapy seems feasible, or for using Cerenkov sensing as a diagnostic tool for cancer.

BIOGRAPHY

Brian Pogue is Professor of Engineering, Physics & Astronomy, and Surgery at Dartmouth College in Hanover, NH, where he is director of MS and PhD Programs in Engineering. He has a Ph.D. in Medical/Nuclear Physics from McMaster University, Canada, was a post-doctoral fellow at the Massachusetts General Hospital. At Dartmouth since 1996, founded the Imaging and Interventional Technologies Research Center at Dartmouth, focusing on advance optical imaging technologies in cancer management. He has published over 300 peer-reviewed papers and 400 conference proceedings in imaging, tomography, surgery, medical oncology and radiotherapy. His NCI funded research includes a P01 and several R01 grants. He is currently an editorial board member for *Physics in Medicine & Biology, Medical Physics*, the *Journal of Biomedical Optics*, and *Breast Cancer Research* and was elected a fellow of the Optical Society of America in 2013.