Department of Biomedical Engineering
UNIVERSITY OF WISCONSIN–MADISON

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Seminar Series

Imaging Oxygen in Cancer: for Radiotherapy & Surgery

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Chair
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Oxygen is one of the ubiquitous molecules in life, but yet one of the most challenging to quantify. This is because of the temporal and spatial microheterogeneity and because most tools developed to measure it only access a small fraction of the information, or worse, alter the measurement as it is happening. This talk will review tools for this purpose, and focus on molecular sensors for oxygen measurement that have applications in science and medicine.

In the field of surgical oncology, many advances have occurred in the field of molecular guidance, where fluorescence from reporters can add important specificity of the signal. The breadth of systems being developed and advanced for fluorescence guidance in surgery is growing rapidly, and a review of these and their technical capabilities will be given. A recent discovery has been made that protoporphyrin IX (PpIX) shows that fluorescence can be produced only in areas of hypoxia with time-gated fluorescence capture. This delayed fluorescence emission lifetime exists when going from oxygenated to hypoxic tissue, and the advancement of this technique is one of the few ubiquitous metabolic signals from most oncologic tissues.

In the field of radiation therapy, a rapidly emerging aspect is what is called 'FLASH' radiotherapy, where the dose to tissue is given in milliseconds. It has been shown that this approach radically changes the radiobiological response, sparing normal tissues. The mechanism for this is implicated to be oxygen consumption effects during the irradiation, and a range of tools have been used to quantify this. The effect of oxygen dynamics in radiotherapy will be shown, and methods to quantify the dominance of oxygen in the damage is being discovered.

ABOUT the SPEAKER

Brian W. Pogue, PhD is the Chair of the Department of Medical Physics at the University of Wisconsin Madison, and Professor of Medical Physics, Radiology, Human Oncology and Biomedical Engineering. Dr. Pogue's work in the area of optical imaging devices to guide cancer therapies, has led to the invention of a unique system for imaging radiation dose with Cherenkov emission, and another unique approach to imaging hypoxia during surgical resection. Each of these is supported by NIH funding, and this translational work led to co-founding of two start-ups, DoseOptics and QUEL Imaging. DoseOptics has now commercialized the first system to allow direct visualization of radiation dose delivery to radiotherapy patients. This work has led to US Patents, with 12 issued and 29 pending, and more than 450 peer-reviewed papers. Dr. Pogue is a Fellow member of Optica, SPIE, AIMBE, and the National Academy of Inventors, and is the Editor-in-Chief of the Journal of Biomedical Optics, the oldest and highest impact journal dedicated to the field of biomedical optics and biophotonics.

Monday, December 5 at noon
1003 Engineering Centers (Tong Auditorium)