Biomedical Engineering Seminar

Using Light for Diagnosing and Treating Cancer Tumors

Dr. Brian Pogue
Dartmouth College
Thursday, December 5, 2002
2-3 pm
United Technologies Building, Room 150, Storrs

Abstract:
This talk will focus on two specific areas in the field of biophotonics as applied to cancer diagnosis and treatment, including diffuse optical tomography and photodynamic therapy.
Optical tomographic imaging of tissue can be achieved within a framework where the light transport is simulated with diffusion theory and the image reconstruction is achieved by iterative solution for the interaction coefficients. This imaging modality can provide functional information about breast tissue and breast tissue tumors, including hemoglobin concentration, oxygen saturation, water content and structural matrix. The results of near-infrared tomographic clinical imaging will be presented, showing that increases in blood volume are readily observed in breast cancer. Correlation between pathology analysis and tomographic images shows that this type of imaging could potentially be used as a surrogate for blood vessel density measurement. This imaging modality could be used for screening high risk patients, staging tumors or following response to therapy.
Pre-clinical photodynamic therapy treatments are being investigated as an adjuvant to radiation treatment in the RIF-1 murine tumor model. When PDT is applied in a manner which targets the cellular function of the tumor tissue, rather than targeting the blood vessels, it is possible to decrease the oxygen consumption rate of the tumor. This has the effect of increasing the available oxygen within the tumor. When this pre-treatment with PDT is combined as an adjuvant with radiation therapy, enhanced killing of the tumor is observed. Adjuvant PDT with radiation therapy could be a viable method to enhance the killing of hypoxic tumors.

Brian W. Pogue, Associate Professor of Engineering at Dartmouth, also holds research scientist positions at Harvard Medical School and Massachusetts General Hospital. He received a B.Sc. and M.Sc. in physics from York University in Toronto, and a Ph.D. in medical physics from McMaster University in Hamilton, ON Canada. He worked for 2 years as a research fellow at Harvard Medical School and Massachusetts General Hospital in the fields of photomedicine and biomedical optical engineering for cancer diagnosis and treatment. He also worked as a research assistant professor at Dartmouth for 5 years, prior to his current position, and has been a scientific review board member for the National Institutes of Health and the U.S. Department of Energy. He is the topical editor for the journal Optics Letters, and is a conference organizer for the Optical Society of America. His current research is sponsored through grants from the National Cancer Institute to study laser-based cancer therapy (called photodynamic therapy) and laser-based imaging of hemoglobin in tissue for physiology and cancer tumor characterization. He has published over 100 scientific papers and proceedings. At Dartmouth's Thayer School of Engineering he teaches courses in electromagnetics, electronics, and biomedical engineering.